



GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document

CURRICULUM: MPECS-2023
(Outcome Based Curriculum)

For

DIPLOMA IN ELECTRICAL ENGINEERING

Secretary

Chairman

Programme-wise Board of Studies (PBOS)
Electrical Engineering Programme
Government Polytechnic, Kolhapur.

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SECTION -I
CURRICULUM PHILOSOPHY
AND
STRUCTURE

1. CURRICULUM DEVELOPMENT : INTRODUCTION AND PROCESS OF DEVELOPMENT OF OUTCOME BASED CURRICULUM

Curriculum Design and Development:

Curriculum is an absolute instructional and effective instrument designed with a student centered approach. It incorporates systematic method of teaching learning process. It is a sequence of planned academic activities; on completion of which the desired programme outcomes are expected to be attained in the student. The curriculum and the course contents are expected to motivate the students to acquire desired level of knowledge and skills. An emphasis and an attempt has been made in the curriculum to get a perfect blending of theoretical concepts and actual requirements of industry. Keen attention has been provided to make it more structured by incorporating the valuable suggestions of industrial experts of PBOs and feed back by the field and academic professionals. An overview of systematic and scientific mode of implementation and evaluation has also been pondered; consequently a practicable model of it has been achieved. It incorporates specific guidelines and assessment criteria for theory/practical/oral modes of evaluation. Specification table for each course has been provided to prepare question paper justifying meticulous coverage.

Curriculum philosophy:

The impact of globalization and rapid changes in the engineering science and technology has been a great cause of comprehensive and noticeable change in engineering fraternity, hence the institutions. Only way to incorporate such a transformation, is to modify the curriculum, preserving the consistency of engineering education. Frequent review and feedback from the experts and the freedom of autonomous status of the institution have encouraged to undertake relevant changes in the curriculum to make it versatile. Consequently the

desired competencies and skills are transformed amongst the students in pursuing their preparedness to cope up with the global changes. It aims to promote self reliance and satisfaction of acquiring modern engineering concepts and multi capabilities within the students to make them model technicians.

“Curriculum is an educational program designed and implemented to achieve specified programme outcomes”

Hence, in a broad sense, a curriculum incorporates the following :

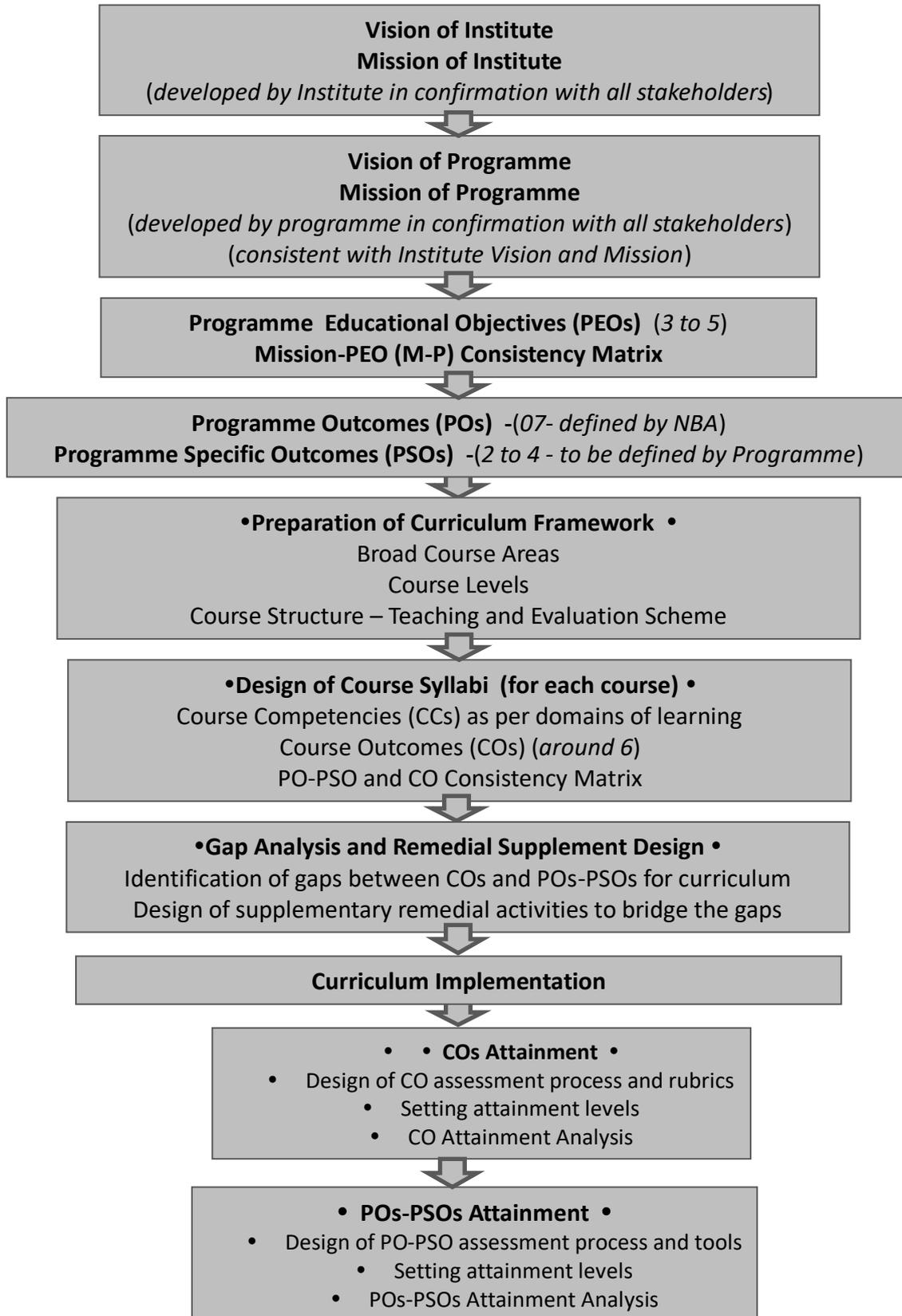
- To define the purpose of education
- To accept systematic planning methods
- To confirm implementation strategies
- To identify and to incorporate needs of industries
- To follow the policy directives
- To cope-up with social concerns
- To aim at personality development of students
- To allow future developments and challenges in emerging science and technology.

Outcome-based Curriculum

Outcome based curriculum is the curriculum based on the concepts of outcome-based education (OBE) philosophy. India is a permanent signatory of the Washington Accord - the international agreement among bodies responsible for accrediting engineering programmes with the National Board of Accreditation (NBA) as the national authority for accrediting degree and diploma programmes in engineering in India. Hence as per the accreditation criteria of the NBA, the curriculum of the Institute is expected to be outcome based.

Outcome Based Education (OBE) is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student. The approach is to be included in the following three aspects of education system :i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation. The flow diagram shown below summarizes the elements of Outcome-based Education System. The glossary of terms used in academic autonomy and OBE are provided for reference.

OUTCOME BASED EDUCATION SYSTEM



Glossary of terms related to Outcome Based Education

Outcome-Based Education (OBE) - It is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student.

The approach is to be included in the following three aspects of education system :i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation

Washington Accord and NBA – It is an International Agreement among bodies responsible for accrediting undergraduate engineering degree programmes. Established in 1989, the signatory countries as of 2014 are Australia, Canada, Taiwan, Hong Kong, India, Ireland, Japan, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Sri Lanka, Turkey, the United Kingdom and the United States. National Board of Accreditation (NBA), India has become the permanent signatory member of the Washington Accord on 13th June 2014.

The membership of Washington Accord is an international recognition of the quality of undergraduate engineering education offered by the member country and is an avenue to bring it into the world class category. It encourages and facilitates the mobility of engineering graduates and professionals at international level.

NBA accreditation is a quality assurance scheme for higher technical education in India.

1. The Washington Accord covers engineering degrees and diploma under outcome-based education approach.

Vision of Institute - It is a statement that defines concisely the aspirations to be achieved in the near future by the Institute

Mission of Institute - It is a set of statements that defines the broad steps to be executed to achieve the vision of the Institute

Vision of Programme - It is the vision statement for a particular educational programme (like Civil Engineering Programme, Mechanical Engineering Programme, etc.). Programme Vision should be consistent with the Institute vision

Mission of Programme - It is the set of statements that define the broad steps to be executed to achieve the vision of the educational programme

Programme Educational Objectives (PEOs) - It is a set of 3 to 5 statements defining the objectives to be attained in order to execute the mission

Programme Outcomes (POs) – It is a set of seven generic outcomes, stated by NBA, expected from any engineering diploma-holder in India

Programme-specific Outcomes (PSOs) – It is a set of 2 to 4 outcomes to be defined by the programme under consideration in addition to the POs

Course Outcomes (COs) – It a set of about 6 outcomes, expected to be attained by

student on learning a course. Course Outcomes shall be defined in curriculum for each course. Course outcomes are worded using action verbs like solve, explain, calculate, compare, distinguish, describe, draw, etc.

Mission-PEO Consistency Matrix – It is a matrix showing degree of consistency of PEOs with mission

PO-CO Consistency Matrix – It is a matrix showing degree of consistency of COs with POs and PSOs

Competency – It is the set of specific abilities, categorized as cognitive, psychomotor and affective domains of learning, from which course outcomes statements are derived

Cognitive domain –It is the set of abilities related to thinking

Bloom's Revised Taxonomy of Cognitive Domain : It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows :

Remembering > Understanding > Applying > Analyzing > Evaluating > Creating

Psychomotor Domain :It is the set of abilities related to physical and psychological skills

Taxonomy of Psychomotor Domain :It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows :

Perception > Set > Guided response > Mechanism > Adaptation > Origination

Affective Domain : It is the set of abilities related to attitudinal development

Taxonomy of Affective Domain :It is a five-level cumulative hierarchy of affective abilities in the order of increasing complexity as follows :

Receiving > Responding > Valuing > Organizing > Characterizing

Educational Technology : It is the systematic study of theoretical foundations and material tools to facilitate learning

Glossary of terms used in Academic Autonomy and MPECS

Academic Autonomy – It is the freedom and responsibility offered to the Institute by the Government to attain high quality standards in the following three dimensions :

- i) Design of own curricula ii) Conduct of own examinations iii) Award of own diploma

Multi-point Entry and Credit System (MPECS) – It is a system of education in which student can be admitted at different entry levels of qualification and he is offered *credits* along with marks on passing in a course

Credits – It is the number of weekly instructional hours provided for a course in the curriculum

Programme – It is the particular branch of Engineering in which Diploma is awarded. e.g. Civil Engineering Programme, Mechanical Engineering Programme, etc.

Curriculum – It is a document providing plan of the complete academic activity to be conducted by student for award of Diploma in a Programme in tune with the vision of the Institute

Course – It is a particular subject defining study and evaluation unit of the curriculum. e.g. Applied Mechanics, Engineering Drawing-1, etc.

Syllabus – It is the complete academic information regarding a particular course in a curriculum

Course Registration (CR) - It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses he/she is going to study in that semester as per academic time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Examination Registration (ER) - It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses in which he/she is going appear for examination in that semester as per examination time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Curriculum MPECS-2020- It is the Curriculum of the Institute revised in the year 2020. It is applicable to the students admitted since 2020

Programme Department– It is the department of the Institute offering Diploma in a particular Programme. e.g. Civil Engineering Department, Mechanical Engineering Department, etc.

Programme Dean – He/she is the Head of Department of a Programme Department

Allied Department – It is department that does not award diploma and contributes to curriculum implementation of many Programmes. e.g. Applied Mechanics Department, Workshop Department, Science Department, English Department, Mathematics Department, etc.

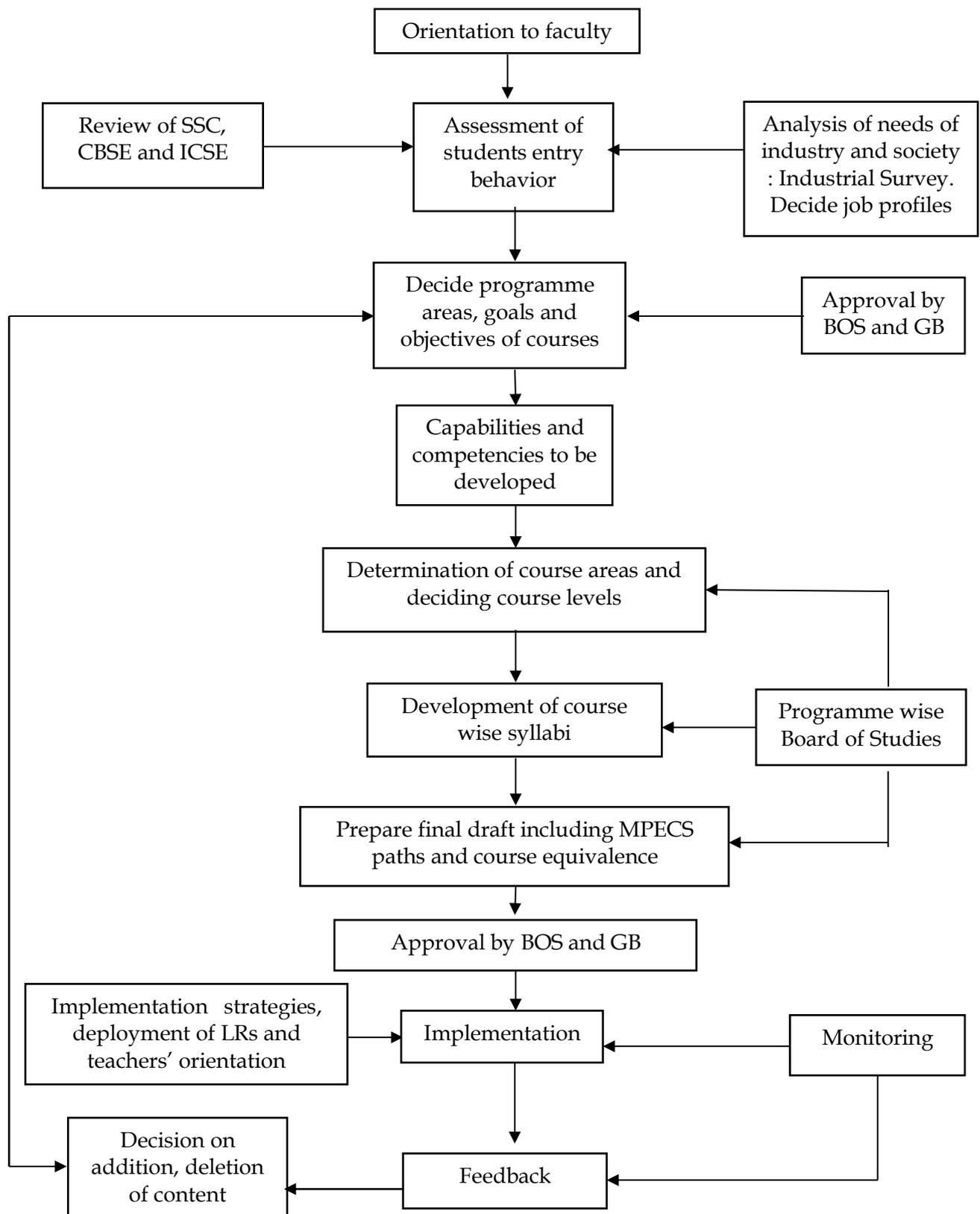
Academic Autonomy and MPECS at Government Polytechnic, Kolhapur –

- Year of award of academic autonomy : 1992 Year of award of MPECS and Flexibility : 1994

Government Polytechnic, Kolhapur is the first Government Polytechnic in Maharashtra to have been awarded academic autonomy

- Bodies and Cells under Academic Autonomy :
 - i) Governing Body
 - ii) Board of Studies
 - iii) Programme-wise Boards of Studies
- Examination Committee Curriculum Revisions under Autonomy : 1992, MPECS-2001, MPECS-2006, MPECS-2010, MPECS-2013, MPECS-2016, MPECS-2020.
- Award of Diploma in *Convocation Ceremony* every year

Curriculum Development Model :



2. VISION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES (PEOs), PROGRAMME OUTCOMES (POs) AND PROGRAMME-SPECIFIC OUTCOMES (PSOs)

Vision of Institute:

Institute of high recognition developing competent technicians for quality services and entrepreneurship to cater the needs of industry and society.

Mission of Institute:

- To educate and train in multi-disciplinary multi-level programmes to develop competent technicians and skilled manpower for industrial needs
- To ensure employability, encourage entrepreneurship, promote lifelong learning
- To inculcate in students the qualities of a good citizen at individual, social and professional level
- To provide quality management system with focus on effective student-centric education and high recognition.

Vision of department:

To produce highly skilled technicians serving the industry/society as entrepreneurs or rendering services in the fields of electrical engineering following professional and ethical practices.

Mission of programme:

- 1) To provide quality innovative skilled based electrical engineering courses.
- 2) To prepare technicians for the state of art technology by promoting lifelong learning, technical expertise, ethical standards, and leadership qualities,
- 3) To commit our faculty expertise and modern facilities to the industry, the profession, and the local constituents.

Programme vision supports the Institute vision as below:

S N	Key points of Institute Vision	Key points of Programme Vision	Remarks
1.	High recognition	Skilled technicians serving the industry/society.	Programme vision supports all the key points of the Institute vision as per the different supporting matching phrases shown beside.
2.	Competent technicians	Skilled technicians.	
3.	Quality services	Rendering services in the fields related to electrical engineering following professional and ethical practices.	
4.	Entrepreneurship	Entrepreneurs in the fields related to electrical engineering following professional and ethical practices.	
5.	Industry needs	Rendering services in the fields related to electrical engineering following professional and ethical practices.	
6.	Society	Following professional and ethical practices.	

Programme Educational Objectives (PEOs):

- 1) Provide responsible and environment friendly solutions to electrical engineering based problems in professionally ethical manner.
- 2) Use prevailing electrical engineering based technologies to solve multi-disciplinary problems.
- 3) Contribute as an individual or as a team member by communicating effectively to solve relevant problems.

Program Outcomes:

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

Programme Specific Outcomes (PSO's):

- 1) Maintain various types of electrical equipment's.
- 2) Maintain various sections of electrical power systems.

3.OVERVIEW AND SALIENT FEATURES OF CURRICULUM: MPECS-2023

Overview of Curriculum MPECS-2023

Total No. of Credits		120
No. of courses offered	Total	49
	Theory	36
Max. no. courses in a semester		7
Total Maximum Marks		5100
Diploma Awarded Marks (5 th & 6 th semester)		1700
Total Credit for Every Semester		20
Notional Learning Hours		40
%Ratio of Th: Pr	Marks -Wise	50.98:49.02
	Hour-wise	60:40
Elective Courses		
Optional Courses	No. of courses	3
	Options/course	1/3, 1/5, 1/4.
No. of Practical/Or al Examination	Internal	10
	External	15

Diploma shall be awarded on the basis of marks obtained in fifth and sixth semester courses

Salient Features of Curriculum MPECS-2023

The curriculum is outcome based and has been reinforced with some new courses while obsolete contents of courses have been replaced with the state of art contents.

Addition and deletion of Courses with respect to MPECS-2023:

1. In MPECS 2023, Total Credit = 120 and Total marks=5100 whereas the diploma award marks=1700 Marks
2. The courses such as Emerging Trends in Electrical Engineering, Robotics and Automation (RBA), Internet of things (IoT), Electric Vehicle and Basic Python Programming, Electrical Workshop Practice courses has been added in the curriculum.
3. In MPECS 2023, Internship of 16 weeks introduced in fifth semester (Credit =10).
4. Indian Knowledge System (IKS) is added in the curricula of some courses. Also, Self learning activities are also added in the some courses.
5. Social life skill course introduced in second semester as self learning activity.
6. Major project Part I and Part II are combined together and made one course i.e. Project and offered in fifth semester.
7. Due to internship of 16 weeks, some of the courses are shifted to third semester of the MPECS2023. DC machine and transformer course is splitted in the two courses. From that, one course (Transformer) is offered in third semester and Rotating Machine 1(DC & AC) is offered in forth semester. Whereas, Industrial Machine course is replaced by Rotating Machine 2 which covers the alternator, synchronous motor and special motors in the respect of recent development in electrical sector.
8. For the introduction of new courses, the courses are removed from the curriculum such as Seminar, Electric Drive, Electrical Engineering Material, Illumination Engineering. whereas some content of these courses are added in the curriculum.
9. The online examination course -Environmental Science has been included in the fourth semester of MPECS2023.

Major modifications in Course Contents with respect to MPECS-2023:

1. As per advancement in the motors, the special motors such as Brushless DC motor, Linear Induction Motor, Stepper Motor, Reluctance Motor etc. are introduced in Rotating Machine 2.
2. From Switchgear and Protection, types of sub-stations, indoor and outdoor substations. Single line diagram of transmission substations as duplicity of the content.
3. In Substation Practices & Maintenance, Gas Insulated Substations content is included.
4. The practical content of non-conventional power generation has been modified as per the recent development.

Changes in Implementation Strategy and Treatment with respect to MPECS-2020:

In MPECS 2023, Assessment weightage is given to self learning activity

The assessment of Internship is done in the fifth semester.

Other salient features:

1. 16 week Internship is offered in fifth semester.
2. MSBTE has sponsored two Centre of Excellence such as Robotics Automation lab and IoT lab. In that context we have offered Robotics & Automation and IoT course to the third year students.

4.PATH WISE CURRICULUM STRUCTURE
PATH1- STUDENTS ADMITTED TO FIRST YEAR – X STD. PASS OUT
LEARNING SCHEME AND ASSESSMENT SCHEME

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name		: Diploma in Electrical Engineering																						
Programme Code		: EE										With Effect From Academic Year					: 2023-24							
Duration Of Programme		: 6 Semester										Duration					: 15WEEKS							
Semester		: First										Curriculum					: MPECS 2023							
Sr No	Course Title	Abbr.	Course Type	Course Level	Course Code	Tot al IK S Hrs for Se m.	Learning Scheme						Credits	Assessm ent Scheme										
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment/Mic ro Project)	Notional Learning Hrs/Week	Paper Duration (hrs.)		Theory				Based on LL & TL		Based on Self Learning		Total Marks		
							C L	T L	LL					FA TH	SA TH	Total		Practical		SLA				
																Max	Min	Max	Mi	Max	Mi		Max	Min
							Max	Min	Max					Min	Max	Mi	Max	Mi	Max	Min	Max		Min	
1	ENGINEERING PHYSICS-A	HPHA	DSC	1	CCH101	4	4	-	2	2	8		4	1.5	30*#	70*#	100	40	25	10	25@		10	25	10	175
2	BASIC MATHEMATICS	HBMT	AEC	1	CCH105	4	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125
3	ENGINEERING GRAPHICS&AUTO-CAD	HGRA	DSC	1	CCH107	2	2	-	2	-	4	2	-	-	-	-	-	50	20	50@	20	-	-	100
4	FUNDAMENTALS OF ICT	HICT	SEC	2	CCH202	1	1	-	2	1	4	2	-	-	-	-	-	25	10	25@	10	25	10	75
5	YOGA AND MEDITATION	HYAM	VEC	2	CCH203	1	-	-	1	1	2	1	-	-	-	-	-	25	10	-	-	25	10	50
6	FUNDAMENTALS OF ELECTRICAL ENGINEERING	HFEE	DSC	1	EEH101	2	4	-	2	2	8	4	3	30	70	100	40	50	20	25@	10	25	10	200
7	ELECTRICAL WORKSHOP PRACTICE	HWEE	SEC	1	EEH102	2	2	-	2	2	6	3	-	-	-	-	-	50	20	25@	10	25	10	100
Total						16	17	2	11	10	40	20		90	210	300		225	150	150				825

Government Polytechnic Kolhapur																									
Learning and Assessment Scheme for Post S.S.C Diploma Courses																									
Programme Name		: Diploma In Electrical Engineering																							
Programme Code		: EE										With Effect From Academic Year : 2023-24													
Duration Of Programme		: 6 Semester										Duration : 15 WEEKS													
Semester		: Second										Scheme : MPECS 2023													
Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks	
							Actual Contact Hrs./Week			Self Learning (Activity / Assignment /Micro Project)	Notional Learning Hrs/Week			Theory	Based on LL&TL				Based on Self Learning						
							CL	TL	LL						FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																	Max	Min	Max	Min	Max	Min	Max		Min
1	ENGINEERING CHEMISTRY	HCHA	DSC	1	CCH103	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175	
2	COMMUNICATION SKILL	HCMS	AEC	2	CCH201		4	-	2	2	8	4	3	30	70	100	40	25	10			25	10	150	
3	SOCIAL AND LIFE SKILLS	HSLS	VEC	2	CCH204		-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50	
4	APPLIED MATHEMATICS	HAMT	AEC	3	CCH301	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100	
5	BASIC ELECTRONICS	HBET	DSC	1	EEH103	1	2	-	2	-	4	2	1.5	15	35	50	20	50	20	25@	10			125	
6	ELECTRICAL POWER GENERATION	HEPG	DSC	3	EEH301	2	3	-	2	1	6	3	3	30	70	100	40	25	10			25	10	150	
7	BASIC MECHANICAL AND CIVIL ENGINEERING	HBMC	SEC	3	EEH302	2	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100	
Total						11	19	2	12	7	40	20		135	315	450		175		100		125		850	

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering		
Programme Code	: EE	With Effect From Academic Year	: 2024-25
Duration Of Programme	: 6 Semester	Duration	: 15 WEEKS
Semester	: Third	Scheme	: MPECS 2023

Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme											
						Actual Contact Hrs/Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hrs/Week			Theory			Based on LL&TL				Based on Self Learning		Total Marks		
						CL	TL	LL					FA - T H	SA - T H	Total		Practical		SLA					
															Max	Min	Max	Min	Max	Min	Max		Min	
Essence of Indian Constitution	HEIC	VEC	2	CCH205		1	-		1	2	1	-	-	-	-	-						50	20	50
Electrical Circuits	HECT	DSC	3	EEH303	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
Electrical Measurement & Instrumentation	HEMI	DSC	3	EEH304	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
Transformer	HTRF	DSC	3	EEH305	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
Transmission and Distribution of Electric Power	HTDP	DSC	3	EEH306	2	4		2	2	8	4	3	30	70	100	40					25	10	125	
Applied Electronics	HAET	SEC	3	EEH307	1	3	-	2	1	6	3	3	30	70	100	40	25	10			25	10	150	
Total					9	17		16	7	40	20		150	350	500		100		75		175		850	

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name		: Diploma In Electrical Engineering																						
Programme Code		: EE										With Effect From Academic Year : 2025-26												
Duration Of Programme		: Semesterr										Duration : 15 WEEKS												
Semester		: Forth										Scheme : MPECS 2023												
Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hrs/Week			Theory			Based on LL&TL				Based on Self Learning			
							CL	TL	LL					FA-TH	SA TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2			2	4	2	1.5	30*#	70*#	100	40					25	10	125
2	Electrical Estimation and Contracting	HEEC	DSC	3	EEH308	2	4		4		8	4	3	30	70	100	40	25	10					125
3	Power Electronics	HPET	SEC	3	EEH309	1	4		2		6	3	3	30	70	100	40	25	10	25#	10			150
4	Energy Conservation & Audit	HECA	DSC	3	EEH310	2	4		2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
5	Rotating Machine-1(DC & IM)	HRM- 1	DSC	3	EEH311	2	4		4		8	4	3	30	70	100	40	25	10	25#	10			150
6	Utilization of Electrical Energy	HUEE	DSC	3	EEH312	2	4		2		6	3	3	30	70	100	40	25	10	25#	10			150
Total						11	22		14	4	40	20		180	420	600		125	100		50		875	

ELECTIVE-I COURSES

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Credits (Round Off)	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hours/Week			Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks	
							C L	T L	L L						FA-TH	SA-TH	Total		Practical		SLA					
																	Max	Min	FA-PR	SA-PR	Max	Min	Max	Min		
ELECTIVE-I																										
1.	Industrial Organization and Management	HIOM	AEC	5	CCH502		5			1	6	1.6	2	1	15*#	35*#	50	20						50	20	100
2.	Marketing Management	HMKM	AEC	5	CCH503		5			1	6	1.6	2	1	15*#	35*#	50	20						50	20	100
3.	Project Management	HPRM	AEC	5	CCH504		5			1	6	1.6	2	1	15*#	35*#	50	20						50	20	100

GOVERNMENT POLYTECHNIC KOLHAPUR

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering		
Programme Code	: EE	With Effect From Academic Year	: 2025-26
Duration Of Programme	: 6 Semester	Duration	: 15 week
Semester	: Sixth	Scheme	: MPECS 2023

S r n o	Course Title	Abbr.	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning			Total Marks
							C L	T L	L L					FA- TH	SA- TH	Total		FA-PR		SA-PR		SLA			
																Max	Min	Max	Min	Max	Min	Max	Min		
1	Switchgear & Protection	HSWP	DSC	4	EEH402	2	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175	
2.	Elective- 2(Dept. related courses)		DSE	4	EEH403/ EEH404/ EEH405/ EEH406/ EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150	
3.	Basic Python Programming	HBPP	SEC	4	EEH410	-	2	-	2	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50	
4.	Electrical Testing and Commissioning	HETC	DSC	5	EEH501	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
5.	Emerging Trends in Electrical Engineering	HETE	DSC	5	EEH502	-	3	-	-	1	4	2	3	30*#	70*#	100	40	-	-	-	-	25	10	125	
6.	Internet of Things (IOT)	HIOT	SEC	5	EEH504	-	2	-	2	-	4	2	-	-	-	-	-	25	10	-	-	-	-	25	
7.	Elective- 3		SEC	5	EEH505/ EEH506/ EEH507/ EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
Total						8	22		12	6	40	20		150	350	500		150	125	100			875		

ELECTIVE-II COURSES (Departed related Courses)

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem .	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity / Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
							C	T	L					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1.	Non Conventional Power Generation	HNCG	GE	4	EEH403	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
2.	Substation Practices & Maintenance	HSPM	GE	4	EEH404	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
3.	Advanced Solar and Wind power Technologies	HASW	GE	4	EEH405	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
4.	Electrical Design Fundamentals	HEDF	GE	4	EEH406	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
5.	Electric Traction	HETR	GE	4	EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150

ELECTIVE-III COURSES

Sr No	Course Title	Abbr.	Course Type	level	Course Code	Total IKS Hrs for Sem .	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self-Learning (Activity/ Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Mark
							C	T	L					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1.	PLC and SCADA	HPLC	GE	5	EEH505	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
2.	Industrial Automation and Control	HIAC	GE	5	EEH506	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3.	Instrumentation and Signal Conditioning	HINS	GE	5	EEH507	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4.	Electric Vehicle	HELV	GE	5	EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

**PATH 2- STUDENTS ADMITTED DIRECTLY TO SECOND YEAR
EARNING SCHEME AND ASSESSMENT SCHEME**

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma
Courses

Programme Name		: Diploma In Electrical Engineering																					
Programme Code		: EE With Effect From Academic Year : 2024-25																					
Duration Of Programme		: 6 Semester Duration : 15 WEEKS																					
Semester		:Third Scheme : MPECS 2023																					
Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
						Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hrs/Week			Theory				Based on LL&TL				Based on Self Learning		
						CL	TL	LL					FA - T H	SA - T H	Total		FA-PR		SA-PR		SLA		
															Max	Min	Max	Min	Max	Min	Max	Min	
Essence of Indian Constitution	HEIC	VEC	2	CCH205		1	-		1	2	1	-	-	-	-	-				-	50	20	50
Electrical Circuits	HECT	DSC	3	EEH303	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Electrical Measurement & Instrumentation	HEMI	DSC	3	EEH304	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Transformer	HTRF	DSC	3	EEH305	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Transmission and Distribution of Electric Power	HTDP	DSC	3	EEH306	2	4		2	2	8	4	3	30	70	100	40					25	10	125
Applied Electronics	HAET	SEC	3	EEH307	1	3	-	2	1	6	3	3	30	70	100	40	25	10			25	10	150
Total					9	17		16	7	40	20		150	350	500		100		75		175		850

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name		: Diploma In Electrical Engineering																								
Programme Code		: EE										With Effect From Academic Year : 2025-26														
Duration Of Programme		: Semesterr										Duration : 15 WEEKS														
Semester		: Forth										Scheme : MPECS 2023														
Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks		
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hrs/Week			Theory			Based on LL&TL				Based on Self Learning					
							CL	TL	LL					FA-TH	SA TH	Total		FA-PR		SA-PR		SLA				
																Max	Min	Max	Min	Max	Min	Max	Min			
1	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2			2	4	2	1.5	30*#	70*#	100	40							25	10	125
2	Electrical Estimation and Contracting	HEEC	DSC	3	EEH308	2	4		4		8	4	3	30	70	100	40	25	10							125
3	Power Electronics	HPET	SEC	3	EEH309	1	4		2		6	3	3	30	70	100	40	25	10	25#	10					150
4	Energy Conservation & Audit	HECA	DSC	3	EEH310	2	4		2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10			175
5	Rotating Machine-1(DC & IM)	HRM- 1	DSC	3	EEH311	2	4		4		8	4	3	30	70	100	40	25	10	25#	10					150
6	Utilization of Electrical Energy	HUEE	DSC	3	EEH312	2	4		2		6	3	3	30	70	100	40	25	10	25#	10					150
Total						11	22		14	4	40	20		180	420	600		125	100		50				875	

ELECTIVE-I COURSES

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem .	Learning Scheme					Credits	Credits (Round Off)	Assessment Scheme													
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hours /Week			Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks		
							C L	T L	L L						FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
																	Max	Min	Max	Min	Max	Min	Max	Min			
ELECTIVE-I																											
1.	Industrial Organization and Management	HIOM	AEC	5	CCH502		5			1	6	1.6	2	1	15*#	35*#	50	20							50	20	100
2.	Marketing Management	HMKM	AEC	5	CCH503		5			1	6	1.6	2	1	15*#	35*#	50	20							50	20	100
3.	Project Management	HPRM	AEC	5	CCH504		5			1	6	1.6	2	1	15*#	35*#	50	20							50	20	100

GOVERNMENT POLYTECHNIC KOLHAPUR

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering		
Programme Code	: EE	With Effect From Academic Year	: 2025-26
Duration Of Programme	: 6 Semester	Duration	: 15 week
Semester	: Sixth	Scheme	: MPECS 2023

S r N o	Course Title	Abbr.	Course Type	level	Course Code	Total IKS Hrs for Sem .	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hours /Week			Theory				Based on LL & TL				Based on Self Learning		
							C L	T L	L L					FA- TH	SA - T H	Total		Practical		SLA				
																Max	Min	FA-PR	SA-PR	Max	Min	Max	Min	
1	Switchgear & Protection	HSWP	DSC	4	EEH402	2	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175
2.	Elective- 2(Dept. related courses)		DSE	4	EEH403 / EEH404 /EEH405/EEH406/EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
3.	Basic Python Programming	HBPP	SEC	4	EEH410	-	2	-	2	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50
4.	Electrical Testing and Commissioning	HETC	DSC	5	EEH501	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
5.	Emerging Trends in Electrical Engineering	HETE	DSC	5	EEH502	-	3	-	-	1	4	2	3	30*#	70*#	100	40	-	-	-	-	25	10	125
6.	Internet of Things (IOT)	HIOT	SEC	5	EEH504	-	2	-	2	-	4	2	-	-	-	-	-	25	10	-	-	-	-	25

7.	Elective- 3		SEC	5	EEH505 / EEH506 / EEH507 / EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Total						8	22		12	6	40	20		150	350	500		150		125		100		875

ELECTIVE-II COURSES (Departed related Courses)

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
							C L	T L	L L					FA-TH	SA-TH	Total		Practical		SLA				
																Max	Min	FA-PR	SA-PR	Max	Min	Max	Min	
1.	Non Conventional Power Generation	HNCG	GE	4	EEH403	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
2.	Substation Practices & Maintenance	HSPM	GE	4	EEH404	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
3.	Advanced Solar and Wind power Technologies	HASW	GE	4	EEH405	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
4.	Electrical Design Fundamentals	HEDF	GE	4	EEH406	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
5.	Electric Traction	HETR	GE	4	EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150

ELECTIVE-III COURSES

Sr No	Course Title	Abbr.	Course Type	level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self-Learning (Activity/Assignment/Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning			Total Mark
							C L	T L	L L					FA-TH	SA-TH	Total		Practical		SLA					
																Max	Min	Max	Min	Max	Min	Max	Min		
1.	PLC and SCADA	HPLC	GE	5	EEH505	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
2.	Industrial Automation and Control	HIAC	GE	5	EEH506	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
3.	Instrumentation and Signal Conditioning	HINS	GE	5	EEH507	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
4.	Electric Vehicle	HELV	GE	5	EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks

5. 1 credit is equivalent to 30 Notional hrs.

6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprentice. /Project. /Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

EXEMPTIONS FOR COURSES

Eligibility for Exemptions for First and Second Semester Courses of MPECS-2023 for students admitted on X-pass basis

S N	Name of Course	Course Code	Whether eligible for exemption ? (Yes / No)				
			XII Science	XII Tech.	XII MCV C	XII Voc.	ITI
1	Engineering Physics	CCH101	YES	YES	No	No	No
2	Basic Mathematics	CCH105	YES	YES	No	YES	No
3	Applied Mathematics	CCH301	YES	YES	No	YES	No
4	FUNDAMENTALS OF ICT	CCH202	Yes,if MSCIT course completed by candidate before registration.				

Note: The above eligibility is subject to condition that the student has secured at least 40 % marks in the respective subject. Students seeking exemption for any other subjects should contact Academic Coordinator / Controller of Examinations.

COURSE EQUIVALENCE FOR PREVIOUS MPECS

MPECS 2006	MPECS 2010	MPECS 2013	MPECS 2016	MPECS 2020	MPECS2023
R 103 Applied Physics - I R 104 Applied Physics - II	X 102 Basic Physics X 108 Applied Physics	CCE102 Engineering Physics	CCF102 Engineering Physics	CCG102 Engineering Physics	CCH101 Engineering Physics
R 105 Applied Chemistry. R 106 Chemistry of Engineering Materials.	X 103 Applied Chemistry X109 Chemistry of Engineering Materials	CCE104 Engineering Chemistry	CCF104 Engineering Chemistry	CCG104 Engineering Chemistry	CCH103 Engineering Chemistry
R 107 Basic Mathematics.	X 104 Basic Mathematics	CCE105 Basic Mathematics	CCF105 Basic Mathematics	CCG105 Basic Mathematics	CCH105 Basic Mathematics
R 109 Engineering Drawing - I	X 105 Engineering Drawing- I	CCE109 Engineering Graphics	CCF109 Engineering Graphics	CCG109 Engineering Graphics	CCH107 Engineering Graphics &Auto-CAD
R 110 Engineering Drawing - II	X 107 Engineering Drawing- II	CCE109 Engineering Graphics	CCF109 Engineering Graphics	CCG109 Engineering Graphics	CCH107 Engineering Graphics &Auto-CAD
R 112 Applied Mechanics	X 111 Applied Mechanics	CCE110 Applied Mechanics	CCF110 Applied Mechanics	CCG110 Applied Mechanics	NIL
R 113 Workshop Practice - I	EE 101 Basic Workshop Practice (Electrical)	CCE113 Workshop Practice	EEF103 Workshop Practice	CCG113 Workshop Practice	EEH102 Electrical Workshop Practice
R 114 Workshop Practice - II	EE 102 Workshop Practice (Electrical)	CCE113 Workshop Practice	EEF103 Workshop Practice	CCG113 Workshop Practice	EEH102 Electrical Workshop Practice
				CCG117 Sports & Yoga	CCH203 Yoga & Meditation
R 108 Engineering Mathematics	X 110 Engineering Mathematics	CCE106 Engineering Mathematics	CCF106 Engineering Mathematics	CCG118 Engineering Mathematics	CCH301 Applied Mathematics
R 111 Computer Fundamentals & Applications	--	EEE301 Computer Fundamentals	EEF101 Fundamentals Computer Hardware & software	CCG201 Introduction to IT System	CCH202 Fundamental of ICT
R 101 Generic Skills	X 101 Generic Skills	CCE201 Generic Skills	CCF 201 Generic Skills	CCG203 Communication Skill in English	CCH201 Communication Skill
R 102 Communication Skills.	X106 Communication Skills	CCE202 Communication Skills	CCF202 Communication Skills	CCG203 Communication Skill in English	CCH201 Communication Skill
R 102 Communication Skills.	X106 Communication Skills	CCE202 Communication Skills	CCF202 Communication Skills	CCG203 Communication Skill in English	CCH201 Communication Skill
				CCG204 Environmental Science	CCH206 Environmental Edu. & Sustainability
				CCG205 Essence of Indian Traditional Knowledge	CCH204 Social and Life Skills

MPECS 2006	MPECS 2010	MPECS 2013	MPECS 2016	MPECS 2020	MPECS2023
				CCG206 Indian Constitution	CCH205 Essence of Indian Constitution
E 202 D.C Circuits	EE 202 D. C. Circuits	EEE102 Fundamentals of Electrical Engineering EEE307 D.C. and A.C. Circuits	EEF102 Fundamentals of Electricity, and Magnetism EEF302 Electric circuits	EEG101 Fundamentals of Electricity, and Magnetism EEG303 Electric circuits	EEH101 Fundamental of Electrical Engineering EEH303 Electrical Circuits
E 206 Fundamentals of Electronics	EE 206 Fundamentals of Electronics	EEE201 Fundamentals of Electronic	EEF303 Basic Electronic	EEG102 Basic Electronics	EEH103 Basic Electronics
R 221 Elements of Civil Engineering	-	-	EEF312 Basic Mechanical & Civil Engineering	EEG301 Mechanical & Civil Engineering	EEH302 Basic Mechanical & Civil Engineering
R 224 Basic Mechanical & Maintenance Engineering	-	EEE101 Basic Mechanical Engineering	EEF312 Basic Mechanical & Civil Engineering	EEG301 Basic Mechanical & Civil Engineering	EEH302 Basic Mechanical & Civil Engineering
E 201 Applied Mathematics	EE 201 Applied Engg. Mathematics	EEE305 Applied Mathematics	EEF301 Applied Mathematics	EEG302 Applied Mathematics	CCH301 Applied Mathematics
E 203 A.C Circuits	EE 203 A. C. circuits	EEE307 D.C. and A.C. Circuits	EEF302 Electric circuits	EEG303 Electric circuits	EEH303 Electric Circuits
E 204 Basic Measurements Theory	EE 204 Electrical Measurement	EEE306 Electrical Measurement	EEF304 Electrical Measurement & Instrumentation	EEG304 Electrical and Electronics Measurement	EEH304 Electrical Measurement & Instrumentation
E205 Electrical measurements and Instrumentation	EE 205 Electrical Instrumentation.	EEE310 Electrical Instrumentation	EEF304 Electrical Measurement & Instrumentation	EEG304 Electrical and Electronics Measurement	EEH304 Electrical Measurement & Instrumentation
NIL	NIL	EEE308 Electrical Material and Wiring	EEF305 Electrical Materials, Wiring and Illumination	EEG305 Electric Engineering Material	EEH102 Electrical Workshop Practice
E 301 Generation & Transmission	EE 211 Generation & Transmission	EEE303 Generation and Transmission	EEF306 Electrical power Generation EEF310 Transmission and distribution of electric power	EEG306 Electrical Power Generation EEG310 Transmission & Distribution of Electric Power	EEH301 Electrical Power Generation EEH306 Transmission & Distribution of Electric Power

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MPECS 2006	MPECS 2010	MPECS 2013	MPECS 2016	MPECS 2020	MPECS2023
E 207 D. C. Machines & Syn. Machines	EE 207 D. C. Machines & Syn. Machines	EEE302 D.C. Machines and Transformers EEE401 A.C. Machines	EEF307 D.C. Machines and Transformers EEF402 AC Rotating Machines	EEG307 DC Machines & Transformers EEG401 Industrial Machines	EEH305 Transformer & EEH311 Rotating Machine-1(DC &IM) EEH311 Rotating Machine-1(DC &IM)& EEH401 Rotating Machine-2
E 208 Transformers.	EE208 Transformers.	EEE302 D.C. Machines and Transformers	EEF307 D.C. Machines and Transformers	EEG307 DC Machines & Transformers EEG401 Industrial Machines	EEH305 Transformer & EEH311 Rotating Machine-1(DC &IM) EEH311 Rotating Machine-1(DC &IM) & EEH401 Rotating Machine-2
			EEF308 CAD & Electrical Drawing	EEG308 CAD & Electrical Drawing.	CCH107 Engineering Graphics & Auto-CAD
			EEF309 Applied Electronics	EEG309 Applied Electronics	EEH307 Applied Electronics
E 302 Economics & Distribution of Electrical Energy	EE 212 Economics & Distribution of Electrical Energy	EEE403 Distribution and Utilization	EEF310 Transmission and distribution of electric power EEF404 Electric power utilization and traction	EEG310 Transmission & Distribution of Electric Power EEG403 Electric power Utilization & Traction	EEH306 Transmission & Distribution of Electric Power EEH312 Utilization of Electric Energy
R 222 Electrical Wiring & Estimating			EEF401 Electrical Estimation and contracting	EEG311 Electrical Estimation & Contracting	EEH308 Electrical Estimation & Contracting
E 411 Electrical Estimation & Contracting	EE 411 Electrical Estimation & Contracting	EEE402 Electrical Estimation and Costing	EEF401 Electrical Estimation and Contracting	EEG311 Electrical Estimation and Contracting	EEH308 Electrical Estimation & Contracting
E 209 Induction Motors	EE209 Induction Machines	EEE401 A.C. Machines	EEF402 AC Rotating Machines	EEG401 Industrial Machines	EEH311 Rotating Machine-1(DC &IM) & EEH401 Rotating Machine-2
E 409 Protection of Electrical Equipment	EE 409 Protection of Electrical Equipment	EEE406 Switchgear and Protection	EEF403 Switchgear and Protection	EEG402 Switchgear and Protection	EEH402 Switchgear and Protection

MPECS 2006	MPECS 2010	MPECS 2013	MPECS 2016	MPECS 2020	MPECS2023
E 415 Electrical Traction & Drives	EE 415 Electric Traction & Drives	EEE508 Electric Traction	EEF404 Electric power Utilization & Traction	EEG403 Electric power Utilization & Traction	EEH312 Utilization of Electric Energy
			EEF405 Energy Conservation & Audit	EEG404 Energy Conservation & Audit	EEH310 Energy Conservation & Audit
E 410 Power Electronics	EE 410 Power Electronics	EEE501 Power Electronics	EEF406 Power Electronics	EEG405 Power Electronics	EEH309 Power Electronics
			EEF503 Project	EEG406 Major Part 1 EEG503 Major Project Part 2	EEH503 Project
			EEF407 Seminar	EEG407 Seminar	NIL
E 413 Maintenance of Electrical Equipment	EE 413 Installation and Maintenance of Electrical Equipment	EEE405 Testing and Maintenance of Electrical Equipment's	EEF501 Testing and Maintenance of Electrical Equipment's	EEG501 Electrical Testing and Commissioning	EEH501 Electrical Testing and Commissioning
-	-	-		EEG502 Industrial Automation and Control	EEH506 Industrial Automation and Control
-	-	-	EEF504 Microcontroller	EEG504 Microcontroller Application	EEH408 Micro-controller and its applications
-	-	-	EEF311 Entrepreneurship Dev.& Tech Writing	CCG501 Entrepreneurship and Startup	CCH501 Entrepreneurship and Startup
-	-	-		CCG502 Internship I (4 Weeks)	CCH505 Internship (16 week)
-	-	-		CCG503 Internship 2 (3 weeks)	CCH505 Internship (16 week)
-	-	-	EEF513/CCF501 Industrial Organization and Management	EEG515 Industrial Organization and Management	CCH502 Industrial Organization and Management
-	-	-	EEF514 Marketing Management	EEG516 Marketing Management	CCH503 Marketing Management
E 408 Project Management.	EE 408 Project Management.	EEE512 Project Management	EEF515 Project Management	EEG517 Project Management	CCH504 Project Management
NIL	NIL	EEE506 Industrial Drives	EEF505 Electrical Drives	EEG505 Electrical Drives	NIL
-	-	-	EEF506 Programmable Logic Controller	EEG506 PLC and SCADA	EEH505 PLC and SCADA
-	-	-	EEF507 Elements of Industrial Automation	EEG507 Elements of Industrial Automation	NIL

MPECS 2006	MPECS 2010	MPECS 2013	MPECS 2016	MPECS 2020	MPECS2023
-	-	-	-	EEG508 Electric Vehicle	EEH508 Electric Vehicle
-	-	-	-	EEG509 Instrumentation and Conditioning	EEH507 Instrumentation and Signal Conditioning
R 227 Non-Conventional Energy Sources	-	EEE311 Non Conventional Energy Sources	EEF508 Non Conventional Power Generation	EEG510 Non conventional Power Generation	EEH403 Non Conventional Power Generation
E 412 Electrical Power Station & Substation Practice	EE 412 Electrical Power Station & Substation Practice	NIL	EEF 509 Substation Practices & maintenance	EEG 511 Substation Practices & maintenance	EEH404 Substation Practices & maintenance
-	-	-	EEF510 Advanced Solar and Wind Power technologies	EEG512Advanced Solar and Wind Power technologies	EEH405 Advanced Solar and Wind Power technologies
-	-	-	EEF511 Electrical Design Fundamentals	EEG513Electrical Design Fundamentals	EEH406 Electrical Design Fundamentals
NIL	NIL	EEE504 Illumination Engineering	EEF512 Illumination Engineering	EEG514 Illumination Engineering	NIL
E 414 Power System Analysis	EE 414 Power system Analysis	NIL	NIL	NIL	NIL
NIL	NIL	CCE203 Professional Practices	CCF203 Professional Practices	NIL	NIL
E 210 Personality Development.	EE 210 Personality Development	NIL	Nil	NIL	NIL
R 223 Basic Electronics	-	-	-	-	-
R 225 Basic Sugar Manufacturing	-	-	-	-	--
R 226 Pollution Control	-	-	-	-	-
-	-	-	-	-	EEH409 Robotics and Automation
-	-	-	-	-	EEH410 Basic Python Programming
-	-	-	-	-	EEH504 Internet of Things
-	-	-	-	-	EEH502 Emerging Trends in Electrical engineering

Equivalence to the courses (and hence exemptions) of other programmes to be granted to branch change candidates entering the Diploma in Electrical Engineering programme will be decided by the Programme Dean in consultation with the teaching staff of the Electrical Engineering Department.

**PROFORMA FOR
FORMATIVE ASSESSMENT OF PRACTICAL'S /TUTORIAL
/SELF LEARNING ASSESSMENT AND
SUMMATIVE ASSESSMENT PRACTICAL /ORAL
EXAMINATION**

Government Polytechnic Kolhapur

PROFORMA -I

Formative Assessment of Practical's /Tutorial /Self Learning Assessment

														Total Marks out of ()	Marks converted As per scheme ()
PR/TU/Assignment No.		1	2	3	4	5	6	7	8	9	10	11	12		
Sr.N o	Roll No.														
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															

Government Polytechnic Kolhapur
PROFORMA II

Summative Assessment Practical /Oral Examination

SR.NO	ROLL NO	Knowledge about the course	Preparedness for practical	Neat & complete Diagram/write up	Communication /Presentation	Performance in practical Exam.	Total out of 25	Converted Marks as per Learning scheme ()
		5M	5M	5M	5M	5M		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

SECTION-II CURRICULUM

COURSE NAME : ENGINEERING PHYSICS
COURSE CODE : CCH101
COURSE ABBREVIATION : HPHA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
1.5	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	175
	30*#	70*#	100	40	25	10	25@	10	25	10	

(Total IKS Hrs for Sem.: 04 Hrs)

C: ABBREVIATIONS :- CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends:@Internal Assessment, #External Assessment,*# Online Examination, @\$Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes microproject / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE :-

Physics is the foundation of engineering and technology. The development of all engineering areas requires good understanding of fundamental principles in physics. Studying physics develops scientific methodology and technical aptitude in the students. Applications of principles of physics in engineering fields create interest and motivate the students.

ii) INDUSTRY/ EMPLOYER EXPECTED OUTCOME

Apply principles of Physics to solve engineering problems as follows:

Cognitive : i) Understanding and applying principles and laws of Physics to simple practical problems/ situations. ii) Observing iii) Classifying iv) Interpreting

Psychomotor : Handling of instruments, apparatus and tools

Affective : Skill of i) working in team ii) curiosity, interest and self-confidence

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH101-1 Estimate errors in measurement of physical quantities.

CCH101-2 Express importance of semiconductors and nanotechnology.

CCH101-3 Select proper material in engineering industry by analysis of its physical properties.

CCH101-4 Apply principles of electricity and magnetism to solve engineering problems.

CCH101-5 Apply principles of optics to solve engineering problems.

CCH101-6 Apply principles of fiber optics for related engineering applications.

Course outcomes and programme outcomes/ programme specific outcomes (co-po/ps) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -0]

COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1	PSO2
CCH101-1 Estimate errors in measurement of physical quantities.	3	1	-	1	1	1	1	-	-
CCH101-2 Express importance of semiconductors and nanotechnology	3	-	-	-	1	1	1	-	-
CCH101-3 Select proper material in engineering industry by analysis of its physical properties	3	1	-	1	1	1	1	-	-
CCH101-4 Apply principles of electricity and magnetism to solve engineering problems	3	1	-	1	1	1	1	-	-
CCH101-5 Apply principles of optics to solve engineering problems.	3	1	-	-	1	1	1	-	-
CCH101-6 Apply principles of fiber optics for related engineering applications	3	-	-	-	1	1	1	-	-

F. CONTENT :

D) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Physics developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	To measure internal and external dimensions of hollow cylinder by using Vernier Caliper	CCH101-1
2	To measure the diameter of bob and thickness of plate by using Vernier Caliper	CCH101-1
3	To measure the diameter of bob and thickness of plate by using Micrometer screw gauge	CCH101-1
4	To determine forbidden energy band gap in semiconductors	CCH101-2

Sr. no	Laboratory experiences	CO
5	To determine the viscosity of liquid by Stokes method.	CCH101-3
6	To determine the buoyancy force on a solid immersed in a liquid	CCH101-3
7	To measure unknown resistance of wire by Ohm's law	CCH101-4
8	To verify series law of resistances	CCH101-4
9	To verify parallel law of resistances	CCH101-4
10	To draw magnetic lines of force for given magnet by using magnetic compass	CCH101-4
11	To verify Snell's law using glass slab	CCH101-5
12	To study variation of δ with i for a prism by pin method	CCH101-5
13	To study Total Internal Reflection using glass slab	CCH101-6
14	To be added by the subject teacher as per requirement	

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH101-1 Estimate errors in measurement in Physical quantities.			
1	UNITS AND MEASUREMENT 1.1 Unit, Physical Quantities : Fundamental and Derived Quantities and their units 1.2 Systems of units : CGS, MKS, FPS and SI 1.3 Errors , Types of errors : Instrumental, Systematic and Random error, Estimation of errors : Absolute, Relative and percentage errors 1.4 Significant figures 1.5 Ancient Astronomical Instruments : Chakra, Dhanuryantra, Yasti and Phalaka yantra (IKS learning) 1.6 Simple Numerical problems	10	12
CO: CCH101-2 Express the importance of Semiconductors and nanotechnology.			
2	INTRODUCTION TO SEMICONDUCTORS AND NANOTECHNOLOGY 2.1 SEMICONDUCTORS 2.1.1 Conductors, insulators and semiconductors 2.1.2 Energy bands	08 (06)	08 (06)

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	2.1.3 Intrinsic and extrinsic semiconductors 2.1.4 Minority and majority charge carriers 2.1.5 P and N type semiconductors 2.1.6 Properties of semiconductors 2.1.7 Applications of semiconductors No numericals on above topic 2.2 Nanotechnology 2.2.1 Definition of nanoscale, nanometer, nanoparticle 2.2.2 Definition and examples of nanostructured materials 2.2.3 Applications of nanotechnology in electronics, automobile, textile, space, medicine, cosmetics and environment No numericals on above topic	(02)	(02)
CO: CCH101-3 Select proper material in engineering industry by analysis of its physical properties.			
3	PROPERTIES OF MATTER 3.1 ELASTICITY 3.1.1 Definitions of elasticity, plasticity, rigidity, deforming force, restoring force 3.1.2 Stress, Strain and their types 3.1.3 Elastic Limit, Statement of Hooke's law 3.1.4 Modulus of elasticity and its types, Relation between Y, K and η (No derivation) 3.1.5 Ultimate stress, breaking stress, Working stress, Factor of safety 3.1.6 Applications of elasticity 3.1.7 Simple Numerical problems 3.2 VISCOSITY 3.2.1 Definition and meaning of viscosity, velocity gradient 3.2.2 Newton's law of viscosity, Coefficient of viscosity 3.2.3 Stokes law 3.2.4 Derivation of expression for coefficient of viscosity of liquid by Stokes method 3.2.5 Effect of temperature and adulteration on viscosity of liquids 3.2.6 Applications of viscosity	12 (06) (06)	14 (10) (04)

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	No numericals on above topic		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH101-4 Apply principles of electricity and magnetism to solve engineering problems			
4	ELECTRICITY AND MAGNETISM 4.1 ELECTRICITY 4.1.1 Concept of charge, Coulomb's inverse square law, 4.1.2 Electric field, Electric field intensity 4.1.3 Electric potential and potential difference 4.1.4 Electric current, Resistance, Ohm's law 4.1.5 Specific resistance 4.1.6 Resistances in series and parallel 4.1.7 Simple Numerical problems 4.2 MAGNETISM 4.2.1 Magnetic field and magnetic field intensity and its units 4.2.2 Magnetic lines of force, magnetic flux No numericals on above topic	10 (06) (04)	12 (08) (04)
CO: CCH101-5 Apply principles of optics to solve engineering problems			
5	OPTICS 5.1 PROPERTIES OF LIGHT 5.1.1 Refraction of light 5.1.2 Laws of Refraction of Light, Snell's law 5.1.3 Refraction through glass prism 5.1.4 Dispersion & Dispersive Power (in terms of angles of deviation only) 5.1.5 Simple Numerical problems 5.2 LASER 5.2.1 Introduction of LASER 5.2.2 Properties of laser 5.2.3 Spontaneous and stimulated emission	14 (06) (04)	18 (08) (06)

	5.2.4 Population inversion and optical pumping 5.2.5 Applications of LASER No numericals on above topic 5.3 X-RAYS 5.3.1 Nature and properties of x-rays. 5.3.2 Production of x-rays by Coolidge tube 5.3.3 Applications of x-rays No numericals on above topic	(04)	(04)
Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH101-6 Apply principles of fiber optics for related engineering applications			
6	FIBER OPTICS 6.1 Optical communication link 6.2 Principle of optical fiber (TIR) 6.3 Structure of optical fiber 6.4 Propagation of light in optical fiber 6.5 Advantages of optical fibers over conventional metal conductors 6.6 Applications of optical fibers No numericals on above topic	06	06

** No questions will be asked on IKS learning subtopics in any question papers.

G : List of Micro projects/ Assignments/ Other Activities under SLA

Sr. No.	List of Microprojects (any one of the following under SLA)	Hrs Allotted
1	Prepare chart showing multipliers required for converting units of physical quantities.	02
2	Prepare prototype vernier caliper of desired least count using card sheet.	02
3	Collect information about ancient astronomical instruments like Chakra, Dhanuryantra, Yasti and Phalaka yantra.	02
4	Collect different materials such as metal, plastic, glass etc and prepare models to show their electrical conductivity.	02
5	Collect different sizes of same material (eg. sugar, salt etc) and list the physical/elerical/optical/chemical/mechanical characteristics for each of them.	02
6	Prepare chart showing the three types of modulus of elasticity developed in a material.	02
7	Prepare working model to differentiate liquids on the basis of viscosity.	02
8	Prepare chart/models to demonstrate magnetic lines of force of different types of	02

	magnets.	
9	Prepare chart/models for series and parallel combination of resistances of different values.	02
10	Prepare a model to demonstrate the variation of angle of refraction with respect to angle of incidence.	02
11	Use keychain laser to differentiate laser with ordinary light.	02
12	Prepare a presentation for application of x-rays in different fields.	02
13	Prepare a model to demonstrate total internal reflection. (For EE/ET/IT students)	02
OR		
Sr.No	List of Assignment (any one of the following under SLA)	Hrs Allotted
1	Write fundamental and derived Physical quantities with their SI units	02
2	Enlist the rules used to decide significant figures in measurements.	02
3	Write points to differentiate conductors, semiconductors and insulators on the basis of energy band diagram.	02
4	List applications of semiconductors in Civil, Mechanical, Electrical, Information Technology, Electronics and Telecommunication, Metallurgical Engineering etc.	02
5	Write down the applications of nanotechnology in the field of electronics, cosmetics, textile, environment, medical, space and defense, automobiles.	02
6	Write applications of elasticity.	02
7	Explain free fall of a sphere in a liquid column.	02
8	Write information of electric lines of force and magnetic lines of force.	02
9	Explain conversion of galvanometer into ammeter/voltmeter of desired range.	02
10	Draw ray diagrams showing different phenomena of light (reflection, refraction, dispersion etc).	02
11	Enlist the properties and applications of laser.	02
12	Explain production of X-rays using Coolidge tube.	02
13	Draw and explain of optical fiber communication link. (For EE/ET/IT students).	02
OR		
Sr.No	List of Activity (any one of the following under SLA)	Hrs Allotted
	Any course related activity assigned by the course teacher.	02

****One micro project/ assignment/ given activity is to be completed during the semester.**

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Units and measurements	2	4	6	12	CCH101-1
I / 2	Introduction to	2	2	4	08	CCH101-2

	Semiconductors and Nanotechnology					
I / 3	Properties of matter (Elasticity and Viscosity)	4	2	8	14	CCH101-3
II / 4	Electricity and Magnetism	2	4	6	12	CCH101-4
II / 5	Optics (Properties of light, Laser & X-rays)	6	6	6	18	CCH101-5
II / 6	Fiber Optics	2	2	2	06	CCH101-6
Total Marks					70	

I :-Assessment Criteria

i) Formative Assessment of Practical:-

Every practical assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Presentation (Observations, calculations & Result table)	05
Psychomotor	Operating Skills	05
	Drawing skills (Neat & complete circuit Diagram/ schematic Diagram)	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram / observation table	05
4	Observations / Calculations / Result / Graph	05
5	Safety / use of proper tools	05
TOTAL		25

iii) Assessment of SLA :-

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Attendance	05
2	Preparedness and workmanship	05
3	Presentation (neat figures/ diagrams/ tables/ graphs etc.)	05
4	Conclusion / Inference	05
5	Oral Based on microproject/ assignment/ activity	05
TOTAL		25

J) Instructional Methods:

1. Lectures cum Discussions
2. Regular Home Assignments
3. Laboratory work
4. Use of projector and soft material for demonstration

K) Teaching and Learning resources:

1. Chalk board
2. Video clips
3. Slides
4. Item Bank
5. Charts

L) Reference Books:

S.N.	Name of Book	Author	Publication
1	Text book of Physics for class XI & XII (Part-I, II)	Narlikar	N.C.E.R.T Delhi
2	Engineering Physics	P.V.Naik.	Pearson Edu. Pvt. Ltd, New Delhi.
3	Concepts in Physics, Vol. I & II.	Narkhede, Pawar, Sutar	Bharti Bhawan Ltd, New Delhi.
4	Principles of Physics.	Walker, Halliday, Resnik	Wiley Publication. , New Delhi.
5	Engineering Physics	B.L. Theraja	S. Chand Publishers – New Delhi
6	Concept of modern physics	Beiser	Tata Mc-Graw Hill
7	Physics for Technicians	E. Zebro Wski	Tata Mc-Graw Hill
8	Engineering Physics	V. Rajendran	Tata McGraw-Hill Publications
9	The Archaic and The Exotic : Studies in the history of Indian astronomical instruments	Steeramula Rajeswara Sarma	Manohar Book Services
10	The Surya Siddhanta	Aryabhata	Baptist Mission Press, Calcutta

M) Learning Website & Software

- 1) <http://www.physicsclassroom.com>
- 2) <http://scienceworld.wolfram.com/physics/>
- 3) <http://physics.about.com/>
- 4) <http://nptel.ac.in/course.php?disciplineId=115>
- 5) <http://nptel.ac.in/course.php?disciplineId=104>
- 6) www.fearofphysics.com
- 7) www.science.howstuffworks.com
- 8) www.iksindia.org

COURSE NAME : BASIC MATHEMATICS(CE/ME/ET/IT/EE/MT)
COURSE CODE : CCH105
COURSE ABBREVIATION : HBMT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	02	
	Laboratory Learning	-	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B: ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Tutorial						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	125
	30	70	100	40	--	--	--	--	25	10	

(Total IKS Hrs for Sem.: 06 Hrs)

C: ABBREVIATIONS:-CL-ClassRoom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH- Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS -Indian Knowledge System, SLA -Self Learning Assessment **Legends:**@Internal Assessment,#External Assessment,*#On Line Examination,@\$Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.
 *Self learning includes micro project /assignment/other activities. (The list of all assignments are given in tabular format. At least 6 to 8 assignments to be given)

D. i)RATIONALE:-

Mathematics is an important prerequisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of mathematics is an effective tool to pursue and master the applications in the engineering and technological fields. Algebra provides the language and abstract symbols of mathematics. The topic Matrices is helpful for finding optimum solution of system of simultaneous equations which

are formed in the various branches of engineering using different parameters. Trigonometry is the study of triangles and angles. Contents of this subject will form foundation for further study in mathematics. Statistics can be defined as a type of mathematical analysis which involves the method of collection and analyzing the data and summing of the data in numerical form for a given set of real world observations. Calculus is a branch of mathematics that calculates how matter, particles and heavenly bodies actually move. Derivatives are useful to find maxima & minima of a function, velocity & acceleration are also useful for many engineering problems. Hence the course provides the insight to analyze engineering problems scientifically using logarithms, matrices, trigonometry, straight line, differential calculus and statistics.

ii) COMPETENCY:

Apply principles of Basic Mathematics to solve industry based technology problems.

1. **Cognitive** : To understand the mathematical concepts
2. **Psychomotor:** Proper handling of scientific calculator
3. **Affective** : Attitude of accuracy, punctuality, proper reasoning and presentation

E. COURSE LEVEL LEARNING OUTCOMES (COS):

- CCH105-1 : To Apply concepts of algebra to solve engineering related problems
- CCH105-2 : To Use techniques and methods of statistics to compare multiple sets of data
- CCH105-3 : Solve area specific engineering problems under given conditions of straight lines
- CCH105-4:- To memorize trigonometric formulae and solve problems based on them.
- CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.

Competency, course outcomes and programme outcomes/programme specific outcomes(cp-co-po/pso) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Disciplin especific knowledg e	PO 2 Proble m Analysi s	PO 3 Design/ Develo pment of solution s	PO 4 Engine ring Tools, Experi mentati on and Testing	PO 5 Enginee ring Practice s for society, sustaina bility and Environ ment	PO 6 Projec t Mana gemen t	PO 7 Life- long Learni ng	PSO1 Maintai n various types of electrica l equipm ents	PSO2 Maintai n various section s of electric al power system s	
Competency: Apply principles of Basic Mathematics to solve industry based technology problems.	3	2	1	-	1	-	2			
CCH105-1-CO-1 : To Apply concepts of algebra to solve engineering related problems	3	1	-	-	-	-	1			

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design Development of solutions	PO 4 Engineering Tools Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO Maintain various sections of electrical power systems
CCH105-2-CO-2 : To Use techniques and methods of statistics to compare multiple sets of data	3	1	-	-	1	-	1		
CCH105-3-CO-3 : Solve area specific engineering problems under given conditions of straight lines	3	-	-	-	-	-	1		
CCH105-4-CO-4:- To memorize trigonometric formulae and solve problems based on them.	3	1	1	-	-	-	1		
CCH105-5-CO-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.	3	2	1	-	1	-	1		

F. CONTENT:

D) Tutorial exercises

Solve any **TEN** the following Tutorial exercises shall be conducted in the Tutorial room in tutorial sessions of batches of about 20- 22 students:

Sr. no	Tutorial experiences	CO
1	Solve Simple problems of Logarithms based on given application	CCH105-1
2	Solve elementary problems on Algebra of Matrices	CCH105-1
3	Solve simultaneous equations using Matrix inversion method	CCH105-1

Sr. no	Tutorial experiences	CO
4	Resolve into Partial Fractions using linear non repeated, repeated and irreducible quadratic factors	CCH105-1
5	Practice problems on equation of straight lines using different forms, Solve problems on perpendicular distance, distance between two parallel lines and angle between two lines	CCH105-3
6	Solve problems on finding range, coefficient of range and mean deviation	CCH105-2
7	Solve problems on Standard deviation, coefficient of variation and comparison of two sets	CCH105-2
8	Solve problems on Allied & Compound angles	CCH105-4
9	Solve problems on Multiple & sub multiple angles	CCH105-4
10	Solve problems on factorization & De- factorization formulae	CCH105-4
11	Solve problems on Inverse Trigonometric Functions	CCH105-4
12	Solve examples on functions & rules of derivatives	CCH105-5
13	Solve examples on Derivative of composite function ,inverse & parametric functions,	CCH105-5
14	Solve examples on Derivative of exponential, implicit and logarithmic functions	CCH105-5
15	Solve examples on Application of Derivatives	CCH105-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH105-1 : To Apply concepts of algebra to solve engineering related problems			
Unit 1 Algebra	<p>1.1 LOGARITHMS 1.1.1 Concept and laws of logarithm 1.1.2 Simple examples based on laws of Logarithms</p> <p>1.2 MATRICES 1.2.1 Definition of a matrix, Types of matrices, Algebra of matrices, Equality of two matrices, Transpose of a matrix, 1.2.3 Adjoint and Inverse of a matrix 1.2.4 Solution of simultaneous equations having 3 unknowns using Matrix inversion method</p> <p>1.3 PARTIAL FRACTIONS 1.3.1 Definition of rational, proper and improper fractions 1.3.2 Various cases of Partial fractions and Examples 1.4 Algebra of Indian Knowledge System: Solution of simultaneous equations using Vedic Mathematics</p>	12	16

CO: CCH105-2 : To Use techniques and methods of statistics to compare multiple sets of data			
Unit 2 Statistics	MEASURES OF DISPERSION 2.1 Range, Coefficient of Range of Discrete and grouped data 2.2 Mean deviation and Standard Deviation about mean for Discrete & Grouped Data (except Assumed mean method and Step deviation method) 2.3 Variance and coefficient of Variance 2.4 Comparison of 2 sets of observations	6	10
CO: CCH105-3 : Solve area specific engineering problems under given conditions of straight lines			
Unit 3 Coordinate Geometry	THE STRAIGHT LINE 3.1 Slope, intercepts & various methods of finding slope 3.2 Conditions for two straight lines to be parallel and Perpendicular to each others 3.3 Various forms of straight line 3.4 Perpendicular distance of a point from a line 3.5 Distance between two parallel lines 3.6 Angle between two straight lines 3.7 Geometry in Sulabh sutras in Indian Knowledge System	6	8

Section –II

Sr. no.	Topics/Subtopics	Learning Hours	Classroom learning evaluation Marks
CO: CCH105-4:- To memorize trigonometric formulae and solve problems based on them.			
Unit 4 Trigonometry	TRIGONOMETRY 4.1 Fundamental Identities(Only state, No examples) 4.2 Conversion of degree into radian and vice versa of standard angles 4.3 Trigonometric ratios of Compound Angles(Without Proof) , Examples 4.4 Trigonometric ratios of Allied Angles (Without Proof) , Examples 4.5 Trigonometric ratios of Multiple and Submultiple Angles (Without Proof) , Examples 4.6 Factorization and De-Factorization Formulae (Without Proof) , Examples 4.7 Inverse Trigonometric ratios , Principle values and simple problems 4.8 Trigonometry in Indian Knowledge System : The evolution of sine function in India 4.9 Trigonometry in Indian Knowledge System : Indian Trigonometry-From ancient beginning to Nilakantha 4.10 Trigonometry in Indian Knowledge System : Ancient Indian Astronomy 4.11 Trigonometry in Indian Knowledge System: Pythagorean to triples in Sulabhsutras	14	14
CO: CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.			
Unit 5 Differential	5.1 Functions: Concept of Functions and simple examples 5.2 Limits: Concept of Limits without examples 5.3 Derivatives:		60

Calculus	5.3.1 Derivative of sum, difference, product and quotient of two or more functions 5.3.2 Derivative of composite functions 5.3.3 Derivative of Inverse functions 5.3.4 Derivative of Implicit functions 5.3.5 Derivative of Parametric functions 5.3.6 Derivative of exponential and logarithmic functions 5.3.7 Calculus in Indian Knowledge system “ Discovery of Calculus by Indian Astronomers (Indian Mathematics)	16	16
CO: CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.			
Unit 6 Application of Derivatives	APPLICATIONS OF DERIVATIVES 6.1 Second Order Derivatives(without examples) 6.2 Equation of Tangent & Normal 6.3 Maxima & Minima(only for algebraic functions) 6.4 Radius of curvature	06	06

** No questions will be asked on IKS related subtopics in any question paper

G. List of Micro project /Assignments under SLA

Sr.No	List of Assignment (under SLA)	Hrs Allotted
1	Collect the Data of Marks obtained by your class in midsemester test. Compute the variance and coefficient of variance of the data	02
2	Prepare a model using the concept of tangent and normal, bending of curves in case of sliding of a vehicle.	02
3	Prepare charts of grouped and ungrouped data.	02
4	Collect statistical data on real world problems and find Mean Deviation & S.D.	02
5	Collect at least 10 examples based on real world applications which will be used to find S.D. /Variance.	02
6	Prepare models to explain different concepts.	02
7	Prepare a model using concept of radius of curvature of bending of railway tracks.	02
8	A window in the form of rectangle surmounted by a semicircular opening . The total perimeter the window to admit maximum light through the whole opening ,prepare a model using concept of Maxima & Minima for the above problem and verify the result.	02
9	Collect applications of radius of curvature on lens design andoptics, mirror and reflective surface properties , road and highway design , structural behavior, roller coaster track design& make a video of 5- minutes duration.	02
10	Design a puzzle based on matrices . Create a grid of numbers and operations.	02

11	Develop a math game based on operations of matrices.	02
12	Collect examples based on real world applications of logarithm and prepare a pdf file.	02
13	Measure height of trees/buildings in surrounding locations using trigonometry and prepare presentation.	02
14	Apply trigonometric principles to calculate angles ,distances, dimensions relevant to the chosen area and make a poster presentation.	02
15	Find height of room or distance between two pillars by using concept of straight line.	02

****Attempt any 10-12 Micro Projects, out of the given list.**

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Algebra	4	6	6	16	CCH105-1
I / 2	Statistics	2	4	4	10	CCH105-2
I / 3	Coordinate Geometry	2	2	4	8	CCH105-3
II /4	Trigonometry	2	6	6	14	CCH105-4
II /5	Differential Calculus	2	6	8	16	CCH105-5
II/6	Application of Derivatives	2	2	2	6	CCH105-5
Total Marks					70	

I. Assessment Criteria

Formative Assessment of Tutorial:-

Every Tutorial shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Solving skill	05
	Remembering formulae & Accuracy	05
Affective	Discipline and punctuality	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration
4. Use of internate.
5. Whatsapp groups.
6. Use of books

K. Teaching and Learning resources:

Chalk board, Books, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N	Name of Book	Author	Publication
1	A Text Book on Engineering Mathematics (First Year Diploma)	G.V.Kumbhojkar	Phadake Prakashan, Kolhapur
2	Basic Mathematics	Patel, Rawal and others	Nirali Prakashan, Pune
3	Basic Mathematics	Sachin S. Shah & Santosh R. Mitkari	Tech-Neo Publications
4	Basic Mathematics	Vitthal B. Shinde & others	Techical Publications
5	Higher Engineering Mathematics	Grewal B.S.	Khanna publication New Delhi, 2013 ISBN: 8174091955
6	A text book of Engineering Mathematics	Dutta D.	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
7	Studies in the History of Indian Mathematics	C.S. Seshadri	Hindustan Book Agency, New Delhi 110016. ISBN 978-93-80250-06-9
8	Indian Mathematics Engaging with the World from Ancient to Modern Times	George Gheverghese Joseph	World Scientific Publishing Europe Ltd. 57 ASBN 978-17-86340-61-0
9	Calculus and Its Applications	Marvin L. Bittinger David J. Ellenbogen Scott A. Sargent	Addison-Wealey 10 th Edition ISBN-13: 978-0-321-69433-1
10	Mathematics- I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
11	Mathematics -II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3
12	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
13	Sansar ke Mahan Ganitagya	Gunakar Muley	Raj kamal Prakashan ISBN-13. 978-8126703579
14	An Introduction to Statistical learning with applications in R	Gareth James & others	Springer New York Heidelberg Dordrecht London ISBN: 978-1-4614-7137-0

M. Learning Website & Software

- a. www.nptel.ac.in/courses/106102064/1
- b. www.scilab.org/-SCI Lab
- c. www.mathworks.com/product/matlab/-MATLAB
- d. Spreadsheet Applications
- e. <http://ocw.abu.edu.ng/courses/mathematics/>
- f. <https://ocw.mit.edu/>
- g. <https://libguides.cmich.edu/OER/mathematics>
- h. <https://libguides.furman.edu/oer/subject/mathematics>

Course Name :ENGINEERING GRAPHICS & AUTO-CAD
Course Code :CCH107
Course Abbreviation: HGRA
Course Type :DSC

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	2
	Tutorial Learning	--	
	Laboratory Learning	02	
SLH-Self Learning	SLH-Self Learning	-	
	NLH-Notional Learning	04	

B. Assessment Scheme:

Theory				Based on LL & TL				Based on Self Learning		Total Marks
				Practical				SLA		
FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
--	--	--	--	50	20	50 @	20	-	-	100

Total IKS Hrs for Semester:02 Hrs.

C. ABBREVIATIONS: CL- Classroom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA- Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

D. RATIONALE: -

The electrical technician / supervisor are called upon to draw or interpret drawings of electrical systems that include machines, control panels, power system components such as transmission and distribution systems etc. This course aims to provide hands on practice in freehand sketches; drawing using relevant tools and

computer based software. The course also provides practice to read and interpret electrical engineering drawings.

E. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

—Prepare engineering drawing using prevailing drawing instruments & Use CAD for creating and editing electrical engineering related drawings.

Course Outcomes:

CCH107-1. Draw symbolic representation of electrical components manually.

CCH107-2. Sketches, isometric and orthographic views of electrical machines and components.

CCH107-3- Use free hand drawing and sketches to draw simple electrical objects.

CCH107-4. Use CAD tools to draw simple electrical objects.

CCH107-5. Create electrical CAD drawings.

CCH107-6. Edit electrical drawings in CAD.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES/PROGRAMME SPECIFIC OUTCOMES (CP-CO-PO/PSO) MATRIX

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0 : no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Competency The aim of this course is to help the student to attain the following industry and field related competency; Use CAD for creating and editing electrical engineering related drawings	3	-	2	3	-	1	2	2	2
CCH107-1. Draw symbolic representation of electrical components manually.	3	1	3	3	-	2	3	3	3
CCH107-2. Sketches, isometric and orthographic views of electrical machines and components.	3	2	3	3	-	3	2	3	3
CCH107-3. Use free hand drawing and sketches to draw simple electrical objects.	3	3	3	3	-	3	1	2	2

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
CCH107-4. Use CAD tools to draw simple electrical objects	3	2	3	3	-	3	3	1	1
CCH107-5. Create electrical CAD drawings	3	2	3	3	-	2	3	3	3
CCH107-6 Edit electrical drawings in CAD	3	2	3	3	-	2	3	3	3

F. CONTENT

I) LAB AND PRACTICAL WORK:

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in practical sessions of batches of about 22 students

Sr. No.	Practical Exercises	Course Outcomes
Using manual drawing tools		
1.	Names & Letters	CCH107-01
2	Draw different electrical (including electronics) symbols using drawing Instruments as per IS: 1032 or new equivalent IS.	CCH107-01
3	Draw the orthographic Projection of Machine parts or electrical components.	CCH107-2
4	Draw the isometric Projection of Electrical Machine parts or electrical Components.	CCH107-02
5	Draw the freehand drawing of Machine parts and electrical Components	CCH107-03
6	Draw labeled layouts of two types of electrical earthing systems.	CCH107-03
Using CAD software		
8.	Locate components of CAD classic screen by creating new drawing: a. CAD screen layout, drawing area, menu and toolbars, status bar Working with toolbar and commands, changing drawing limits, creating rectangle etc. saving drawing for first time	CCH107-04
9.	Draw a line diagram using absolute coordinate method. Use LIMITS, UNITS, LINE, ARC Commands:	CCH107-05

	<p>a. Absolute coordinate method</p> <p>b. Drafting set-up: units, angle, area, coordinate system, limits, grid, object snap</p> <p>c. Creating two dimensional drawings using draw commands- line and arc.</p>	
10	<p>Draw a line diagram using relative coordinate and relative polar coordinate method. Use LIMITS, UNITS, LINE, ARC, Commands:</p> <p>a. Relative coordinate and relative polar coordinate method</p> <p>b. Draft set-up: units, angle, area, coordinate system, limits, grid, object snap</p> <p>c. Create two dimensional drawings using draw commands-line and arc.</p>	CCH107-05
11	<p>Draw a 2D figure using Draw and Modify commands. Use LINE, CIRCLE, OFFSET, TRIM, FILLET commands:</p> <p>a. Create two dimensional drawings using draw commands- line and circle</p> <p>b. Modify two dimensional drawings using modify commands- offset, trim, fillet</p>	CCH107-05
12	<p>Draw a 2D figure using Draw and Modify commands. Use LINE, ARC, POLYGON, ELLIPSE, COPY, MIRROR, TRIM, ROTATE, CHAMFER commands:</p> <p>a. Create two dimensional drawings using draw commands- line, arc, polygon, and ellipse.</p> <p>b. Modify two dimensional drawings using modify commands- copy, Mirror, trim, rotate, chamfer</p>	CCH107-05
13	<p>Draw isometric drawing of electrical machine. Use LIMITS, UNITS, ZOOM, GRID, SNAP, LINE, COPY, ISOPLANE, ELLIPSE, TRIM, ERASE, PROPERTIES, SAVE commands,</p> <p>a. Draft set-up: units, limits, zoom, grid, object snap, ortho mode</p> <p>b. Snap and grid- snap spacing, grid spacing, isometric snap type</p>	CCH107-05
14	Create a simple drawing using electrical CAD software for the given electrical circuit diagram	CCH107-06
15	Create a simple drawing using electrical CAD software for the given Single line diagram of various simple wiring	CCH107-06

II) THEORY			
SECTION - I			
Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
<i>Course Outcome CCH107-1 Understand various fundamentals in engineering drawing</i>			
1.	<p>Introduction To Engineering Drawing</p> <p>1.1 Drawing Instruments and their uses</p> <p>1.2 Standard sizes of drawing sheets as per ISO – —A1 series, Layout of Sheet(* IKS)</p> <p>1.3 Letters and numbers (single stroke vertical), Convention of lines and their applications.</p> <p>1.4 Dimensioning Technique as per SP-46 (Latest Edition), Elements of dimensioning, Types and applications of chain, parallel and Co-ordinate dimensioning</p>	03	

Course Outcome CCH107-2 Draw the orthographic projections & Isometric projections of objects and machine components			
2.	Introduction of Orthographic Projections & Isometric Projections 2.1 First and Third angle Projection Method 2.2 Conversion of Pictorial view into orthographic Views. (First angle Projection Method Only) 2.3 Orthographic projections of simple parts. 2.4 Introduction of isometric projections, isometric scale & natural scale. 2.5 Isometric view & Isometric projections of simple parts. 2.6 Isometric Projections of Electrical Machine parts or electrical components.	09	
Course Outcome CCH107-3 Draw free hand sketches & single line diagram of simple electrical engineering components			
3.	Free hand sketches & single line diagram 3.1 Need for free hand sketching with its importance. 3.2 Freehand sketches of electrical machine parts or electrical components. 3.3 Single line diagram of various simple wiring. 3.4 Basic of earthing (*IKS) 3.5 Draw labeled layouts of two types of electrical earthing systems.	03	

SECTION - II			
Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome CCH107 -4 Use CAD tools to draw simple electrical objects.			
4.	4.1 Components of CAD classic screen, Identify components of CAD classic screen. 4.2 Menu bar and status bar. Identify components of CAD screen. 4.3 CAD tool bar. 4.4 Identify toolbar and commands(*IKS)	03	
Course Outcome CCH107-5 Create electrical CAD drawings			
5.	5.1 Absolute Coordinate Method: Commands: LIMITS, UNITS, LINE and ARC. Interpret line diagram using absolute coordinate method. 5.2 Relative coordinate Method: Commands: LIMITS, UNITS, LINE and ARC. Interpret line diagram using relative coordinate and relative polar coordinate method. 5.3 Relative polar coordinate method: Commands: LIMITS, UNITS, LINE and ARC. Interpret 2D figures using Draw and Modify commands. Use commands in CAD. 5.4 D figures: Commands: LINE, CIRCLE, OFFSET, TRIM, FILLET, ARC, POLYGON, ELLIPSE, COPY, MIRROR, TRIM, ROTATE and CHAMFER., 5.5 Isometric drawings: commands: LIMITS, UNITS, ZOOM, GID, SNAP, LINE, COPY, ISOPLANE, ELLIPSE, TRIM, ERASE, PROPERTIES and SAVE. 5.6 Interpret isometric drawing of electrical machine in CAD(*IKS)	08	
Course Outcome CCH107-6 Edit electrical drawings in CAD.			
6.	Applications of electrical CAD software to: Draw circuit diagrams and layouts. 6.1 Use of electrical CAD to draw the given electrical circuit diagram. 6.2 Use electrical CAD to draw layouts of two types of earthing systems	04	

**** No questions will be asked on IKS learning subtopics in any question papers.**

G: LIST OF ASSIGNMENTS UNDER SLA

.....Not applicable

I:-ASSESSMENT CRITERIA

The assessment need to be done as per Proforma I & II

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr.No	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat& complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

6. Lectures cum Demonstrations,
7. Classroom practices.
8. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE MATERIAL:

a. Reference Books:

Sr. No.	Author	Title	Publisher
1.	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2.	Amar Pathak	Engineering Drawing	Dreamtech Press, 2010
3.	D.Jolhe	Engineering Drawing	Tata McGraw Hill Edu., 2010
4.	M.B.Shah,	Engineering Drawing	Pearson, 2010

	B.C.Rana		
5.	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006
6.	IS Code, SP – 46	Engineering Drawing Practice	Bureau Of Indian Standards

b. Web References:

- i) <http://www.design-technology.info/IndProd/drawings/>
- ii) <http://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/>
- iii) http://en.wikipedia.org/wiki/Engineering_drawing
- iv) <http://www.engineeringdrawing.org/>
- v) http://www.teachengineering.org/view_activity
- vi) www.howtoread.co.in/2013/06/how-to-read-ed.html
- vii) <http://www.slideshare.net/akhilrocker143/edp>
- viii) <http://www.24framesdigital.com/pstulpule>

* * *

COURSE NAME : FUNDAMENTALS OF ICT
COURSE CODE : CCH202
COURSE ABBREVIATION: HICT

A. TEACHING-LEARNING & ASSESSMENT SCHEME :

Scheme component	Hours / week	Credits
Theory	1	2
Practical	2	

Course Code	Course Title	Abbr	Course Category /s	Learning Scheme					Credits	Paper Duration	Assessment Scheme								Total Marks		
				Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TSL				Based on SL			
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR			SLA	
							Max	Min					Max	Min	Max	Min	Max	Min			
CCH202	FUNDAMENTALS OF ICT	ICT	SEC	1	-	2	1	4	2		-	-	-	-	25	10	25	10	25	10	75

Total IKS Hrs for Sem. : 01 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learn Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - India Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be failed and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

B. RATIONALE:

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job. This course also presents an overview of emerging technologies so that students of different discipline can appraise the applications of these technologies in their respective domain.

C. COMPETENCY:

Apply Fundamental knowledge of computer system to work with simple applications.

Cognitive: i) State the basic parts of a computer system and relationships among component. ii) State characteristics and functions of CPU's, motherboard, RAM, Storage devices etc.

Psychomotor: i) Use computers for Internet services, Electronics Documentation, Data Analysis and Slide Presentation. ii) Appraise Application of ICT based Emerging Technologies.in different domain.

Affective: Attitude of i) Precision ii) Accuracy iii) Safety iv) Punctuality

D. COURSE OUTCOMES:

- CCH202-1 - Use computer system and its peripherals for given purpose
- CCH202-2 - Prepare Business document using Word Processing Tool
- CCH202-3 - Analyze Data and represent it graphically using Spreadsheet
- CCH202-4 - Prepare professional Slide Show presentations
- CCH202-5 - Use different types of Web Browsers and Apps
- CCH202-6 - Explain concept and applications of Emerging Technologies

E. COURSE OUTCOMES AND PROGRAMME OUTCOMES (CO-PO) MATRIX

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analyses	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CCH202-1	1	-	-	-	-	-	1		

CCH202-2	-	-	-	3	-	-	1		
CCH202-3	-	2	1	3	-	-	1		
CCH202-4	-	-	-	3	-	-	1		
CCH202-5	1	-	-	3	-	-	3		
CCH202-6	1	-	-	3	-	-	3		

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

F. LABORATORY WORK:

Laboratory experiments and related skills to be developed:

Sr. No.	Title of Experiment	Skills to be developed	Course outcome
1.	a) Work with Computer System, Input/output devices, and peripherals. b) Work with files and folders	1.1 Identify various Input/output devices, connections and peripherals of computer system 1.2 Work with Computer System, Input/output devices, and	CCH202-1
2.	Work with document files: a) Create, edit and save document in Word Processing. b) Text, lines and paragraph level formatting	2.1 Create and manage word document. 2.2 Apply formatting features on text at line, paragraph and page level.	CCH202-2
3.	Work with Images and Shapes in Word Processing.	3.1 Insert and edit images, shapes in a document file	CCH202-2
4.	Work with tables in Word Processing.	4.1 Insert table and apply various table formatting features on it.	CCH202-2
5.	Working with layout and printing a) Document page layout, Themes, and printing. b) Use of mail merge with options.	5.1 Apply page layout features in word processing. 5.2 Print a document by applying various print options 5.3 Use mail merge in word processing	CCH202-2
6.	Create, open and edit Worksheet.	6.1 Enter and format data in a worksheet. 6.2 Insert and delete cells, rows	CCH202-3

		And columns 6.3 Apply alignment feature on cell	
7.	Formulas and functions in Worksheet.	7.1 Create formula and —Ifl Condition on cell data 7.2 Apply various functions and name dranges in worksheet.	CCH202-3
8	Sort, Filter and validate data in Spreadsheet.	8.1 Implement data Sorting, Filtering and Data validation features in a worksheet.	CCH202-3
9	Charts for Visual Presentation in Spreadsheet.	9.1 Create charts using various chart options in spreadsheet.	CCH202-3
10	Worksheet Printing.	10.1 Print the worksheet by applying various print options for worksheet	CCH202-3
11	Make Slide Show Presentation.	11.1 Apply design themes to the given presentation 11.2 Insert pictures text/images/shapes in lide 11.3 Use pictures text/images/shapes editing options.	CCH202-4
12	Use Tables and Charts in Slide	12.1 Add tables and charts in the slides. 12.2 Run slide presentation in different modes 12.3 Print slide presentation as handouts/notes	CCH202-4
13	a) Insert Animation effects to Text and Slides. b) Insert Audio and Video files in presentation	13.1 Apply animation effects to the text and slides 13.2 Add/set audio and video files in the presentation.	CCH202-4
14	a) Internet connection configuration b) Use Internet and Web Services.	14.1 Configure internet connection on a computer system 14.2 Use different web services on internet	CCH202-5
15	Working with Browsers.	15.1 Configure different browser settings 15.2 Use browsers for the given purpose	CCH202-5
16	Prepare Web Forms for Survey.	16.1 Create web forms for survey using different options.	CCH202-6
17	Prepare Web Forms for Quiz	17.1 Create web forms for Quiz	CCH202-6

		using different options	
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G. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNINGSKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

Following are some suggestive self-learning topics: 1) Use ChatGPT/any other AI tool to explore informatUse Calendar to Schedule and edit activities. 3) Use Translate app to translate the given content from one lang another. 4) Use cloud based storage drive to store and share your files.

Assignment

Prepare journal of practical performed in the laboratory.

Micro project

The micro project has to be industry application based, internet-based, workshop-based, laboratory-based o based as suggested by Teacher. 1) Perform a survey on various input and output devices available in market aits report. 2) Prepare Time Table, Prepare Notes on Technical Topics, Reports, Bio data with covering letter (S teacher shall assign a document to be prepared by each students) 3) Prepare slides with all Presentation feature as: classroom presentation, presentation about department, presentation of Technical Topics. (Subject teacher assign a presentation to be prepared by each student). 4) Student Mark sheet, Prepare Pay bills, tax statement, assessment record using spreadsheet. (Teacher shall assign a spreadsheet to be prepared by each student). 5) C Survey on different web browsers. 6) Generate resume for different job profile, survey report of any industry ChatGPT/any other AI tool.

H. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Any Office Software c) Any Browser (Any General Purpose Computer available in the Institute)

I. CONTENT:

Sr. No.	Topics / Sub-topics	Lectures (Hours)
<i>Course Outcome CCH202-1 - Use computer system and its peripherals for given purpose.</i>		
1	Unit - I Introduction to Computer System 1.1 Basics of Computer System: Overview of Hardware and Software: block diagram of Computer System, Input/ Output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit 1.2 Internal components: processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives)	2

Sr. No.	Topics / Sub-topics	Lectures (Hours)
	<p>1.3 External Devices: Types of input/output devices, types of monitors, keyboards, mouse, printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive</p> <p>1.4 Application Software: word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editing software, graphics manipulation software System Software compilers, linkers, device drivers, operating system</p> <p>1.5 Network environments: network interface cards, hubs, switches, routers and modems, concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth</p> <p>1.6 Working with Operating Systems: Create and manage file and folders, Copy a file, renaming and deleting of files and folders, Searching files and folders, application installation, creating shortcut of application on the desktop.</p>	
<i>Course Outcome CCH202-2 - Prepare Business document using Word Processing Tool.</i>		
2	<p>Word Processing</p> <p>2.1 Word Processing: Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application.</p> <p>2.2 Editing a Document: Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting</p> <p>2.3 Changing the Layout of a Document: Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs</p> <p>2.4 Inserting Elements to Word Documents: Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture</p> <p>2.5 Working with Tables: Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent page working with Columned Layouts and Section Breaks: a Columns, Section breaks, Creating columns, News letter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust</p>	3

Sr. No.	Topics / Sub-topics	Lectures (Hours)
<i>Course Outcome CCH202-3: Design files of word processors, spreadsheets, presentation software, and database application.</i>		
3	<p>Spreadsheets</p> <p>3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook.</p> <p>3.2 Editing Worksheet: Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, - Freeze</p> <p>3.3 Formatting Cells and sheet: Setting Cell Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades ,Sheet Options, Adjust Margins, Page Orientation, Header and Footer, Insert Page Breaks</p> <p>3.4 Working with Formula: Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions using IF.</p> <p>3.5 Working with Charts: Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet.</p> <p>Advanced Operations: Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.</p>	3
<i>Course Outcome CCH202-4 - Prepare professional Slide Show presentations</i>		
4	<p>Presentation Tool</p> <p>4.1 Creating a Presentation: Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Presentation.</p> <p>4.2 Inserting Media elements: Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format</p> <p>4.3 Working with Tables: Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications.</p> <p>Working with Charts: Insert Charts in a Slide, Modify Chart, Import Charts from Other Office Applications.</p>	4

Sr. No.	Topics / Sub-topics	Lectures (Hours)
Course Outcome CCH202-5 - Use different types of Web Browsers and Apps CCH202-6 - Explain concept and applications of Emerging Technologies		
5	Basics of Internet and Emerging Technologies 5.1 World Wide Web: Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers-history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively for 5.2 Web Services: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking 5.3 Emerging Technologies: IOT, AI and ML, Drone Technologies, 3D Printing. Tools: Docs, Drive, forms, quiz, Translate and other Apps	3

J. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Lab performance, Assignment, Self-learning and Seminar/Presentation

Summative Assessment (Assessment of Learning)

- Lab. Performance, viva voce

K. PROGRESSIVE SKILLS TEST :

Criteria for Continuous Assessment of Practical work and Progressive skill Test:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	02
3	Neat & complete Diagram.	04
4	Observations & computer handling skill	02
5	Use of toolbar, menu bar and short cut keys.	04
6	Logical thinking and approach	04
7	Oral Based on Lab work and completion of task	04
TOTAL		25

Assessment at semester end practical exam as per Pro-forma II.

Criteria for assessment at semester end practical exam:

Sr. no	Criteria	Marks allotted
1.	Technical ability	10
2.	Communication skill	5
3.	Logical approach	10
	TOTAL.	25

L. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

1. Lectures cum Discussions
2. Regular Home Assignments.
3. Laboratory experiences and laboratory interactive sessions

Teaching and Learning resources:

1. Chalk board
2. Slides(PPT)
3. Self-learning Online Tutorials

M. REFERENCE MATERIAL:

a) Books / Codes

Sr.No	Author	Title	Publisher
1	Goel Anita	Computer Fundamentals	Pearson Education, New Delhi, 2014, ISBN-13: 978-8131733097
2	Miller Michael	Computer Basics Absolute Beginner's Guide, Windows 10	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Alvaro Felix	Linux: Easy Linux for Beginners	Creative Space Independent Publishing Platform- 2016, ISBN-13: 978-1533683731
4	Johnson Steve	Microsoft Office 2010: On Demand	Pearson Education, New Delhi India, 2010. ISBN :9788131770641
5	Schwartz Steve	Microsoft Office 2010 for Windows: Visual Quick Start	Pearson Education, New Delhi India, 2012, ISBN : 9788131766613
6	Leete Gurdy, Finkelstein Ellen, Mary Leete	OpenOffice.org for Dummies	Wiley Publishing, New Delhi, 2003 ISBN : 978-0764542220

b) Suggested Websites and Portals

Sr.No	Link / Portal	Description
1	https://www.microsoft.com/en-in/learning/office-training.aspx	Office
2	http://www.tutorialsforopenoffice.org/	Open Office
3	https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf	Open Office
4	https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf	Computer Fundamental
5	http://www.tutorialsforopenoffice.org/	Open Office
6	https://www.tutorialspoint.com/computer_fundamentals/index.htm	Computer Fundamental
7	https://www.tutorialspoint.com/word/	Word Processing
8	https://www.javatpoint.com/ms-word-tutorial	Word Processing
9	https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847	Word Processing
10	https://www.javatpoint.com/excel-tutorial	Spreadsheet
11	https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb	Spreadsheet
12	https://www.javatpoint.com/powerpoint-tutorial	Powerpoint Presentation
13	https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b	Powerpoint Presentation
14	https://www.geeksforgeeks.org/ms-dos-operating-system/	Operating System
15	https://www.javatpoint.com/windows	Windows Operating System
16	https://www.javatpoint.com/what-is-linux	Linux Operating System

Sr.No	Link / Portal	Description
17	https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT	IoT
18	https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/	IoT
19	https://www.javatpoint.com/machine-learning	AI & Machine Learning
20	https://www.skillrary.com/blogs/read/introduction-to-drone-technology	Drone Technology
21	https://www.cnet.com/tech/computing/what-is-3d-printing/	3D Printing
22	https://support.google.com/a/users/answer/9389764?hl=en	Apps

COURSE NAME : **YOGA & MEDITATION.**
COURSE CODE : **CCH203**
COURSE ABBREVIATION : **HYAM**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	1
	Tutorial Learning	00	
	Laboratory Learning	01	
	SLH-Self Learning	01	
	NLH-Notional Learning	2	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						50
-NA-	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	-NA--	--NA-	--NA-	--NA-	-NA-	25	10	--NA-	--NA-	25	10

(Total IKS Hrs for Semester: 01Hr)

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learn Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - India Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be das fail and will have to repeat and resubmit SLA work.

Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks

1 credit is equivalent to 30 Notional hrs.

* Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities.

C. RATIONALE

Diploma Graduate needs a sound body and mind to face the challenging situations in career as employee or as an entrepreneur. Yoga and Meditation brings about the holistic development of an individual and equips with necessary balance to handle the challenges. The age of polytechnic student is appropriate to get introduced to yoga practice as this will help them in studies as well as his professional life. Moreover, Yoga inculcates discipline in all walks of the life of student. Pranayama practice regulates breathing practices of the student to improve stamina, resilience. Meditation empowers a student to focus and keep calm to get peace of mind.

World Health Organization (WHO) has also emphasized the role of yoga and meditations stress prevention measure. National Education Policy -2020 highlights importance of yoga and meditation amongst students of all ages. Therefore, this course for Diploma students is designed for the overall wellbeing of the student and aims to empower students to adopt and practice Yoga in daily life.

D. INDUSTRY/EMPLOYER EXPECTED OUTCOME

By practicing basic yoga and pranayam in daily life, candidate should have attained the state of sound physique and balance mind to execute daily duties.

E. COURSE LEVEL LEARNING OUT-COMES (COs)

Students will be able to achieve & demonstrate the following Cos on completion of course based learning-

CCH203-1 Practice basic Yoga and Pranayam in daily life to maintain physical and mental fitness.

CCH203-2- Practice meditation regularly for improving concentration and better handling of stress and anxiety.

CCH203-3- Follow healthy diet and hygienic practices for maintaining good health.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0]

Course Outcomes(COs)	Programme Outcomes(POs)							Programme Specific Outcomes*(PSOs)		
	PO-1 Basic Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	
CO1	-	-	-	-	3	-	1	-	-	
CO2	-	-	-	-	3	-	1	-	-	

CO3	-	-	-	-	3	1	-	-	
Legends:-High:03,Medium:02,Low:01,NoMapping:- *PSOs are to be formulated at institute level									

F. CONTENT:

i. Practical exercises

Sr .No	Laboratory Experiment/Practical Titles /TutorialTitles	Learning Of hrs.	Relevant COs
1	Introduction:- 1.1 Introduction to Ashtang Yog 1.2 Presentations on Introduction to Yoga and its History, Omkar chanting, prayer, Padmasan, Siddhasan & Vajrasan Lab Exp: 1. Perform warming up exercises to prepare the body from head to toe for Yoga - i) Neck Movement ii) Shoulder Movement iii) Trunk Movement iv) Knee Movement v) Ankle Movement	03	CCH203-1
2	Lab Exp: 2. After warm up, perform all the postures of Surya Namaskar one by one in a very slow pace, Lab Exp 3. Perform multiple Surya-Namaskar (Starting with three and gradually increasing it to twelve) in one go. (Experiment 2 to 4 must be followed by shavasana for self relaxation.)	4	CCH203-1, CCH203-2
3	Lab Exp: 4 Perform Sarvangasana, Halasana, Kandharasana (setubandhasana), Uttanpadasana, Pavanmuttasan. LabExp:5 Perform Bhujangasana, Naukasana, Mandukasana. LabExp:6 Perform Shalabhasana, Dhanurasana, Vakrasana, Goumukhasana, Paschimottasana, Ardhamasendrasana LabExp: 7 Perform Veerasana, Veer-Bhadrasana, Vrukshasana, Trikonasana. (Follow up experiment 5 to 7 with shavasana for self relaxation)	4	CCH203-2
4	Lab Exp: 8 Perform Deepbreathing, Anulom Vilom Pranayam Kriya LabExp:9 Practice Kapalbhati Pranayam Kriya, Bhastrika LabExp:10 Practice Bhramary Pranayam and Sheetal Pranayam	2	CCH203-3
5	Lab Exp: 11 Perform sitting in Dhyana Mudra and meditating. Start with five minute and slowly increasing to higher durations. Introduction to Vipassana, Anapan & Chakras. (Trainer will explain the benefits of Meditation before practice)	2	CCH203-3

ii. Theory : (Not Applicable)

Section I NA

Section –II NA

G. List of Assignments under SLA

**Candidate has to complete at least one major assignment from the given during his or her a single semester.

- Maintain a diary indicating date wise practice done by the student with a photograph of self in yogic posture. Prepare Diet for and nutrition chart self

Assignment:

Prepare Diet for and nutrition chart for your self

- Self-Learning
 - Practice atleast thrice a week.
 - Read books on different methods to maintain health, wellness and to enhance mood
 - Watch videos on Yoga Practices.

Sr. No.	List of Assignment (under SLA)	Hrs Allotted
1	Maintain a diary indicating date-wise practice done by the student with a photograph of self-yogic posture	02
2	Prepare Diet for and nutrition chart self	01
3	Practice at least thrice a week.	02
4	Read books on different methods to maintain health, wellness and to enhance mood	02
5	Watch videos on Yoga Practices.	01
6	Post your selfie with one asana on social media	02
7	Post your selfie with meditation posture on social media FB	02
8	Create your short video clip while performing one or two asanas	02
9	Create your short video performing Sun Salutation (Suyranamaskar)	01
	Total	15hrs

H. Specification table for setting question paper for semester end theory examination: NA

Section/ Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA

I. Assessment Criteria

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per the following criteria

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Performance Skills	10
Affective	Discipline and Mind Balance	05
	TOTAL	25

ii) Summative Assessment of Practical: NA

Every practical assignment shall be assessed for - marks as per following criteria:

Sr.no	Criteria	Marks allotted
NA	NA	NA
TOTAL		NA

J. Instructional Methods:

1. Lectures cum Demonstrations
2. Laboratory practices.
3. Use of third party audio visual material for demonstration
4. Demonstration Chart

K. Teaching and Learning resources:

Presentations, Yoga kits, Demonstrative charts, Actual Practice demonstration

L. Reference Books:

S. N.	Name of Book	Author	Publication
1	Patanjalis Yoga Sutras	Swami Vivekananda	Fingerprint Publishing (2023) Prakash Books India Pvt Ltd, New Delhi ISBN N-13?:?978-9354407017
2	Yoga for Every Body: A beginner's guide to the practice of yoga	Luisa Ray, Angus Sutherland	Vital Life Books (2022) ISBN-13?:?978-1739737009

	postures, breathing Exercises and me		
3	Mudras for Modern Living: 49 inspiring cards to boost your health, enhance your yoga and deepen your mind	Swami Saradananda	Watkins Publishing(2019) ISBN- 13?:?978-1786782786
4	The Relaxation and Stress Reduction Workbook	Martha Davis, Elizabeth Robbins, Matthew McKay, Eshelman MSW	A New Harbinger Self- Help Workbook(2019)
5	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Ann Swanson	ISBN-13?:?978-1465479358

M. Learning Website & Software

- 1 https://onlinecourses.swayam2.ac.in/aic19_ed28/preview- introduction to Yoga and Applications of Yoga
- 2 <https://onlinecourses.swayam2.ac.in/aic23ge09/preview> - Yoga for Creativity
- 3 https://onlinecourses.swayam2.ac.in/aic23_e05/preview- Yoga for Creativity
- 4 <https://onlinecourses.nptel.ac.in/noc2lhs29/preview-> Psychology of Stress, Health and Well-being
- 5 <https://onlinecourses.swayam2.ac.in/ncl9sc04/preview-> Food Nutrition for Healthy Living Course — Swayam
6. <https://onlinecourses.swayam2.ac.in/aic2306/> preview- yoga for memory development

Course Name : FUNDAMENTALS OF ELECTRICAL ENGINEERING
Course Code : EEH101
Course Abbreviation : HFEE
Course Type :DSC

A. TEACHING-LEARNING :

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ONSLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	200
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	50	20	25@	10	25	10	

Total IKS = 02 Hrs

C. ABBREVIATIONS CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks

1(one) credit is equivalent to 30 Notional hrs.

* Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i. RATIONALE:

The Diploma Course in Electrical Engineering mainly involves the study of Electrical machines, equipment's and instruments. In order to understand the working principle, construction, operation and applications of the various Electrical machines, equipment's and instruments; the basic concepts, rules and laws of Electric and Magnetic Circuits be understood by the students of Electrical Engineering Course.

This subject will help the students to study, understand and comprehend the fundamentals of various facts, the basic concepts, rules and laws of Electric and Magnetic Circuits. This subject is classified as Engineering Science subject.

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use basic principles of electrical engineering in electrical system.

Cognitive: Understand electrical charges, magnetism and electromagnetism.

Psychomotor: Use the basic electrical components in various applications.

Affective: Attitude of i) Punctuality ii) Accuracy iii) Safety iv) precision.

E. COURSE LEVEL LEARNING OUTCOMES

(COS) COURSE OUTCOMES:

EEH101-1: Apply the principles of electricity in different applications.

EEH101-2: Solve simple resistive networks in electrical engineering applications.

EEH101-3: Use by calculations relevant capacitors in electric circuits.

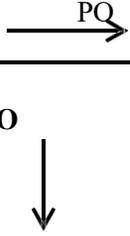
EEH101-4: Apply the principles of electromagnetism due to conductors and coils with currents

EEH101-5: Solve magnetic circuits used in electrical machine/device applications.

EEH101-6: Use the principles of electromagnetic induction in electrical engineering applications.

COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —| : no correlation]

 PQ ↓ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
	Basic and discipline specific knowledge	Problem Analysis	Design/ Development of solutions	Engineering Tools ,experimentation and testing	Engineering practices for society, sustainability and environment	Project Management	Lifelong Learning	Maintenance of equipment	Maintenance of sections of electrical
COMPETENCY-Apply Fundamental knowledge of electrical engineering and maintain computer network in healthy condition	3	1	1	2	1	-	1	-	-
EEH101-1	3	-	-	2	-	-	1	-	-
EEH101-2	3	1	-	2	-	-	1	-	-
EEH101-3	3	-	-	-	-	-	1	-	-
EEH101-4	3	-	-	-	-	-	1	-	-
EEH101-5	3	1	1	2	1	-	1	-	-
EEH101-6	3	1	-	2	1	-	1	-	-

F. CONTENT

I) Practical exercises

Laboratory experiments and related skills to be developed:

Sr. No.	Title of Experiment	Skills to be developed	Course outcome
1.	Introduction to electrical Laboratory	Identify different types of electrical supply sources, equipment's. Interpret circuit diagram.	EEH101-1
2.	Use Ohm's Law to determine current in simple circuit.	. Connect the various components as per the circuit diagrams by using wires. . Calculate the resistance from the	EEH101-1
3.	Observe the effect of temperature on resistance of copper	Calculate temperature coefficient of material.	EEH101-1
4.	To verify current division in parallel resistive circuit	. Connect the various components as per the circuit diagrams by using wires. . Verify theoretical and practical reading.	EEH101-2
5.	To verify voltage division in series resistive circuit.	. Connect the various components as per the circuit diagrams by using wires. . Verify theoretical and practical reading.	EEH101-2
6.	To verify Kirchhoff's current law(KCL)	Connect the various components as per the circuit diagrams by using wires. . Verify theoretical and practical reading.	EEH101-2
7	To verify Kirchhoff's Voltage Law(KVL)	Connect the various components as per the circuit diagrams by using wires. . Verify theoretical and practical reading.	EEH101-2
8	To plot the B H curve for a given magnetic material and determine the relative Permeability.	. Connect the various components as per the circuit diagrams by using wires . Plot the B-H curve from the readings . Determine the relative Permeability of the material.	EEH101-5
9	a) Use Faraday first law of electromagnetic induction to analyze behavior of statically induced	. Connect the apparatus as per the circuit diagrams . . Observe the deflection of galvanometer with respect to magnitude & direction. . Analyze the observations.	EEH101-6

	emf in given circuit.		
10	b) Use Faraday's first law of electromagnetic induction to analyse the behavior of dynamically induced emf in a given circuit.	<ul style="list-style-type: none"> . Connect the apparatus as per the circuit diagrams . . Observe the deflection of galvanometer with respect to magnitude & direction. . Analyze the observations. 	EEH101-6

II) THEORY

SECTION I

Sr · No ·	Topics / Sub-topics	Lecture (Hours)	Theory Evaluation (Marks)
<i>EEH101-1 Apply the principles of electricity in different applications.</i>			
1	<p>ELECTRICITY CONCEPT #Generation of Electricity in India (IKS Learning) 1.1 Electric Charge 1.2 Electric Potential 1.3 Electric Current 1.4 Electromotive Force (EMF) 1.5 Resistance and resistivity. 1.5.1 Concept of Resistance & Resistivity 1.5.2 Effect of Temperature on Resistance, Temp coefficient of Resistance (simple numerical) 1.6 Classification of Electric current 1.6.1 Direct current with waveforms. 1.6.2 Alternating current with waveforms. 1.7 Electric Sources 1.7.1 Concept of Voltage Source: Ideal and Practical 1.7.2 Concept of Current Source: Ideal and Practical 1.7.3 Source Conversion. (simple numerical) 1.8 Effects of Electric Current 1.8.1 Heating effect 1.8.2 Magnetic effect 1.8.3 Chemical effect with its application. 1.9 Concept of electrical Work, Power and Energy. Their S.I. Unit (Simple Numerical)</p>	10	12
<i>EEH101-2 Solve simple resistive networks in electrical engineering applications.</i>			
2	<p>Resistive Networks: 2.1 Ohm's Law, Concept of Voltage drop and Terminal Voltage. 2.2 Revision of resistance in series and parallel 2.3 Concept of voltage division and current division in simple resistive circuit with its derivation (Numerical) 2.4 Star Delta conversion of resistive networks</p>	10	12

	2.5 Calculations of Equivalent Resistance of simple Series, Parallel, Series Parallel Circuits and star-delta network (Simple Numerical) 2.6 Kirchhoff's Laws 2.6.1 Kirchhoff's Current Law 2.6.2 Kirchhoff's Voltage Law (Numericals based on only Two loop)		
<i>EEH101-3 Use by calculations relevant capacitors in electric circuits.</i>			
3	Capacitors: 3.1 Concept and Definition of Capacitance. 3.2 Electric Field 3.2.1 Electric Lines of force, Electric Flux 3.2.2 Electric Field Strength 3.2.3 Concept of electric flux density. 3.3 Construction & development of Capacitance in dielectrics. 3.4 Parallel Plate Capacitor. (Uniform Di-electric Medium) 3.5 Capacitors in Series & Parallel. 3.6 Calculations of Equivalent Capacitance of simple Series, Parallel and Series Parallel Combinations. (Simple Numerical) 3.7 Energy Stored in Capacitor. (No Derivation Only Simple Numerical) 3.8 Concept of Breakdown Voltage and Di-electric strength 3.9 Types of Capacitor & its application #Manufacturing of capacitors in India in various Industries(IKS Learning)	08	10
	Total	28	34

SECTION II

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
<i>EEH101-4 Apply the principles of electromagnetism due to conductors and coils with currents</i>			
4	<p>ELECTROMAGNETISM #Earth and its relevance with Magnetic Field(IKS) 4.1 Concept of Magnetic Field (definitions & relations of terms) 4.1.1 Magnetic Flux 4.1.2 Magnetic Flux Density 4.1.3 Magnetic field due to a Current carrying Conductor 4.1.4 Direction of Magnetic Field- Right hand rule, Cork Screw rule 4.1.5 Permeability 4.1.6 Relation between Magnetic flux Density and Field Intensity 4.2 Magnetic field due to current carrying Solenoid(Multi turn coil) 4.3 Concept of Toroid and its applications.</p>	6	10
<i>EEH101-5: Solve magnetic circuits used in electrical machine/device applications.</i>			
5	<p>MAGNETIC CIRCUIT 5.1 Definitions Concerning Magnetic Circuit. Magneto-Motive-Force (MMF), Reluctance, Reluctivity, Permeance, Permeability. 5.2 Magnetic Circuit - Ohm's law of Magnetic Circuit 5.3 Comparison Between Electric and Magnetic circuit. 5.4 Parallel Magnetic Circuit. (Only Introduction No derivation and No Numerical) 5.5 Calculations of Amp.-Turns for simple Series Magnetic circuit(Simple Numerical) 5.6 Concept of Leakage Flux, Useful Flux & Fringing, Leakage coefficient. 5.7 Magnetization Curve (B - H Curve) 5.7.1 Magnetization Curve for Magnetic and Non-Magnetic material. 5.8 Magnetic Hysteresis, Hysteresis Loop. 5.8.1 Hysteresis Loops for Hard & Soft Magnetic Material. 5.8.2 Area of Hysteresis Loop, Hysteresis Loss.(No Derivation and No Numerical) 5.9 Eddy current Loss (No derivation only formula). 5.10 Types of Magnets and their applications. Permanent Magnet and Electromagnet. #Bar Magnet and its application like Compass(IKS Learning)</p>	14	12

<i>EEH101-6 Use the principles of electromagnetic induction in electrical engineering applications.</i>			
Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
6	ELECTROMAGNETIC INDUCTION. 6.1 Relation Between Magnetism and Electricity. 6.2 Production of Induced E.M.F. and Current. 6.3 Faraday's Laws of Electromagnetic Induction. (No Numerical) 6.4 Statically Induced E.M.F. & Dynamically Induced E.M.F.(Simple Numerical) 6.5 Direction of Induced E.M.F. (induced Currents). 6.5.1 Fleming's Right Hand Rule 6.5.2 Lenz's Law 6.5.3 Self Induced E.M.F. 6.5.4 Mutually Induced E.M.F. 6.6 Self Inductance (definition & unit) 6.7 Coefficient of Self-induction (L) (Simple Numerical) 6.8 Mutual Inductance (definition & unit) 6.9 Coefficient of Mutual Inductance (M) (Simple Numerical) 6.10 Energy Stored in Magnetic Field (expression only)(No Derivation and No Numerical) 6.11 AC fundamentals Cycle, Time Period, Amplitude, Frequency, Phase	12	14
	Total	32	36

** No questions will be asked on IKS learning subtopics in any question papers.

G. List of Assignments under SLA(Micro-project/activity)

1. Simple problems on Ohms law, Law of resistance, Power and energy.
2. Survey of different magnetic material.
3. Simple problems on magnetic circuits.
4. Simple problems on of induced E.M.F: Statically induced E.M.F., dynamically induced E.M.F.
5. Survey the electrical appliances which represents different types of load.(resistive, inductive and capacitive)
6. Compare types of transformer as per voltage level, construction, number of phases, applications.
7. Survey different types of Capacitors.

H. Specification table for setting question paper for semester end theory examination

Section /Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Electricity Concepts	6	4	2	12	EEH101-1
I / 2	Resistive Networks	4	4	4	12	EEH101-2
I / 3	Capacitors	2	4	4	10	EEH101-3
II / 4	Electromagnetism	6	2	2	10	EEH101-4
II / 5	Magnetic Circuits	6	2	4	12	EEH101-5
II / 6	Electromagnetic Induction	6	4	4	14	EEH101-6
Total		30	20	20	70	

I. ASSESSMENT CRITERIA

The assessment need to be done as per Proforma

i) Formative Assessment of Practical and SLA:-

Every assignment/ Practical shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

i) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL STRATEGIES:

I) Instructional Methods:

1. Lectures cum Discussions
2. Class room practices.
3. Use of projector for ppt

II) Teaching and Learning resources:

1. Chalkboard
2. Slides(PPT)
3. Self learning Online Tutorial
4. Virtual Lab

K. REFERENCE MATERIAL

I) Books / Codes

Sr. No.	Author	Title	Publisher
1.	B. L. Theraja A. K. Theraja	A Text Book of Electrical Technology Vol-I (Basic Electrical Engg)	S. Chand and Co.
2.	V.N. Mittle	Basic Electrical Engg.	Tata McGraw-Hill
3.	V.K. Mehta	Electrical Technology	S. Chand and Co.
4.	Edward Hughes	Electrical Technology	Pearson Education, New Delhi

II) Websites

- i) www.electrical4u.com
- ii) www.vlab.co.in
- iii) www.circuitglobe.com

Course Name : Electrical Workshop practice.
Course Code : EEH-102.
Course Abbreviation : HWEE.
Course Type : SEC

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	3
	Tutorial Learning	...	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning *	06	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	100
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	00	00	00	00	50	20	25@	10				25	10

Total IKS Hrs for Sem.: 02Hrs.

C. ABBREVIATIONS: CL- Class Room Learning, TL-Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment.

Legends:@ Internal Assessment, # External Assessment,*# On Line examination, @\$ Internal Online Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- *Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project/assignment/other activities.

(Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D: RATIONAL:

This course is important for candidates to learn practical approach to various electrical materials, electrical wiring accessories, tools, wiring circuits, protections of circuits with basic study of electrical concepts and correspondingly practically working. This encourages students to get hands on experiences of handling electrical apparatus which will be helpful for learning of next courses in consecutive semesters.

E. COURSE LEVEL LEARNING OUTCOMES(COS):

EEH102-1-Use particular material for electrical circuit or application.

EEH 102-2-Select proper electrical wires & accessory in electrical wiring work.

EEH 102-3-Make connections in circuit of electrical meters.

EEH 102-4-Identify electrical machines & their spare parts.

Competency: Identify, select & use various electrical materials, wires, insulators, & Electrical accessories.

Competency, course outcomes and programme outcomes (cp-co-po) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), --- : no correlation

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
Competency: Able to identify, select & use various electrical materials wires insulators & equipment's.	3	1	1	2	3	1	3	1	-	
EEH 102 -1 Use particular material for electrical circuit or application.	3	1	1	1	1	-	3	1	-	
EEH 102 -2 Select proper electrical wires & accessory in electrical wiring work.	3	1	1	1	1	-	3	1	-	
EEH 102 -3 Make connections in circuit of electrical meters.	3	1	1	1	1	-	3	1	-	
EEH 102 -4 Identify electrical machines & their spare parts.	3	1	1	1	1	-	3	1	-	

F. CONTENT:

I. Practical exercises and related skills to be developed:

The following practical exercises shall be conducted in the *Laboratory for Electrical workshop practice* developed by the Institute in practical sessions of batches of students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
01	**To draw various electrical symbols useful in electrical engineering field.	Able to identify meaning of symbol	EEH 102 -1
02	**Perform experiment on measurement of length, cross sectional area and resistance of copper conductor.	Able to measure electrical parameter values	EEH 102 -1
04	**Demonstrate various magnetic materials used in electrical equipment's & machines.	Able to identify & select electrical material	EEH 102 -1
05	**Demonstrate various insulating materials used in electrical equipment's & machines.	Identify, select & use electrical material	EEH 102 -1
06	Demonstrate different tools used in electrical wiring system.	Identify, select & use electrical wiring tools.	EEH 102 -2
07	**Demonstrate function of one way & two way switch in lamp control.	Make connections & Use electrical apparatus.	EEH 102 -2
08	**Connect MCB in simple single phase circuit.	Make connections & Use electrical apparatus.	EEH 102 -2
09	Connect ELCB in simple single phase circuit.	Make connections & Use electrical apparatus.	EEH 102 -2
10	**Testing of specific fuses for given load. (Up to 5 Amp)	Make connections & Use electrical apparatus.	EEH 102 -2
11	Demonstrate different DC and AC Ammeter, Voltmeter & Wattmeter & Energy meter.	Able to use electrical apparatus	EEH 102 -3
12	Demonstrate hands on operations of Clamp on meter, Digital multimeter.	Able to handle & use electrical equipment's	EEH 102 -3
13	**Demonstrate identification of components, constructional, circuit diagram & function of following equipment's: 1) Tube light, 2) Ceiling fan, 3) Electric Iron, 4) Electric geyser, 5) Electrical Mixer. 6) Auto transformer or Dimmerstat.	Identify spare parts, equipment's & machines	EEH 102 -4

**** Compulsory 08 assignments to be completed + Any 01 from remaining = 09.**

II) THEORY:

SECTION-I

Sr. No.	Topics / Sub-topics	Lectures (Hours)
EEH 102 -1- Use particular material for electrical circuit or application.		
1	<p>Chapter 1: Electrical Materials.</p> <p>1.1 Conducting Materials-- 1.1.1 Types-Copper & Aluminium. 1.1.2 Specific resistance & Resistivity 1.1.3 Temperature coefficient to resistance for metals</p> <p>1.2 Magnetic materials-- 1.2.1 Types of magnetic materials: Paramagnetic, Diamagnetic and Ferromagnetic materials, Applications of magnetic materials</p> <p>1.3 Insulating Material-- 1.3.1 Classification of Insulating Material- Typical examples of gaseous, liquid and solid insulating materials. 1.3.2 Class of Insulation 1.3.3 Applications of some important insulating materials viz. Mica, porcelain, cotton, silk, Bakelite, mineral oil/transformer oil and asbestos.</p>	08
EEH 102 – 2- Select proper electrical wires & accessory in electrical wiring work.		
2.	<p>Chapter 2. Electrical Wiring Components.</p> <p>2.1 Electrical useful symbols for wiring. 2.2 Wiring Tools & equipment's. 2.3 Wiring components: 2.3.1 Various electrical points, Switches, Sockets, Switch boards(*IKS) 2.3.3 Applications & connections of Fuses, MCB, ELCB.</p> <p>2.4 Simple wiring and single line diagrams. 2.4.1 One lamp control by one switch. 2.4.2 One lamp control by two way switch. 2.4.3 Godown wiring.</p>	07
	Total	15

SECTION- II

Sr. No.	Topics / Sub-topics	Lectures (Hours)
EEH 102 -3- Make connections in circuit of electrical meters.		
3	Chapter 3. Electrical Measuring Instruments. 3.1 Identification of AC-DC meter, their symbols & selection of rating. 3.2 Connections of Ammeter, Voltmeter & Wattmeter, and Energy meter. 3.3 Handling of Clamp on meter, Digital multimeter.	07

Sr. No.	Topics / Sub-topics	Lectures (Hours)
EEH 102 -4- Identify electrical machines & their spare parts.		
04	Chapter 4. Electrical equipment's. 4.1 Electrical safety- <u>4.1.1 IE safety rules>(*IKS)</u> <u>4.1.2</u> Safety measures. <u>4.1.3</u> Necessity of earthing system. (From following given equipment's.) 4.2 Identify components & their connection diagram----- 4.3 Study Construction & their function --- 4.4 Study of open & short circuit faults & their causes. Equipment's: 1) Tube light 2) Ceiling fan, 3) Electric Iron, 4) Electric geyser, 5) Electrical Mixer, 6) Auto transformer or Dimmerstat.	08
	Total	15

(*No questions will be asked for IKS)

List of Assignments under SLA

1. Survey on different types of wires.
2. Comparative survey on different wires
3. Survey on different types of lamps
4. Survey on electrical wiring accessories
5. Survey on different instruments

H .Specification table for setting question paper for semester end theory examination

.....Not Applicable.....

I. Assessment criteria for practical assignments and oral examination

The assessment need to be done as per Proforma I & II

i) Continuous Assessment of Practical Assignments :

Every practical assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05

Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Progressive Skill Test :

One mid-term *Progressive Skill Test* of 25 marks

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for Practical/Drawing/	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work/Drawing work and completion of task	05
TOTAL		25

iii) Final marks of ORAL examination shall be awarded as per Assessment Pro-forma I&II

J. Instructional Methods:

I) 1.Lectures cum Demonstrations 2. Laboratory practicals. 3. Term write up.

K. Teaching and Learning resources:

I) 1.Chalk board. 2. Demonstrations by Visual/LCD presentations. 3. Practical work in laboratory.

L. Ref. Books / Journals / IS Codes

Sr. No.	Title	Author	Publisher
01	An Introduction to Electrical Engineering Materials	C. S. Indulkar and S. Thiruvengadam	S.Chand Publishing, 2008
02	K.B. Raina, S.K. Bhattacharya	Electrical Design, Estimating and costing	New Age Int (p)Ltd, New Delhi
03	Electrical Measuring Instruments	D.B.Dhar.	Tata McGraw-Hill P. Co. Ltd
04	Basic Electrical Engineering	V. N. Mittle	Tata McGraw-Hill P. Co. Ltd

M. Software/learning websites:

- i. www.ntpc.co.in,
- ii. www.nhpcindia.com,

- iii. www.nptel.ac.in,
- iv. ISO, IS, BS standards, Data Sheets,
- v. IE Rules Handbooks /International code: IS5909, 7733, 2174, 732, 4648

Websites:

- i. <http://www.bestestimatepro.com/bicap.gov.in/estimatingandcosting.pdf>
- ii. http://indiacatalog.com/web_directory/electrical/electrica
- iii. www.howstuffworks.com
- iv. www.electrical4u.com
- v. www.meda.com

Government Polytechnic Kolhapur																								
Learning and Assessment Scheme for Post S.S.C Diploma Courses																								
Programme Name		: Diploma In Electrical Engineering																						
Programme Code		: EE										With Effect From Academic Year : 2023-24												
Duration Of Programme		: 6 Semester										Duration : 15 WEEKS												
Semester		: Second										Scheme : MPECS 2023												
Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
							Actual Contact Hrs/Week			Self Learning(Activity/Assignment/Micro Project)	Notional Learning Hrs/Week			Theory	Based on LL&TL				Based on Self Learning					
							CL	TL	LL						FA-TH	SA-TH	Total		Practical		SLA			
																	Ma	Mi	Ma	Mi	Ma	Mi	Max		Min
1	ENGINEERING CHEMISTRY	HCHA	DSC	1	CCH103	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
2	COMMUNICATION SKILL	HCMS	AEC	2	CCH201		4	-	2	2	8	4	3	30	70	100	40	25	10			25	10	150
3	SOCIAL AND LIFE SKILLS	HSLS	VEC	2	CCH204		-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
4	APPLIED MATHEMATICS	HAMT	AEC	3	CCH301	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100
5	BASIC ELECTRONICS	HBET	DSC	1	EEH103	1	2	-	2	-	4	2	1.5	15	35	50	20	50	20	25@	10			125
6	ELECTRICAL POWER GENERATION	HEPG	DSC	3	EEH301	2	3	-	2	1	6	3	3	30	70	100	40	25	10			25	10	150
7	BASIC MECHANICAL AND CIVIL ENGINEERING	HBMC	SEC	3	EEH302	2	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100
Total						11	19	2	12	7	40	20		135	315	450		175	100		125		850	
<p>Abbreviations:CL-ClassroomLearning,TL-TutorialLearning,LL-LaboratoryLearning,FA-FormativeAssessment, SA-SummativeAssessment,IKS-IndianKnowledgeSystem,SLA-SelfLearningAssessment</p> <p>Legends :@ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination</p> <p>Note :</p> <ol style="list-style-type: none"> 1. FA-TH represents average of two class tests of 30 marks each conducted during the semester. 2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester. 3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work. 4. Notional Learning hours for the semester are(CL+LL+TL+SL)hrs.*15Weeks 5. 1 credit is equivalent to 30 Notional hrs. 6. *Self learning hours shall not be reflected in the Time Table. 7. * Self learning includes micro project / assignment / other activities. <p>Course Category: Discipline Specific Course Core(DSC): 3,DisciplineSpecificElective (DSE):0,ValueEducation Course(VEC):1, Intern./Apprenti./Project./Community(INP):0,AbilityEnhancementCourse (AEC) : 1, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0</p>																								

Government Polytechnic Kolhapur (MPECS 2023)

PROFORMA -I

Formative Assessment of Practical's /Tutorial /Self Learning Assessment

														Total Marks out of()	Marks converted As per scheme ()
PR/TU/Assignment No.		1	2	3	4	5	6	7	8	9	10	11	12		
Sr.No	Roll No.														
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															

Government Polytechnic Kolhapur

PROFORMA II

Used for Summative Assessment Practical / Oral Examination

SR.NO	ROLL NO	Knowledge about the course	Preparedness for practical	Neat & complete Diagram/write up	Communication / Presentation	Performance in practical Exam.	Total out of 25	Converted Marks as per Learning scheme ()
		5M	5M	5M	5M	5M		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

COURSE NAME : ENGINEERING CHEMISTRY.
COURSE CODE : CCH 103
COURSE ABBREVIATION : HCHA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	175
1.5	30 *#	70*#	100	40	25	10	25 @	10	25	10	

(Total IKS Hrs. for Sem.: 04 Hrs.)

C: ABBREVIATIONS: - CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination. (TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course, then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail & will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Timetable.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Basic science such as Chemistry is the fundamental of Engineering & technology. It is most essential to learn the basic science to understand the fundamental concepts in Engineering & technology. Engineering chemistry deals with the study of structure, composition & properties of the materials, which form the core of the fundamental science. Many processes are based on principle of Chemistry in various industries. Topics such as Water, Electrochemistry, Corrosion, & protection of metals from corrosion are some of the direct applications of chemistry in engineering. Hence, the knowledge of chemistry is essential to the aspiring engineers of all branches in their field. Engineering materials like Steel, Rubber, Plastic, Thermocole, Glass wool, Paints, Lubricants are the backbone of various industries, machines, equipment & processes.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply principles of advanced chemistry to solve engineering problems.

Cognitive: Understanding concepts of chemistry for applications in the area of engineering.

Psychomotor:

- i) Sketching and labeling the diagrams for extraction of copper
- ii) Experimentally analyzing the water samples for preparing portable water by different methods.
- iii) Preparing chart of showing percentage, composition, properties and industrial applications of solders.
- iv) Handling & use of glassware & chemicals.

Affective: i) Accuracy ii) Safety iii) Punctuality iv) Attitude.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH103-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.

CCH103-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.

CCH103-3 Select the relevant catalyst, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.

CCH103-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.

CCH103-5 Explain the method of Extraction of Copper and select proper types of alloys, solders for various purposes.

CCH103-6 Apply the basic knowledge of Cells and Batteries in Industrial applications.

Competency, course outcomes and programme

outcomes/programme specific outcomes(cp-co-po-pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1	PSO2
CCH103-1 CO-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.	3.0	2.0	-	1.0	3.0	1.0	3.0	1.0	1.0
CCH103 -2 CO-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.	3.0	2.0	-	1.0	2.0	1.0	3.0	-	-
CCH103 -3 CO-3 Select the relevant catalyst, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.	3.0	1.0	-	-	2.0	1.0	3.0	-	-
CCH103 – 4 CO-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.	3.0	2.0	-	1.0	3.0	1.0	3.0	-	-
CCH103-5 CO-5 Explain the method of Extraction of Copper and select proper types of alloys, solders for various purposes.	3.0	1.0	-	-	2.0	1.0	3.0	-	-
CCH103- 6 CO-6 Apply the basic knowledge of cells and Batteries in Industrial applications.	3.0	2.0	-	1.0	2.0	1.0	3.0	-	-

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Engineering Chemistry* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	Introduction to Chemistry laboratory	CCH103-1
2	Volumetric analysis of solution.	CCH103-1
3	Preparation of 1 N, 0.5 N & 0.1 N Solutions of different chemicals like NaOH, HCl, Oxalic acid, FeSO ₄ , etc.	CCH103-1
4	Titration of strong acid and strong bases (HCl X NaOH)	CCH103-1
5	Double titration of strong acid, strong base & weak acid (HCl X NaOH X H ₂ C ₂ O ₄ .H ₂ O)	CCH103-1
6	Titration of weak base, strong acid & strong base (Na ₂ CO ₃ X H ₂ SO ₄ X KOH)	CCH103-1
7	Estimation of chloride content in water by Mohr' s method	CCH103-4
8	Determination of amount of Ca and Mg ions present in given sample of water by E.D.T.A method	CCH103-4
9	Estimation of viscosity of oils/solutions by Ostwald's method	CCH103-1
10	Estimation of Ca in limestone.	CCH103-4
11	Titration of KMnO ₄ & FeSO ₄ (Redox titration)	CCH103-1
12	Estimation of % of Fe in given sample of steel.	CCH103-1
13	Determination of alkalinity of water.	CCH103-4
14	Determination of Electrochemical equivalent (ECE) by copper voltmeter.	CCH103-2
15	To estimate volumetrically the percentage of copper in a given sample of Brass.	CCH103- 5
16	To demonstrate the different types of Solders.	CCH103-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation. Marks
CO - CCH103-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.			
1	ATOMIC STRUCTURE AND CHEMICAL BONDING 1.1 Philosophy of atom by Acharya Kanad. 1.2 Atom, Fundamental particles, Nature of atom. 1.3 Atomic Number, Mass Number, Isotopes and isobars. 1.4 Bohr's theory of atom. 1.5 Statement of Aufbau's principle, Hund's rule of maximum	07	08

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation. Marks
	multiplicity, Pauli's exclusion principle. 1.6 Lewis and Langmuir's concept of stable electronic configuration. 1.7 Electrovalence and Co-valency. 1.8 Formation Of electrovalent compounds- NaCl, CaCl ₂ . 1.9 Formation of Covalent compounds- H ₂ O, CO ₂		
CO - CCH103-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.			
2	ELECTROCHEMISTRY AND CORROSION. 2.1 Definitions- Cathode, Anode, Conductor, Electrolyte, Electrode, Ionization, Electrolysis. 2.2 Arrhenius Theory of Ionization. 2.3 Degree of Ionization & Factors affecting degree of ionization. 2.4 Statement of Faraday's first and second law of electrolysis. 2.5 Relation between CE and ECE. 2.6 Electrolysis of molten NaCl. 2.7 Electrolysis of CuSO ₄ solution by using Cu-Electrodes. 2.8 Industrial applications of electrolysis. 2.8.1 Electroplating. 2.8.2 Electro refining of Cu. 2.9 Definition & types of corrosion. 2.10 Dry or Atmospheric corrosion, Oxide Film Formation & its types, Factors affecting atmospheric corrosion. 2.11 Wet or electrochemical corrosion 2.12 Factors influencing immersed corrosion. 2.13 Methods of protection of metal from corrosion - Hot dipping (Galvanizing & Tinning), Metal spraying, Metal cladding, Cementation or sherardizing.	10	10
CO - CCH103-3 Select the relevant catalyst, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.			
3	CHEMISTRY OF ENGINEERING MATERIALS AND CATALYSIS. 3.1 INSULATORS 3.1.1 Definition & Characteristics of insulator. 3.1.2 Preparation, properties & uses of Glass wool, Thermocole. 3.2 COMPOSITE MATERIALS 3.2.1 Definition. 3.2.2 Classification, Properties & Application of	13	16

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation. Marks
	composite materials. 3.3 PLASTICS 3.3.1 Definition of Polymer, Polymerization. 3.3.2 Types of polymerization – Addition & Condensation polymerization. 3.3.3 Classification of plastic - Thermosoftening & Thermosetting plastic. 3.3.4 Engineering properties & applications of plastic. 3.4 RUBBER 3.4.1 Elastomer 3.4.2 Drawbacks of Natural rubber. 3.4.3 Vulcanization of rubber. 3.4.4 Engineering properties & uses of rubber. 3.5 ADHESIVES 3.5.1 Definition of adhesives. 3.5.2 Characteristics of good adhesive. 3.5.3 Properties of adhesive. 3.6 CATALYSIS 3.6.1 Definition. 3.6.2 Types of Catalyst with example. - Positive catalyst - Negative catalyst 3.6.3 Types of Catalysis. - Homogeneous catalysis. - Heterogeneous catalysis 3.6.4 Catalytic Promoters. 3.6.4 Catalytic Inhibitors 3.6.5 Autocatalysis.		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO - CCH103-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.			
4	WATER 4.1 Impurities in natural water. 4.2 Hard water & Soft water. 4.3 Hardness of water- Temporary & Permanent. 4.4 Reactions of hard water with soap.	09	12

	<p>4.5 Disadvantages of hard water for domestic & Industrial purpose - Textile Industry, Sugar Industry, Paper Industry Dying Industry.</p> <p>4.6 Sterilization of water - Chlorination –by Cl₂, bleaching powder, Chloramines with chemical reactions.</p> <p>4.7 Ion Exchange method to remove total hardness of Water.</p>		
CO - CCH103-5 Explain the method of Extraction of Copper and select proper types of alloys, solders for various purposes.			
5	<p>METALLIC CONDUCTORS AND SOLDERS</p> <p>5.1 METALLIC CONDUCTORS</p> <p>5.1.1 Occurrence of metals</p> <p>5.1.2 Distinction between mineral & ore</p> <p>5.1.3 Definition of flux, Gangue & Slag</p> <p>5.1.4 Steps involved in metallurgy-Flow chart.</p> <p>Concentration of ores—</p> <p>A) Physical Methods</p> <ol style="list-style-type: none"> 1. Gravity Separation Method 2. Electromagnetic separation 3. Froth floatation method. <p>B) Chemical Methods</p> <ol style="list-style-type: none"> 1. Calcination 2. Roasting <p>5.1.6 Important ores of copper Metallurgy of copper-Extraction of copper from copper pyrites by concentration, roasting, smelting, Bessemerization, Electrorefining.</p> <p>5.1.7 Physical properties & uses of copper.</p> <p>5.2 SOLDERS</p> <p>5.2.1 Definition of alloy, classification of alloys & purposes of making alloy.</p> <p>5.2.2 Composition, properties & applications of soft solder.</p> <p>A) Tinman’s solder, B) Brazing alloy, C) Plumber’s solder D) Rose metal E) Woods metal</p>	14	16
CO - CCH103-6 Apply the basic knowledge of Cells and Batteries in Industrial applications.			
6	<p>CELL AND BATTERIES</p> <p>5.1 Definition of Electrochemical cell, Battery, Charge, Discharge, Closed Circuit Voltage, Electrochemical couple, Internal resistance, Open Circuit Voltage, Separator, E.M.F.</p> <p>5.2 Classification of Batteries such as – Primary & Secondary Batteries</p> <p>5.3 Construction, Working and Applications of a</p>	07	08

	Primary Cell such as Dry Cell, Secondary Cell such as Lead Acid Storage Cell 5.4 Charging and Discharging of Lead Acid Storage Cell 5.5 Hydrogen-Oxygen fuel cell, its chemical reactions & advantages 5.6 Introduction of solar cell		
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** No questions will be asked on IKS learning subtopics in any question papers.

G: List of Assignments under SLA (25 marks)

** From the above any two assignments to be completed by the students.

Sr. No.	List of Assignment (under SLA) (Any one of the following)	Hrs. Allotted
1	Prepare distinguish chart for Isotopes & Isobars, Electrovalent & Covalent bond	02
2	Prepare Charts of Bohr's Theory, Lewis & Langmuir's theory.	02
3	Faraday's First & Second law statements & formula.	02
4	Electroplating & Electro refining with diagram	02
5	Note on corrosion due to Oxygen & its types	02
6	With neat, labelled diagram explain the process of 1. Galvanizing, 2. Tinning, 3. Metal spraying, 4. Metal Cladding, 5. Sherardizing	02
7	Properties of Plastics, rubber, insulator, composite materials & adhesives.	02
8	Uses/Applications of Plastics, rubber, insulator, composite materials & adhesives.	02
9	Draw diagram of Ion Exchange method	02
10	Note on Impurities present in Natural Water.	02
11	Disadvantages of hard water in Domestic purposes	02
12	Disadvantages of hard water in Industrial purposes	02
13	Flow chart of Metallurgical processes	02
14	With neat, labelled diagram explain 1. Gravity separation method. 2. Electromagnetic separation method. 3. Froth floatation method.	02
15	Distinguish between Calcination & Roasting	02
16	Smelting process of copper with diagram	02
17	Bessemerization of Copper with diagram	02
18	Physical properties & uses of copper.	02
19	Definition & classification of alloys	02
20	Purposes of making of alloys	02
21	Composition, properties & applications of 1. Soft solder, 2. Tinman's solder, 3. Brazing alloy, 4. Plumber's solder, 5. Rose metal, 6. Wood's metal	02

22	Definitions of Electrochemical cell, Battery, Charge, Discharge, Closed circuit voltage, Open circuit voltage, Electrochemical couple, internal resistance, Separator, EMF.	02
23	Distinguish between Primary & Secondary batteries	02
24	Construction of Dry cell	02
25	Working & applications of Dry cell	02
26	Construction of Lead acid storage cell	02
27	Working & applications of Lead acid storage cell	02
28	Construction of H ₂ -O ₂ fuel cell with Chemical reactions & advantages	02
29	Construction & working of solar cell	02

H: Specification table for setting question paper for semester end theory Examination.

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Atomic Structure and Chemical Bonding	4	2	2	08	CCH103-1
I / 2	Electrochemistry & Corrosion	4	4	2	10	CCH103-2
I / 3	Chemistry of Engineering materials & catalysis	6	6	4	16	CCH103-3
II / 4	Water	4	4	4	12	CCH103-4
II / 5	Metallic conductors & solders	6	6	4	16	CCH103-5
II / 6	Cell & Batteries	4	2	2	8	CCH103-6
Total Marks					70	

I:-Assessment Criteria

i) Formative Assessment of Practical / Self learning assessment: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical: -

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J) Instructional Methods:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration
4. Charts
5. Simulation videos

K) Teaching and Learning Resources: -

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

Sr. No.	Author	Title	Publisher
1.	Jain & Jain	Engineering chemistry	Dhanpatrai publishing co.
2.	S. C. Rangawala	Engineering materials	Engineering publication
3.	Jain & Agarwal	Metallurgical Analysis	Agarwal publications
4.	O. P. Khanna	Material science & technology	Khanna publication on 2006
5.	Rollason	Metallurgy for Engineers	ASM publication
6.	J. C. Kuriacose	Chemistry in Engineering & Vol. 1 & 11	-
7.	P. C. Jain	Chemistry of Engineering Materials	-
8	S. S. Dara	A text of Engineering Chemistry	-
9.	R.Gopalan, D.Venkappa	Engineering Chemistry	Vikas Publishing House.

M) Learning Website & Software

- a. www.substech.com
- b. www.kentchemistry.com
- c. www.chemcollective.org
- d. www.wqa.org
- e. www.chemistryteaching.com
- f. www.ancient-origins.net/history-famous-people/indian-sage-acharya-kanad-001399

COURSE NAME : COMMUNICATION SKILLS
COURSE CODE : CCH201
COURSE ABBREVIATION : HCMS

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	-	-	25	10	150

(Total IKS Hrs for Sem. : 00 Hrs)

C: ABBREVIATIONS:- CL- Class Room Learning , TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA- Self Learning Assessment **Legends:** @ Internal Assessment, # External Assessment, *#On Line Examination , @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D.i) RATIONALE:-

Communication, being an integral part of every human activity, plays a fundamental role in education, science and technology. The communication skills are essential for engineering professionals to carryout routine tasks at workplace. These skills are also required for professional activities like dialogue, persuasion and negotiation. Considering the age group and socio-economical background of the students of the Institute, this course has been designed with a skill-oriented content with some necessary theoretical foundation. Thus, this course has been designed to enhance the skills to communicate effectively and skillfully at workplace.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Communicate in written and oral form of English effectively at workplace.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

CCH201-1 Use Contextual words in English appropriately.

CCH201-2 Comprehend the concept of communication and identify communication barriers. CCH201-3 Prepare and participate in dialogue, conversation, elocution and debate.

CCH201-4 Make effective use of body language & graphical communication.

CCH201-5 Write letters, reports, e-mails and technical description in correct language. CCH201-6 Prepare and present effective media aided presentation.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0]

	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineerin g Tools, Experiment ation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Manage ment	PO 7 Life- long Learnin g	PSO1	PSO2
Competency: Communicate in written and oral form of English effectively at workplace.	2	-	-	-	-	1	2		
CCH201-1 Use Contextual words in English appropriately.	1	1	-	-	-	2	1		
CCH201-2 Comprehend the concept of communication and identify communication barriers	2	1	-	-	-	2	2		
CCH201-3 Prepare and participate in dialogue, conversation, elocution and debate.	2	1	-	-	-	2	1		

CH201-4 Make effective use of body language & graphical communication.	2	-	-	-	-	2	2		
CCH201-5 Write letters, reports, e-mails and technical description in correct language.	2	-	-	-	-	2	1		
CCH201-6 Prepare and present effective media aided presentation.	1	1	-	-	-	1	1		

F.CONTENT:

i. Practical Exercises

The following practical exercises shall be conducted in the Laboratory for *Communication Skills* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr No.	Title of Practical Exercise	Course Outcome
1.	Vocabulary Building: Affixation	CCH201-1
2.	Vocabulary Building: Homophones	CCH201-1
3.	Vocabulary Building: Synonyms-Antonyms and Collocations	CCH201-1
4.	Communication Cycle and Communication Barriers	CCH201-2
5.	Oral Communication: Transcription	CCH201-3
6.	Oral Communication: Prepared Speech	CCH201-3
7.	Oral Communication: Conversation	CCH201-3
8.	Oral Communication: Group Discussion	CCH201-3
9.	Oral Communication: Group Debate	CCH201-3
10.	Non-verbal Communication: Graphic Communication	CCH201-4
11.	Non-verbal Communication: Body Language	CCH201-4
12.	Written Communication: Writing formal Letters	CCH201-5
13.	Written Communication: Writing Reports	CCH201-5
14.	Written Communication: Drafting of E-mail	CCH201-5
15.	Written Communication: Technical Writing	CCH201-5
16.	Presentation Aids	CCH201-6

ii. Theory

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH201-1 Use Contextual words in English appropriately.			
1	Vocabulary Building 1.1 Affixation: Prefix and Suffix, Definition and Examples, List of common Prefixes and Suffixes 1.2 Synonyms and antonyms: Vocabulary Expansion, Context and Usage 1.3 Homophones: Identifying Homophones, Meaning and Contest, Vocabulary Expansion 1.4 Collocation: Definition and Identification, Types of Collocations	8	08
CO: CCH201-2 Comprehend the concept of communication and identify communication barriers.			
2	Introduction to Communication 2.1 Definition and Importance of Communication 2.2 Model of Communication 2.3 Principles of Effective Communication 2.4 Types of Communication: Formal, Informal, Oral, Written, Verbal, Non-Verbal, Horizontal, Upward, Downward and Diagonal Communication 2.5 Barriers to communication: Physical, Mechanical, Psychological and Language Barriers	14	16
CO: CCH201-3: Prepare and participate in dialogue, conversation, elocution and debate.			
3	Oral Communication 3.1 Characteristics of Oral Communication. 3.2 Phonetics: IPA, Vowels(12), Consonants(24) and Diphthongs (12) 3.3 Tone, Pronunciation and Accents. 3.4 Spoken English: Prepared and Extempore speeches 3.5 Role Play: Conversation and Dialogue 3.6 Group Discussion and Debate	8	10

Section II

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH201-4: Make effective use of body language & graphical communication.			
4	Non-verbal Communication 4.1 Importance of Non-Verbal Communication. 4.2 Aspects of Body Language: Facial Expressions, Eye Contact, Vocalics, Gestures, Posture, Dress, Appearance and Personal Grooming and Haptics. 4.3 Non-Verbal Codes: Proxemics, chroemics, artefacts 4.4 Graphical Communication: 4.4.1 Advantages and Disadvantages of Graphical Communication. 4.4.2 Tabulation of Data and its depiction in the form of Bar Graphs and Pie Charts	08	12
CO: CCH201-5 Write letters, reports, e-mails and technical description in correct language.			
5	Written Communication 5.1 Characteristics of Written Communication. 5.2 Letter Writing: Application with Resume, Enquiry Letter, Order Letter and Complaint Letter 5.3 Writing Reports: Accident, Fall in Production Reports and Micro Project 5.4 Email Writing 5.5 Technical Writing: Object Description, Picture Description, Diary Writing 5.6 Paragraph Writing: Narrative, Descriptive and Technical	16	20
CO: CCH201-6 Prepare and present effective media aided presentation.			
6	Media-Aided Presentations 6.1 Media aids for Presentation: Strengths and Precautions 6.2 Planning, Preparing and Making a Presentation 6.3 Use of Presentation Media	06	04

** No questions will be asked on IKS learning subtopics in any question papers.

G . List of Assignments/Activities/Micro-project under SLA

**A learner should complete at least on major activity mentioned in the above list under the guidance of subject teacher.

Sr. No	List of Assignment (under SLA)	Hrs Allotted
1	Report different types of episodes and anecdotes	02
2	Seminar preparation and Presentation	04
3	Make a pod cost episode based on Indian freedom fighters.	02
4	Present summary of the editorial column of English news paper	02
5	Write review of on any one: short story, novel, film	02
6	Prepare a booklet on Indian scientist/ eminent persons	04
7	Prepare blog, vlogs and pod cast	04
8	Prepare questionnaire for interview on any one: industry personnel, social worker, entrepreneur and conduct interview.	02
9	Prepare charts/tables of vowels, diphthongs, consonant, organs of speech, vocabulary in English	02
10	Prepare charts/tables of types of communication, barrier in communication, aspects of body language	02
11	Prepare a micro project on a given topic.	04

H. Specification Table for Setting Question Paper for Semester End Theory Examination

Section/ Topic No.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Vocabulary Building	02	02	04	08	CCH201-1
I / 2	Introduction to Communication	04	06	06	16	CCH201-2
I / 3	Oral Communication	04	02	04	10	CCH201-3
II / 4	Non-verbal Communication	04	02	06	12	CCH201-4
II / 5	Written Communication	04	04	12	20	CCH201-5
II / 6	Media-aided Presentations	-	02	02	04	CCH201-6
Total Marks					70	

I. Assessment Criteria

1. Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

2. Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Attendance at regular practical	NA
2	Preparedness for practical	NA
3	Neat & complete Diagram.	NA
4	Observations & handling of instrument.	NA
5	Oral Based on Lab work and completion of task	NA
TOTAL		

J. Instructional Methods:

1. Lecture cum Demonstration,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning Resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Communication Skills	Sanjay Kumar ad Pushp Lata	Oxford University Press
2	Personality Development and Soft Skills	Brun K. Mitra	Oxford University Press
3	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill
4	Human Communication	Burgoon Michael	SAGE Publication Inc.
5	101 Ways to Better Communication	Elizabeth Hiemey	Pustak Mahal
6	Technical Writing and Professional Communication	Thomas Huckin and Leslie	McGraw-Hill College Division

M. Learning Website & Software

- a. www.nptel.com/iitm/
- b. <https://www.britishcouncil.in/english/learn-online>
- c. <https://www.vocabulary.com>
- d. www.newagegolden.com
- e. <https://www.internationalphoneticassociation.org>

COURSE NAME : SOCIAL AND LIFE SKILLS
COURSE CODE : CCH204
COURSE ABBREVIATION : HSLs

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	1
	Tutorial Learning	00	
	Laboratory Learning	00	
	SLH-Self Learning	02	
	NLH-Notional Learning	02	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
00	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	50
	00	00	00	00	00	00	-	-	50	20	

(Total IKS Hrs for Sem. : 00 Hrs)

C: ABBREVIATIONS:- CL- Class Room Learning , TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA

- Self Learning Assessment **Legends:** @ Internal Assessment, # External Assessment, *# Online Examination, @\$Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Life skills can be defined as abilities that enable an individual to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing, understanding attitudes, values, morals, social skills and better equip them to handle stress and build their self-efficacy, self-esteem and self-confidence.

Note: The course offers four different alternatives (modules) for achieving above outcomes. Students must complete any one module from the following given options.

- A) MODULE-I : Unnat Maharashtra Abhiyan (UMA)
- B) MODULE-II : National Service Scheme (NSS)
- C) MODULE-III : Universal Human Values
- D) MODULE-IV: Value Education (Unati Foundation)
- E) MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into consideration the resources required and resources available in the institute. Different group of students may be offered different MODULE based on their choices.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude, integrity and self-confidence.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CCH204-1 - Develop ability to adapt to new challenges.
- CCH204-2 - Manage emotions effectively.
- CCH204-3 - Follow workplace ethics and practices.
- CCH204-4 - Manage time effectively.
- CCH204-5 - Increased self-confidence to handle stress.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO)

MATRIX:

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0]

	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineerin g Tools, Experiment ation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Manage ment	PO 7 Life- long Learnin g	PSO1	PSO2
Competency: Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude, integrity and self-confidence.									
CCH204-1 Develop ability to adapt to new challenges.						1	2		
CCH204-2 Manage emotions effectively.						1	2		
CCH204-3 Follow workplace ethics and practices.						1	2		
CCH204-4 Manage time effectively.						2	2		
CCH204-5 Increased self-confidence to handle stress.						2	2		

F. CONTENT:

- I) **Practical Exercises:**
.....Not Applicable.....
- II) **Theory**

Sr. No.	Theory Learning Outcomes (TLOs) Aligned to COs.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems TLO 1.3 Design a methodology for fieldwork	Unit - I MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA) 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets	Implementation Methodology: Considering the nature of the course designed, following points shall be considered while implementing the course. i) Regroup in the batches of 5-6 students for conducting the fieldwork

	<p>TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation</p> <p>TLO 1.5 Measure & quantify the quantities / systems parameters</p> <p>TLO 1.6 Write a report using information collected. Study the data collected from fieldwork and conclude the observations.</p>	<p>available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc</p> <p>1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal)</p> <p>1.6 Key attributes of measurement</p> <p>1.7 Various instruments used for data collection - survey templates, simple measuring equipments</p> <p>1.8 Format for measurement of identified attributes/ survey form and piloting of the same</p> <p>1.9 Fieldwork : Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B</p> <p>1.10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc</p> <p>Observations of field visits and data collected.</p>	<p>from the bigger group.</p> <p>ii) Assign a few batches of the students for this course to all the faculty members.</p> <p>iii) A group of course teachers will visit local governance bodies such as Municipal Corporations, Village Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work.</p> <p>iv) The group of course teachers will carry out initial field visits to evaluate the various possibilities of field visits / various scenarios wherein students can conduct field work to measure / quantify the parameters / attributes.</p> <p>v) The course will be implemented in eight sessions and fieldwork.</p> <p>a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy</p> <p>b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting</p> <p>c) Session VIII - Final closure session feedback and assessment</p> <p>d) Field work - 1. Pilot Visit - Pilot of survey instrument Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Data gathering</p>
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			Summary Visit - Closure After analysis
2	TLO 2.1 Adoption of Village or Slum TLO 2.2 Survey and Problem Identification TLO 2.3 Conduct Project / Programs in the selected village / slum TLO 2.4 Undertake Special Camping Programme	Unit - II MODULE II : National Service Scheme (NSS) 2.1 Contacting Village/Area Leaders 2.2 Primary socio economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	(i) The teachers should visit the village / slum before adopting it for NSS activities. (ii) The selected area should be compact. (iii) The community people should be receptive to the ideas of improving their living standard. They should also be ready to coordinate and involve in the projects undertaken by the NSS for their upliftment (iv) The areas where political conflicts are likely to arise should be avoided by the NSS units. The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums;
3	TLO 3.1 Love and Compassion (Prem and Karuna) TLO 3.2 Truth (Satya) TLO 3.3 Non-Violence (Ahimsa) TLO 3.4 Righteousness (Dharma) TLO 3.5 Peace (Shanti) TLO 3.6 Service (Seva) TLO 3.7 Renunciation (Sacrifice) Tyaga TLO 3.8 Gender Equality and Sensitivity	Unit - III MODULE-III : Universal Human Values 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks by Practitioners Site/Industry Visit
4	TLO 4.1 Punctuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3	Unit - IV MODULE-IV: Value Education (Unnati Foundation) 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Chalk-Board

	<p>Responsibility TLO 4.4 Gratitude and Appreciations TLO 4.5 Determination & Persistence TLO 4.6 Respect TLO 4.7 Team Spirit TLO 4.8 Caring & Sharing TLO 4.9 Honesty TLO 4.10 Forgive and Forget</p>	<p>Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity 4.3 Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management 4.4 Gratitude and Appreciation , Asking Simple Questions & Asking for the price , Stress Management, Student Referral process , Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/Objects, Refusal Skills, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and up skilling Caring and Sharing , Handling Customer queries, Flexibility & Adaptability, Student referral process, Writing a Resume, OCSEM- Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension</p>	
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		Forgive and Forget, Facing and Interview, OSCEM-Public Speaking , Attending a telephonic/Video interview & Mock Interview , Affirmation , Pat-a-Back & Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	
5	TLO 5.1 Literacy About Savings and Investments TLO 5.2 Literacy About Financial Planning TLO 5.3 Literacy About Transactions TLO 5.4 Literacy About Income, expenditure and budgeting TLO 5.5 Literacy About Inflation TLO 5.6 Literacy About Loans TLO 5.7 Literacy About the Importance of Insurance TLO 5.8 Literacy About the Dos and Don'ts in finances	Unit - V MODULE-V : Financial Literacy 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection Dos and Don'ts in Financial planning and Transactions	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board Collaborative learning

** No questions will be asked on IKS learning subtopics in any question papers.

G. List of Assignments/Activities/Micro-project under SLA

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme. It would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation:

The activities under this sub-theme would inter-alia, include:

- (i) plantation of trees, their preservation and upkeep
- (ii) Construction & maintenance of village streets, drains
- (iii) Cleaning of village ponds and wells;
- (iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
- (v) Disposal of garbage & composting;

- (vi) Prevention of soil erosion and work for soil conservation,
- (vii) Watershed management and wasteland development
- (viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

- (i) Programme of mass immunization;
- (ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
- (iii) Provision of safe and clean drinking water;
- (iv) Integrated child development programmes;
- (v) Health education, AIDS Awareness and preliminary health care.
- (vi) Population education and family welfare programme;
- (vii) Lifestyle education centres and counselling centres.

© Programmes aimed at creating an awareness for improvement of the status of women: (i) programmes of educating people and making them aware of women's rights both constitutional and legal;

- (ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
- (iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
- (iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

- (i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
- (ii) work with the organisations of child welfare;
- (iii) work in institutions meant for physically and mentally handicapped;
- (iv) Organising blood donation, eye pledge programmes;
- (v) work in Cheshire homes, orphanages, homes for the aged etc.;
- (vi) work in welfare organisations of women;
- (vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

- (i) working with people and explaining and teaching improved agricultural practices;
- (ii) rodent control and pest control practices;
- (iii) weed control;
- (iv) soil-testing, soil health care and soil conservation;
- (v) assistance in repair of agriculture machinery;
- (vi) work for the promotion and strengthening of cooperative societies in villages;
- (vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
- (viii) Popularisation of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

- (i) assisting the authorities in distribution of rations, medicine, clothes etc.;
- (ii) assisting the health authorities in inoculation and immunisation, supply of medicine etc.;

- (iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
 - (iv) assisting and working with local authorities in relief and rescue operation;
 - (v) collection of clothes and other materials, and sending the same to the affected areas;
- (g) Education and Recreations: Activities in this field could include:
- (i) adult education (short-duration programmes);
 - (ii) pre-school education programmes;
 - (iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
 - (iv) work in crèches;
 - (v) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;
 - (vi) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
 - (vii) programmes including discussions on eradications of social evils like communalism, casteism, regionalism, untouchability, drug abuse etc.;
- (viii) Non- formal education for rural youth and
- (ix) Legal-literacy, consumer awareness.

H. Specification Table for Setting Question Paper for Semester End Theory Examination

..... Not Applicable.....

I. Assessment Criteria

The assessment need to be done as per Proforma I & II

i) Formative Assessment of Practical:-

Formative assessment (Assessment for Learning) report and presentation of fieldwork activities, self-learning (Assignment)

ii) Summative Assessment of Practical:

(Assessment of Learning)

J) Instructional Methods:

1. Group Discussion, Flipped Classroom
2. Demonstration, Case Study, Role Play, Collaborative Learning, Cooperative Learning
3. Field Visit, Survey
4. Use of projector and soft material for Demonstration (ppt, audio ,video etc)

K) Teaching and Learning Resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on _IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA‘ Districts Economic survey reports	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	UNICEF
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team

M. Learning Website & Software

- a. <https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf> (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan)
- b. <https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf> (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines)
- c. <https://censusindia.gov.in/census.website/> (A Website of Census of India)
- d. <https://gsda.maharashtra.gov.in/english/> (A Website of Groundwater Survey and Development Agency, GoM)
- e. <https://mrsac.gov.in/MRSAC/map/map> (A Website where district-wise mapsshowcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.)
- f. <https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx> (A Website of Jal Jivan Mission, Government of India)
- g. <https://cpcb.nic.in/> (A Website of Central Pollution Control Board, Government of India)
- h. <http://www.mahapwd.com/#> (A Website of Public Works Department, GoM)
- i. <http://tutorial.communitygis.net/> (A Website for GIS data sets developed by Unnat Maharashtra Abhiyan)
- j. <https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U> (A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society)
- k. <https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac> (A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead)

COURSE NAME : **APPLIED MATHEMATICS**
COURSE CODE : **CCH301**
COURSE ABBREVIATION : **HAMT**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	02	
	Laboratory Learning	-	
	SLH-Self Learning	-	
	NLH-Notional Learning	06	

B: ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Tutorial						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	100
03	30	70	100	40	--	--	--	--	--	--	

(Total IKS Hrs for Sem.: 02 Hrs)

C: ABBREVIATIONS:- CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends: @Internal Assessment, # External Assessment, *# OnLine Examination, @\$Internal Online Examination. (TNR 12 font)

FA-TH represents average of two class tests of 30 marks each conducted during the semester. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks

1(one) credit is equivalent to 30 Notional hrs.

*Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project /assignment/other activities. (The list of all assignments are given in tabular format. At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Mathematics is an important pre-requisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of Mathematics is an effective tool to pursue and to master the applications in the engineering and technological fields. Applied mathematics is designed for its applications in engineering and technology. It includes integration, differential equation,. The connection between applied mathematics and its applications in real life can be understood

and appreciated. Integral calculus helps in finding the area . Differential equation is used in finding curve, rectilinear motion. Statistics and probability will help a student to analyze data of large volume in their higher studies. The fundamentals of these topics are directly useful in understanding engineering applications in various fields.

ii) Competency:

The course should be taught and implemented with the aim to develop the course outcomes (CO's) for the student to acquire the competency needed to apply the mathematical techniques for engineering subjects.

1. **Cognitive** : Understanding and applying principles of mathematics to engineering problems
2. **Psychomotor**: To prepare charts displaying the area of irregular shapes using the concept of integration, prepare charts to displaying grouped and ungrouped data .
3. **Affective** : discipline, consistency, hard work , to concentrate ,accuracy, punctuality, aesthetics

E.COURSE LEVEL LEARNING OUTCOMES (COS)

CCH301-1 : To solve examples on integration using various techniques

CCH301-2 : To solve Differential equation of first order and first degree by various methods

CCH301-3 : To find approximate solution of algebraic equations and simultaneous equations by various methods.

CCH301-4:- To solve problems on Probability distributions

CCH301-5 :- Solve examples on Laplace Transform

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0]

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
To apply the mathematical techniques for engineering subjects.	3	2	1		1		2			
CCH301-1-CO-1 : To solve examples on integration using various techniques	3	1	-	-	1	-	1			
CCH301-2-CO-2 : To solve Differential equation of first order and first	3	1	-	-	-	-	1			
Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
degree by various methods										
CCH301-3-CO-3 : To find approximate solution of algebraic equations and simultaneous equations by various methods.	2	3	1	1	-	-	1			

CCH301-4-CO-4:- To solve problems on Probability distributions	2	1	1	1	1	1	1		
CCH301-5-CO-5:- Solve examples on Laplace Transform	2	1	-	-	-	-	1		

F.CONTENT:

D) Tutorial exercises

Any **TEN** of the following Tutorial exercises shall be conducted in the Tutorial room in tutorial sessions of batches of about 20- 22 students:

Sr. no	Tutorial experiences	CO
1	Solve simple problems of Integration by substitution.	CCH301-1
2	Solve integration using by parts.	CCH301-1
3	Solve examples on Definite Integral based on given methods.	CCH301-1
4	Solve problems on properties of definite integral.	CCH301-1
5	Solve given problems for finding the area under the curve and area between two curves . (Only for civil and mechanical engg. group)	CCH301-1
Sr. no	Tutorial experiences	CO
6	Solve examples on mean value and root mean square value.(only for Computer, Electrical and Electronics engg. group)	CCH301-1
7	Solve first order first degree differential equation using variable separable method.	CCH301-2
8	Solve first order first degree differential equation using exact differential equation and linear differential equation.	CCH301-2
9	Solve engineering application problems using differential equation.	CCH301-2
10	Solve problems on Bisection method, Regula falsi and Newton-Raphson method.	CCH301-3
11	Solve problems on Jacobi's method and Gauss Seidel method.	CCH301-3
12	Use Bakshali iterative methods for finding approximate value of square root.(IKS)	CCH301-3
13	Solve engineering problems using Binomial Distribution, Poisson Distribution and Normal Distribution.	CCH301-4
14	Solve problems on Laplace transform and properties of Laplace transform.	CCH301-5
15	Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	CCH301-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH301-1 : To solve examples on integration using various techniques.			
Unit 1 Indefinite Integration	Indefinite Integration 1.1 Definition, Standard formulae 1.2 Rules of Integration (without proof), Examples 1.3 Integration by substitution 1.4 Integration by parts 1.5 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction)	14	16
CO: CCH301-1 : To solve examples on integration using various techniques			
Unit 2 Definite Integration	Definite Integration 2.1 Definition, Examples 2.2 Properties of Definite Integration (without proof), Examples based on properties	8	8
CO: CCH301-3: To solve Differential equation of first order and first degree by various methods			
Unit 3 Differential equation	Differential equation 3.1 Definition of differential equation 3.2 Order & degree of Differential equations 3.3 Methods of solving Differential equations of first order & first degree of following types:	8	10
	3.3.1 Variable separable form 3.3.2 Exact Differential equations 3.3.3 Linear Differential Equations		

Section –II

Sr. no.	Topics/Subtopics	Learning Hours	Classroom learning evaluation Marks
CO: CCH301-4 :- To find approximate solution of algebraic equations and simultaneous equations by various methods.			
Unit 4 Numerical Methods	Numerical Methods 4.1 Numerical solution of Algebraic Equations 4.1.1 Bisection Method 4.1.2 Regula- Falsi Method 4.1.3 Newton –Raphson method. 4.2 Numerical solution to simultaneous equations 4.2.1 Jacobi’s Method 4.2.2 Gauss-Seidel method Bakhshali iterative method for finding approximate square root.(IKS)	10	14
CO: CCH301-4:- To solve problems on Probability distributions			
Unit 5 Probability Distribution	Probability Distribution 5.1 Binomial distribution 5.2 Poisson’s distribution 5.3 Normal distribution	8	8
CO: CCH301-5:- Solve examples on Laplace Transform .			
Unit 6 Laplace Transform	Laplace Transform 6.1 Definition , Linearity property 6.2 Laplace Transforms of Standard functions (without proof) and examples 6.3 First shifting property and examples 6.4 Examples on Multiplication by t^n 6.5 Inverse Laplace Transform, Definition 6.6 Standard formulae(without proof) and examples 6.7 Inverse L.T.by using First shifting property 6.8 Inverse L.T. by using Partial fraction method	12	14

** No questions will be asked on IKS related subtopics in any question paper

G : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Indefinite Integration	4	6	6	16	CCH301-1
I / 2	Definite Integration	-	4	4	8	CCH301-1
I / 3	Differential equation	2	4	4	10	CCH301-2
II / 4	Numerical Methods	2	4	8	14	CCH301-3
II / 5	Probability Distribution	-	4	4	8	CCH301-4
II/6	Laplace Transform	2	6	6	14	CCH301-5
Total Marks					70	

H .Assessment Criteria

- i) **Formative Assessment (Assessment for Learning)**
 - Tests
- ii) **Summative Assessment (Assessment of Learning)**
 - End term exam

I. Instructional Methods:

1. Lectures cum Demonstrations
2. Classroom practices
3. Use of projector and soft material for demonstration
4. Use of softwares such as Geogebra

J. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

K. Reference Books:

S.N.	Name of Book	Author	Publication
1.	Higher Engineering Mathematics	Grewal B.S.	Khanna publication New Delhi, 2013 ISBN: 8174091955
2.	A textbook of Engineering Mathematics	Dutta.D.	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi, 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi, 2008 ISBN: 978-81-219-0345-5
5.	Introductory Methods of Numerical Analysis	S.S.Sastry	PHI Learning Private Limited, New Delhi. ISBN: 978-81-203-4592-8
6.	Studies in the History of Indian Mathematics	C.S.Seshadri	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9

7	Calculus & Its Applications	Marvin L. Bittinger	Addison-Wesley 10 th Edition ISBN-13:978-0-321-69433-1
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		David J. Ellenbogen Scott A. Sargent	
8.	An Introduction to Statistical Learning with Application in R	Gareth James, Hastie Robert & Tibshirani	Springer New York Heidelberg Dordrecht London ISBN:978-1-4614-7138-7 (eBook)

L. Learning Website & Software

- b. <http://nptel.ac.in/courses/106102064/1>
- c. <https://www.woframalpha.com/>
- d. <http://www.sosmath.com/>
- e. <http://mathworld.wolfram.com>
- e) <https://www.brilliant.org/>
- f) <https://ocw.mit.edu/index.htm>

COURSE NAME : BASIC ELECTRONICS
COURSE CODE : EEH 103
COURSE ABBREVIATION : HBET

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	02
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	00	
	NLH-Notional Learning	04	

B. ASSESSMENT SCHEME:-

PAPER DURATION INHRS	THEORY				BASED ON LL&TL				BASED ON SLA		Total
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1.5	15	35	50	20	50	20	25@	10	-	-	125

(Total IKS Hrs for Sem.: 01 Hrs)

C: ABBREVIATIONS: - CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

D. i) RATIONALE: -

Diploma engineers must deal with the various electronic components while maintaining various electronic equipment/systems. The use of basic electronics components and handling of various electronics systems will help them troubleshoot electronics equipment used in industry or in the consumer market etc. This course is developed to empower the students to apply their knowledge to solve broad electronic engineering application problems.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Maintain electronic equipment/systems comprising of discrete electronic components.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

EEH 103 -1 Identify and use relevant diode in electronic circuits

EEH 103 -2 Examine and operate rectifier and filter.

EEH 103 -3 Identify and illustrate use bipolar junction transistor in electronic circuits.

EEH 103 -4 Convert the decimal number into other number system and use logic gates in electronics circuit.

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), --- : No correlation]

Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimenta tion and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Managemen t	PO 7 Life- long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
EEH 103 -1	3	2	-	3	-	-	--	2	--
EEH 103 -2	3	2	-	2	--	--	--	3	1
EEH 103 -3	3	-	-	2	-	--	--	3	1
EEH 103 -4	3	1	-	2	--	--	--	3	--

F. CONTENT:

D) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for electronics fundamental developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. No.	Laboratory experiences	CO
1.	Identification electronic equipment in basic electronics laboratory 1) Identify different electronic equipment. 2) Operate DMM, power supply, CRO, function generator. 3) Illustrate the use of breadboard	EEH 103-1
2.	Find the value of given resistor, capacitor and inductor using color codes 1) Calculate the value of resistor by color code. 2) Find the value of given capacitor and inductor	EEH 103-1
3.	Measure amplitude, time period and frequency of sine wave using CRO 1) Use of function generator to generate sine wave. 2) Measure the amplitude, time period and frequency of sine wave	EEH 103-1
4.	Test the performance of PN junction diode 1) Build the circuit as per circuit diagram 2) Record the measured readings in observation table 3) Draw the forward & reverse characteristics	EEH 103-2
5.	Test the performance of Zener diode 1) Build the circuit as per circuit diagram 2) Record the measured readings in observation table 3) Draw the forward & reverse characteristics	EEH 103-2
6.	Test Zener voltage regulator for given voltage (With varying input voltage) 1) Build the circuit as per circuit diagram 2) Record the readings in observation table	EEH 103-2
7.	Test Zener voltage regulator for given voltage With varying load 1) Build the circuit as per circuit diagram 2) Record the readings in observation table	EEH 103-2
8.	Test the half wave circuits on breadboard 1) Construct the circuit as per circuit diagram 2) Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3) Record readings measured in observation table	EEH 103-2
9.	Test the full wave center tapped circuit on breadboard 1) Construct the circuit as per circuit diagram 2) Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3) Record readings measured in observation table	EEH 103-2
10.	Test the full wave bridge circuit on breadboard 1) Construct the circuit as per circuit diagram 2) Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3) Record readings measured in observation table	EEH 103-2
11.	Test the operation of transistor as a switch 1) Construct the circuit as per circuit diagram 2) Record the reading in observation table.	EEH 103-3

Sr. No.	Laboratory experiences	CO
	3) Sketch the graph of input & output characteristics.	
12.	Plot input –output characteristic of common emitter amplifier 1) Construct the circuit as per circuit diagram 2) Record the reading in observation table. 3) Sketch the graph of input & output characteristics	EEH 103-3
13.	Test the performance of logic gate ICs of AND,OR,NOT. 1) Build the circuit as per circuit diagram 2) Verify the truth-table	EEH 103-4
14.	Test the performance of logic gate ICs of NAND,NOR. 1) Build the circuit as per circuit diagram 2) Verify the truth-table.	EEH 103-4
15.	Test the performance of logic gate ICs of XOR,XNOR. 1) Build the circuit as per circuit diagram. 2) Verify the truth-table.	EEH 103-4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	EEH103-1 Identify and use relevant diode in electronic circuits		
1	1.1 Semiconductor Diode 1.0 Conductor , Insulator, semiconductor 1.0.1 Band theory 1.0.2 Intrinsic semiconductor : Si, Ge 1.0.3 Doping 1.0.4 Extrinsic semiconductor : P type , N type 1.1 P.N. junction diode – Ge & Si 1.1.1 Constructional features. 1.1.2 Operating principle. 1.1.3 Characteristics. 1.1.4 Applications. 1.1.5 Specifications. 1.2 Zener diode 1.2.1 Constructional features. 1.2.2 Operating principles. 1.2.3 Characteristics 1.2.4 Specifications. 1.2.5 Applications-Zener as a voltage regulator 1.2.6 Voltage regulators (*IKS)	8	12

	EEH103-2 Examine and operate rectifier and filter.		
2	<p style="text-align: center;">Rectifiers and filters</p> <p>2.0 Block diagram of regulated power supply</p> <p>2.1 Rectifiers:</p> <p>2.1.1 Definition: Rectification, Rectifier</p> <p>2.1.2 Need of rectification</p> <p>2.1.3 Classification of rectifier</p> <p>2.2 Half wave rectifier and full wave rectifier (Center-tapped and bridge)</p> <p>2.2.1 Circuit diagram and waveforms</p> <p>2.2.2 Operation</p> <p>2.2.3 Parameters its definition and values for corresponding rectifier-</p> <p>(i) Average output voltage and current</p> <p>(ii) Ripple factor</p> <p>(iii) Rectifier efficiency</p> <p>(iv) Peak Inverse Voltage</p> <p>(v) Transformer Utilization Factor</p> <p>2.2.4 Comparison of rectifier</p> <p>2.3 Filter</p> <p>2.3.1 Need of filter(*IKS)</p> <p>2.3.2 Types of filter-</p> <p>(i) Shunt capacitor filter</p> <p>(ii) Series inductor filter</p> <p>(iii) LC filter</p> <p>(iv) CLC filter</p> <p>2.3.2 Operation of each filter w.r.t. full wave bridge Rectifier only</p> <p>2.3.3 Comparison of filters</p>	12	10
	EEH103-3 : Identify and illustrate use bipolar junction transistor in electronic circuits.		
3	<p style="text-align: center;">Bipolar Junction Transistor(BJT)</p> <p>3.0 BJT-.Types, symbols</p> <p>3.1 Construction of BJT. 3.2 Operating principles of NPN & PNP Transistor</p> <p>3.3 Transistor configurations & Modes of operation</p> <p>3.4 Transistor input & output characteristic of CE & CB configuration.</p> <p>3.5 Relation between α & β</p> <p>3.6 Switching action of transistor</p> <p>3.7 Applications of transistor.</p>	6	7
	EEH103-4; Convert the decimal number into other number system and use logic gates in electronics circuit.		
4	<p style="text-align: center;">Number Systems and Logic gates</p> <p>4.1 Number System: binary, octal, decimal and hexadecimal</p> <p>4.2 Conversion of given decimal number into binary, octal and hexadecimal (simple numerical with no fractions)</p> <p>4.3 Boolean logic (*IKS)</p> <p>4.4 Digital logic gates symbol and truth table:</p>	4	6

	AND,OR,NOT,NAND,NOR,XOR,XNOR		
	Sub-total:	30	35

* No questions will be asked on IKS related subtopics in any question paper.

H. Specification table for setting question paper for semester end theory assessment

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I	Semiconductor Diode	4	6	2	12	EEH103-1
II	Rectifiers and filters	2	8	-	10	EEH103-2
III	Bipolar Junction Transistor (BJT)	1	4	2	07	EEH103-3
IV	Number Systems and Logic gates	-	2	4	06	EEH103-4
Total Marks		07	20	08	35	

I. Assessment Criteria

The assessment need to be done as per Proforma I & II

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations
2. Class room practices
3. Use of projector and soft material for demonstration
4. Virtual Laboratory

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

L. Reference Books:

Sr. No	Name of Book	Author	Publication
1	V. K. Mehta	Principles of Electronics	S.Chand
2	B. L. Theraj	Basic Electronics	S.Chand
3	R.S.Sedha	A text book of Applied Electronics	S.Chand
4	G. K. Mithal	Applied Electronics	Khanna Publication
5	A. Motershed	Electronics Devices & Circuits	PHI Publication
6	Malvino	Electronics Principles	McGraw Hill

M. Learning Website & Software

- i. www.nptel.iitm.ac.in
- ii. www.learningaboutelectronics.com
- iii. www.electronics-tutorials.com
- iv. <https://circuitdigest.com/electronic-circuits>
- v. https://www.tutorialspoint.com/basic_electronics/basic_electronics_transistors.htm
- vi. https://www.youtube.com/watch?v=O_pqCNPs6xw
- vii. <https://www.youtube.com/watch?v=0nXEUKFBd8A>

COURSE NAME : ELECTRICAL POWER GENERATION
COURSE CODE : EEH 301
COURSE ABBREVIATION : HEPG

A. LEARNING SCHEME:

Scheme component	Hours	Credits
Actual Contact Hours / week	Classroom Learning	03
	Tutorial Learning	...
	Laboratory Learning	02
	SLH-Self Learning	01
	NLH-Notional Learning Hrs /Week*	06
		03

Total IKS Hrs for Sem.: 02Hrs.

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical				MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
	30	70	100	40	25	10	....	....	25	10

C. ABBREVIATIONS: CL- Class Room Learning, TL-Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment.
 Legends:@ Internal Assessment, # External Assessment,*# On Line examination, @\$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project/assignment/other activities.

(Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D: RATIONALE:

This course deals in detail about generation of electric power using conventional and nonconventional power plants like Thermal (Coal), Hydro, Nuclear fuels, Solar, Wind, Geothermal, Tidal and Magneto-hydro dynamic. These types of power plants need highly skilled technicians who are capable of operating various control equipment to supply uninterrupted power. This course attempts to develop the basic skills required to take appropriate actions to maintain the various generating and auxiliary equipment of power plants.

Competency: Able to compare & explain different types of electric power generating plants.

Cognitive : Understand the operation of different types of electric power generating plants.

Psychomotor: Explain different types of electric power generating plants.

Affective: Attitude of i) Safety ii) Punctuality iii) Accuracy iv) Precision v) Aesthetic presentation.

E: COURSE LEVEL OUTCOMES:

EEH 301 -1: Suggest which electrical power generation is safe & environment friendly.

EEH 301 -2: Select the power generation plant based on economy.

EEH 301 -3: Infer components & operation of different power plants.

EEH 301 -4: Demonstrate wind and solar power plants.

EEH 301 -5: Illustrate & use Bio-mass, bio-gas & Ocean power plant.

EEH 301 -6: Explain geothermal power plant & fuel cell energy.

Competency, course outcomes and programme outcomes (cp-co-po) matrix

[**Note : Correlation levels** : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High),
—0— : no correlation

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Able to compare & explain different types of electric power generating plants.	3	1	-	1	2	0	2	-	-
EEH 301 -1: Suggest which electrical power generation is safe & environment friendly.	3	1	-	0	2	0	2	-	-
EEH 301 -2: Select the power generation plant based on economy.	3	1	0	0	2	0	2	-	-
EEH 301 -3: Infer components & operation of different power plants.	3	0	0	1	2	0	2	-	-
EEH 301 -4: Demonstrate wind and solar power plants.	3	1	-	1	2	0	2	-	-
EEH 301 -5: Illustrate & use Bio-mass, bio-gas & Ocean power plant.	3	0	0	1	1	0	2	-	-
EEH 301 -6: Explain geothermal power plant & fuel cell energy.	3	0	0	1	1	0	2	-	-

F. CONTENT:

I) Practical Exercises:

The following practical exercises shall be conducted in the Laboratory for Electrical Power Generation developed by the Institute in practical sessions of batches of about 22 students:

Note-Use half imperial drawing sheets

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	C O
01	Draw labeled layout of Coal based thermal power plant.	To realize/ identify the various equipment's in thermal power plant.	EEH 301-2
02	Draw labeled layout of Hydroelectric power plant.	.....As above.....	EEH 301-2
03	Draw labeled layout of Nuclear power plant.	.....As above.....	EEH 301-3
04	Draw labeled basic diagrams & block diagrams of Wind power plant.	.....As above.....	EEH 301-4
05	Draw labeled basic diagrams & block diagrams of Solar power plant.	.....As above.....	EEH 301-4
06	Draw labeled basic diagrams & block diagrams of Ocean power plant.	.....As above.....	EEH 301-5
07	Draw labeled basic diagrams & block diagrams of Tidal power plant.	.....As above.....	EEH 301-5
08	Draw labeled basic diagrams & block diagrams of Geothermal.	.....As above.....	EEH 301-6
09	Draw labeled basic diagrams & block diagrams of Biogas.	.....As above.....	EEH 301-6

Two or three industrial Visits to Electrical power generation plant.

II) THEORY

SECTION-I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
EEH 301 -1: Suggest which electrical power generation is safe & environment friendly.			
	Basics of power generation:		

1	<p>1.1. Importance of electrical power in day-to-day life. 1.2 Various sources of energy 1.3 Environmental issues of electrical power generation. 1.4 India Scenario of Power Generation(IKS*)</p>	03	06
EEH 301 -2: Select the power generation plant based on economy.			
2	<p>Economics Aspects: 2.1 Related terms: Connected Load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants, load curve, load duration curve, integrated duration curve. 2.2 Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, Diversity factor, load factor and plant load factor. 2.3 Choice of size and number of generator units, combined power operation of power station. 2.4 Grid System:- State grid and National grid.</p>	06	08
EEH 301 -3: Infer components & operation of different power plants.			
3	<p>Generating Stations: History of Power Generation (IKS*) 3.1 Thermal Power Plant: 3.1.1 Sources of Conventional Thermal Power Plant. 3.1.2 Block diagram. 3.1.3 Working and function of auxiliary component. 3.1.4 Advantages and Disadvantages. 3.1.5 Application. 3.1.6 Major TPS in Maharashtra state with their capacity. 3.2 Hydro Power Plant: 3.2.1 Sources of Conventional Hydro Power Plant. 3.2.2 Classification & Layouts. 3.2.3 Working and function of auxiliary component. 3.2.4 Advantages and Disadvantages. 3.2.5 Application. 3.2.6 Major HPS in Maharashtra state with their capacity. 3.3 Nuclear Power Plant: 3.3.1 Nuclear fuels, Chain reaction. 3.3.2 Block Diagram Conventional Power Plant. 3.3.3 Working and Functions of auxiliary component. 3.3.4 Advantages and Disadvantages. 3.3.5 Application. 3.3.6 Major NPS in Maharashtra state with their capacity.</p>	<p>15 (05)</p> <p>(04)</p> <p>(04)</p>	<p>20 (06)</p> <p>(06)</p> <p>(08)</p>
Total		22	34

SECTION-II

Sr.No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
EEH 301 -4: Demonstrate wind and solar power plants.			
4	4.1 Solar Power Plant (Electrical) 4.2 Introduction of Solar power plant 4.2.1 Photovoltaic cell: Construction, Types. 4.2.2 Series and parallel connections: Cell, module, array. 4.2.3 Performance: Influencing factors-tilt angle, solar radiation, I-V, P-V characteristics.	03	16 (08)
	4.2 Wind Power Plant Basic of Wind Energy (IKS*) 4.2.1 Site Selection for wind plant. 4.2.2 Basic Components: Block diagram, 4.2.3 Functions of each part. 4.2.4 Classification of wind turbines: 1. Horizontal (Basic Diagram, construction and advantages) 2. Vertical Axis Turbine(Basic Diagram, construction and advantages)	06	(08)
EEH 301 -5: Illustrate & use Bio-mass, bio-gas & Ocean power plant.			
5	5.1 Bio-gas energy& Bio-mass Energy. 5.1.1 Introduction of Bio-gas & its calorific value. 5.1.2 Block diagram of Bio-mass based power 5.1.3 Types of Bio Gas plant (KVIC & Pragati).	05	12 (08)
	5.2 Energy from the oceans. 5.2.1 Ocean energy: Principle of ocean thermal electric conversion. (Only principle & no types) 5.2.2 Tidal Power: Basic principle and operation of single basin tidal power plant, site requirements.	04	(04)
EEH 301 -6: Explain geothermal power plant & fuel cell energy.			
6	Energy from other Sources 6.1 Geothermal Energy. 6.1.1 Geothermal energy sources, working principle of Power generation. 6.1.2 Advantages, limitations & applications geothermal.	03	08 (04)
	6.1.3 Sites of Geothermal energy in India (IKS*)	02	(04)

	6.2 Fuel cell. 6.2.1 Construction & working of Hydrogen Fuel cell. 6.2.2 Advantages, limitations & applications.]		
Total		23	36

*No questions will be asked for IKS subtopics.

G: UNDER SLA LIST ASSIGNMENT / MICRO PROJECT:

Sr No.	Title of Exercise/Practices
1	Prepare list of major Conventional power plants (TPS, HPS & NPS) in Maharashtra state with their capacity
2	Prepare a load curve as per data given & show fitting of power generated & supplied to load by thermal, hydroelectric & Nuclear power plant or any other power plants in that load curve suggested by concerned faculty.
3	Study of environment scenario due to conventional power generation plants.
4	Study basic terms related to power generation system like firm power, hot & cold reserve capacity, Connected load, Maximum demand, Average demand, Plant capacity factor, Plant use factor Demand factor, Load curve, Base load & Peak load.
5	Prepare list of major Non conventional power plants in Maharashtra state with their capacity
6	Market survey of list of components of solar water heating scheme for home utility.
7	Prepare a visit report on the Hydro Power station
8	Prepare a visit report on Wind/Solar Power plant

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Basics of power generation	04	02	00	EEH301-1	06
2	Economics aspects	02	02	04	EEH 301-2	08
3	Generating stations	04	08	08	EEH 301-3	20
4	Solar (electrical)&wind power plant	04	04	08	EEH 301-4	16
5	Bio-gas, Bio-mass & oceans energy.	04	04	04	EEH 301-5	12
6	Energy from other Sources.	02	02	04	EEH 301-6	08

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

I: ASSESSMENT CRITERIA FOR PRACTICAL- ASSIGNMENTS AND ORAL EXAMINATION

The assessment need to be done as per Proforma I & II

iv) Formative Assessment of Practical Assignments :

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for Practical/Drawing/Assignment	05
3	Neat & complete diagram with proper labels.	05
4	Lab work handling of instrument, observations & calculations.	05
5	Lab work/Drawing work and Assignment completion in proper manner with topic wise knowledge.	05
TOTAL		25

Self Learning Assessment of exercises given :

Every exercise shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for Practical/Drawing/Assignment	05
3	Neat & complete diagram with proper labels.	05
4	Lab work handling of instrument, observations, calculations.	05
5	Lab work/Drawing work and Assignment completion in proper manner and with topic wise knowledge.	05
TOTAL		25

J: Instructional Methods:

1. Lectures cum Demonstrations.
2. Classroom practices.
3. Drawing sheet preparation.

Teaching and Learning resources:

1. Chalk board
2. LCD presentations.
3. Audio presentations.
4. Item/ Question Bank.

K: REF. BOOKS / JOURNALS / IS CODES

Sr. No.	Title	Author	Publisher
01.	Generation of electrical energy	Dr. Gupta BR	S.Chand & Co. New Delhi, 1983,
02.	A course in electrical power	Gupta JB	S. K Kataria and sons, 2014,
03.	A course in electrical power.	Soni, Gupta, Bhatnagar	Dhanpat rai and sons
04.	Principles of power system	Mehta VK and Rohit Mehta	S.Chand & Co. New Delhi, 1982,
05	Power plant engineering	Nag P K	Tata McGraw Hill, New Delhi

L.SOFTWARE/LEARNING WEBSITES

- i. www.ntpc.co.in,
- ii. www.nhpcindia.com,
- iii. www.nptel.ac.in,
- iv. www.mnre.org.in
- v. www.powergridindia.com,
- vi. www.howstuffworks.com
- vii. www.electrical4u.com
- viii. www.media.com

* * *

COURSE NAME : **BASIC MECHANICAL AND CIVIL ENGINEERING**
COURSE CODE : **EEH302**
COURSE ABBREVIATION : **HBMC**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	3
	Tutorial Learning	--	
	Laboratory Learning	04	
	SLH-Self Learning	--	
	NLH- Notional Learning	06	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	100
Nil	Nil	Nil	Nil	Nil	50	20	50@	20			

(Total IKS Hrs for Sem. : 02 Hrs)

C: ABBREVIATIONS:- CL- Class Room Learning , TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit

SLA work.

4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro projects / assignments / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

i) RATIONALE:-

Exposure to basic mechanical engineering subjects equips electrical engineering students with a well-rounded skill set. This interdisciplinary knowledge enhances their ability to design, analyze, and optimize electrical systems within the broader context of mechanical considerations, fostering a holistic approach to engineering. Understanding power plant engineering is valuable for electrical engineers working on power distribution and generation systems. Fluid mechanics is relevant in cooling systems for electrical devices and the design of transformers., Gears, Belt drives, Chain drives, Bearings, Coupling gives understanding of industrial material handling system.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

—Use the principles of mechanical and civil engineering in electrical engineering"

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH302-1 Identify basic components of thermal power plants.

EEH302-2 Select suitable Industrial power transmission system

EEH-302-3 Identify basic components & their specifications in hydraulic equipment.

EEH302-4 Identify Different parts of Hydroelectric Power plant.

EEH302-5 Identify/Study Different component parts of the building

EEH302-6 Assist in infrastructure works.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps0) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), —0]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Use the principles of mechanical and civil engineering in electrical engineering"	3	2	2	2	2	2	2	-	-
EEH-302-1 Identify basic components of thermal power plants	3	2	1	2	2	1	2	-	-
EEH-302-2 Select suitable Industrial power transmission system	3	3	2	2	1	2	1	-	-
EEH-302-3 Identify basic components & their specifications in hydraulic equipment.	3	2	2	2	2	1	2	-	-
EEH-302-4 Identify Different parts of Hydroelectric Power plant.	3	2	2	0	1	1	1	-	-
EEH-302-5 Identify/Study Different component parts of the building	3	2	2	1	2	1	2	-	-

EEH-302-6 Assist in infrastructure works.	3	1	2	1	1	1	1	-	-
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F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory developed* by the Institute in practical sessions of batches of about 20- 22 students.

Sr. no	Basic Mechanical Engineering	CO
1	*Identify steam boilers using models and charts	EEH302-1
2	*Identify steam turbines using models and charts	EEH302-1
3	Measure temperature of different equipment using temperature measuring devices	EEH302-1
4	Measure pressure of different equipment using pressure measuring devices	EEH302-1
5	Measure speed of different rotating elements using speed measuring devices	EEH302-1
6	*Identify drive system using models/ actual set up	EEH302-2
7	Calculate Velocity Ratio of given gear/belt drive of suitable mechanical system.	EEH302-2
8	*Demonstrate Working of Hydraulic Power plant using pelton wheel turbine set up.	EEH302-3
9	*Identify different components of Reciprocating Pump	EEH302-3

Sr. no	Basic Civil Engineering	CO
1	*Study of Layout plan for Hydroelectric power plant.	EEH302-4
2	*Study the different types of buildings.	EEH302-5
3	Reading of a working drawing for Different types of buildings.	EEH302-5
4	Introduction of different building component	EEH302-5
5	Different types of openings and ducts in the Residential buildings.	EEH302-5
6	*Study of different construction activity sequence.	EEH302-5&6
7	Study Requirements of concealed wirings in the construction activities	EEH302-5
8	*Study of foundation used in residential and industrial works.	EEH302-5 & 6
9	*Study of different types of Concrete grades.	EEH302-5
10	Identify the structures for the electrification in the infrastructure development.	EEH302-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH-302-1: Identify the different parts of a thermal power plant.			
1	Power plants equipment 1.1 Layout of Thermal Power Plant, Major thermal power plants in India(*IKS) 1.2 Introduction to steam boilers- Difference between water tube & fire tube boiler. Babcock Wilcox boilers, 1.3 Introduction to steam Turbines- Impulse and reaction turbine.	07	16

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.4 Introduction to portable generators: Basic components and working of four stroke petrol & diesel I.C engine 1.6 Mechanical parameters measurement 1.6.1 Pressure measurement: Bourdon tube pressure gauge 1.6.2 Temperature measurement: Optical pyrometer, Thermocouple 1.6.3 Heat measurement: Calorimeter 1.6.4 Speed measurement of rotating elements: Tachometer, Stroboscope		
CO: EEH-302-2: Select suitable Industrial power transmission system			
2	Power Transmission systems ; 2.1 Gears: Spur, helical, bevel, and worm gears. 2.2 Belt drives: Flat belt, V-belt 2.3 Chain drives; Roller chains, Inverted Tooth Chains 2.4 Bearings; Ball Bearing, Roller Bearing. 2.5 Couplings Flexible Couplings, Rigid Couplings	04	08
CO: EEH-302-3: Identify basic components & their specifications in hydraulic equipment.			
3	Hydraulic pumps, turbines, and Air Compressor 3.1 Layout of Hydraulic Power Plant, 3.2 Major hydraulic power plants in India(*IKS) 3.3 Introduction to hydraulic turbines: construction and working of Pelton wheel, 3.4 Introduction to hydraulic pumps: construction and working of centrifugal pump, reciprocating pump 3.5 Air Compressor; construction and working of two stage reciprocating air compressor, centrifugal air compressor.	05	12

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH302-4. Identify Different parts of Hydroelectric Power plant.			
4	1.1 Layout of Hydroelectric Power Plant 1.2 Major Hydroelectric power plants in India(*IKS) 1.3 Civil works structures and their uses	02	00
CO: EEH302-5 Identify/Study Different component parts of the building			
5	<p>Building Construction & drawing:- 5.1 Types of building Component parts of the building. 5.2 Stone Masonry & Brick masonry and Plastering 5.3 Openings: doors and windows their types. 5.4 Introduction to building drawing. 5.5 Circulation: Horizontal and vertical (passages and staircases) 5.6 Types of structure load bearing, framed & industrial 5.7 Terms Related to Built up Area: plinth area, carpet area, built-up area and FSI.</p> <p>Foundation and soil mechanics:: 5.8 Types of soils and bearing capacities.(*IKS) 5.9 Different Types of foundations.</p> <p>Concrete technology: 5.10 Ingredients of concrete 5.11 Different types of concrete grade and its application. 5.12 Concreting procedure & centering works.</p>	08	00
CO: EEH302-6: Assist in infrastructure works.			
6	Introduction to various infrastructure Projects. 6.1 Need of Infrastructure 6.2 Role of Civil & Electrical engineer in development. 6.3 Different sectors in the infrastructure 6.4 Transportation Engineering. 6.4.1 Railway 6.4.2 Roads 6.4.3 Bridges 6.4.4 Tunnels 6.5 Water supply and Sanitary Engineering 6.5.1 Water treatment plant and supply network 6.5.2 Collection of waste water & sewage treatment plant 6.6 Irrigation engineering 6.6.1 Intake structure 6.6.2 Types of irrigation projects. Lift irrigation 6.7 Modern Infrastructure work 6.7.1 Modern public transport system like metro	06	00

	6.7.2 Renewable energy plants like solar energy wind energy(*IKS)		
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No questions will be asked on IKS learning subtopics in any question papers.

G : List of Assignments under SLA

.....Not applicable.....

H. Specification table for setting question paper for semester end theory examination

_____Not applicable._____

I .Assessment Criteria

The assessment need to be done as per Proforma I & II

i) Formative Assessment of Practical:-

Every practical shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

Every candidate shall be assessed for 25 marks as per following criteria:

Sr . no	Criteria	Mark s allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N	Name of Book	Author	Publication
1	A Textbook of Thermal Engineering,	R. S/ Khurmi	S. Chand, New Delhi, 2012 or latest
2	A Textbook of Basic Mechanical Engineering.	D.K.Gupta	Dhanpat rai Publication.
3	Basic Mechanical Engineering.	S. C. Sharma	Khanna Publication, New Delhi, 2012 or latest
4	Electrical Machine	Nagrath I.J. a Kothari, D.P.	Tata McGraw Hill, New Delhi, 2012 or latest
5	Electrical Machine-I	Gupta, J. B.	S. K. Kataria& Sons, New Delhi, 2012 or latest
6	Basic Civil Engineering	G.K.Hiraskar	Dhanpat rai Publication.
7	Basic Civil Engineering	S.S.Bhavikatti	New age international Publication.

M. Learning Website & Software

- a. www.nptel.com/iitm/
- b. www.howstuffworks.com/
- c. www.vlab.com
- d. www.sskphdmm.com
- e. <http://www.youtube.com/watch?v=RAc1RYilugI>

Government Polytechnic Kolhapur
Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering																				
Programme Code	: EE										With Effect From Academic Year					: 2024-25					
Duration Of Programme	: 6 Semester										Duration					: 15 WEEKS					
Semester	: Third										Scheme					: MPECS 2023					

Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hrs/Week			Theory				Based on LL&TL				Based on Self Learning		
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1	Essence of Indian Constitution	HEIC	VEC	2	CCH205		1	-		1	2	1	-	-	-	-	-			-	50	20	50	
2	Electrical Circuits	HECT	DSC	3	EEH303	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	Electrical Measurement & Instrumentation	HEMI	DSC	3	EEH304	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4	Transformer	HTRF	DSC	3	EEH305	2	3		4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
5	Transmission and Distribution of Electric Power	HTDP	DSC	3	EEH306	2	4		2	2	8	4	3	30	70	100	40					25	10	125
6	Applied Electronics	HAET	SEC	3	EEH307	1	3	-	2	1	6	3	3	30	70	100	40	25	10			25	10	150
Total						9	17		16	7	40	20		150	350	500		100		75		175	850	

Abbreviations: CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, FA-Formative Assessment, SA-Summative Assessment, IKS-Indian Knowledge System, SLA-Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category: Discipline Specific Course Core(DSC): 3, Discipline Specific Elective (DSE):0, Value Education Course(VEC):1, Intern./Apprenti./Project./Community(INP):0, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE NAME : ESSENCE OF INDIAN CONSTITUTION
COURSE CODE : CCH205
COURSE ABBREVIATION : HEIC

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	1	1
	Tutorial Learning	-	
	Laboratory Learning	-	
	SLH-Self Learning	1	
	NLH-Notional Learning	2	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
NA	-	-	-	-	-	-	-	-	50	20	50

(Total IKS Hrs for Sem. : 04 Hrs)

C. ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination.

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the

drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futuristic goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome –
Abide by the Constitution in their personal and professional life.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - List salient features and characteristics of the constitution of India.
- CO2 - Follow fundamental rights and duties as responsible citizen and engineer of the country.
- CO3 - Analyze major constitutional amendments in the constitution.
- CO4 - Follow procedure to cast vote using voter-id.
- CO5-List the roles and responsibilities of State Election Commission towards peoples in the state.
- CO-6 List Judiciary provisions for the peoples in general

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	-	-	2	-	-			
CO2	1	-	-	-	2	-	-			
CO3	1	2	-	-	2	-	1			
CO4	-	-	-	1	-	-	-			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”

F. CONTENT:-

1) Practical exercises

.....Not Applicable.....

II) Theory

SECTION-I		
Sr. No.	Topics / Sub-topics	Lectures (Hours)
1	CCH 205. 1. The Constitution:- 1.1 Introduction. 1.2 The History of making of the Indian Constitution. 1.3 Basic structure and its interpretation. 1.4 Fundamental Rights and Duties and their interpretation	2
2	CCH 205. 2. Union Government 2.1 Structure of the Indian Union. 2.2 President –Role and power. 2.3 Prime minister and council of ministers. 2.4 Lok Sabha and Rajya Sabha. 2.5 Union Territories and their limitations.	3
3	CCH 205. 3. State Government. 3.1 Governor –Role and power. 3.2 Chief Minister and council of ministers. 3.3 State secretariat. 3.4 Administrative Regions of Maharashtra.	3
SECTION -II		
4	CCH 205.4 Local Administration:-Their roles and responsibilities 4.1 District Administration. 4.2 Municipal Corporation. 4.3 Zilla Panchayat 4.4 Taluka (Tahasil) Administration .	2
5	CCH 205. 5. Election Commission. 5.1 Role and functioning. 5.2 Chief Election Commissioner –Appointment. 5.3 State Election Commission. 5.4 Elections and duties of government /Non government servants – introduction	2
6	CCH 205. 6. Introduction to Judiciary Provisions :- 1.1 Introduction 1.2 Different courts. 1.3 Government legal advisor-provisions. 1.4 Limitations of courts and co-ordination with Home department.	3

G. LIST OF ASSIGNMENTS UNDER SLA

1. Outline the procedure to submit application for Voter-id
2. Assignments are to be provided by the course teacher in line with the targeted Cos.
3. Prepare an essay on Constitution of India .
4. Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA [Assignments are to be provided by the course teacher in line with the targeted Cos. A1. Prepare an essay on Constitution of India. A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies.]

Micro project :- Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

- i. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
- ii. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- a) Differences in the ideals of Social democracy and Political democracy.
- b) Democracy and Women's Political Participation in India.
- c) Khap Panchayat – an unconstitutional institution infringing upon Constitutional ethos.
- d) Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

- a) Art 356 and its working in Post-Independent India.
- b) Women's Resrvation in Panchayat leading to Pati Panchayats – Problems and Solutions.
- c) Adoption of Article 365 in India.
- d) Need of Amendments in the constitution.
- e) Is India moving towards a Unitary State Model ?

Activity

Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.

National (Art 352) & State Emergencies (Art 356) declared in India.

1. Seven fundamental rights.
2. Land Reforms and its effectiveness – Case study of West-Bengal and Kerala.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

.....Not Applicable.....

I. ASSESSMENT METHODOLOGIES/TOOLS

- a. **Formative assessment (Assessment for Learning): Suggested Proformas are to be used for ASSESSMENT.**

Assignment, Self-learning and Terms work Seminar/Presentation

- b. **Summative Assessment (Assessment of Learning):- Suggested Proformas are to be used for ASSESSMENT**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6th edition, 2011, ISBN:8120344197
4	MORE READS :	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan, Agra, 2017, ISBN:8193413768

M. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf	Parts of constitution
7	https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-constitution	Parts of constitution

COURSE NAME : ELECTRICAL CIRCUITS
COURSE CODE : EEH303
COURSE ABBREVIATION : HECT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	3	4
	Tutorial Learning	--	
	Laboratory Learning	4	
SLH-Self Learning	1		
	NLH-Notional Learning	8	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical		Practical		MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	175
	30	70	100	40	25	10	25#	10	25	10	

(Total IKS Hrs for Sem. : 02 Hrs)

C. ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i. RATIONAL :-

Electrical technicians working in the field have to deal with applications that require them to be well conversant with the concepts of electrical parameters such as resistance, inductance and capacitors. Combination of these parameters in AC circuits gives rise to the different applications of electrical engineering. This course deals with these parameters and their behavior under different source conditions.

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is that the student should solve different electric networks.

E.COURSE OUTCOMES:

EEH303 -1 Solve for ac circuit quantities of voltage, current and different factors.

EEH303-2. Solve ac series circuits and resonant circuit.

EEH303-3. Solve ac parallel circuits and resonant circuit.

EEH303-4 Apply electrical network theorems to solve dccircuits.

EEH303-5 Apply network theorems to solve ac circuits.

EEH303-6 Solve three phase star and delta circuits for voltage, current, power and power factors.

COMPETENCY,COURSE OUTCOMES AND PROGRAMME OUTCOMES /PROGRAMME SPECIFIC OUTCOMES (CP-CO-PO/PSO) MATRIX

[Note : Correlation levels : 1: Slight, 2: Moderate , 3: Substantial, “0”: no correlati

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Competency: Solve different electric application networks	2	2	-	-	1	-	1	0	1
EEH303-1: Solve for ac circuit quantities of voltage, current and different factors.	2	2	-	-	-	-	1	1	1
EEH303-2: Solve ac series circuits and resonant circuit.	2	1	2	-	1	-	1	1	1
EEH303-3: Solve ac parallel circuits and resonant circuit.	2	2	-	-	1	-	1	1	1
EEH303-4: Apply electrical network theorems to solve dc circuits	2	2	-	-	-	-	1	1	1
EEH303-5: Apply network theorems to solve ac circuits.	2	1	2	-	1	-	1	1	1
EEH303-6: Solve three phase star and delta circuits for voltage, current, power and power factors.	2	2	-	-	1	-	1	0	1

F. CONTENT:

I. Suggested Practical's/ Exercise:-

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as practical's and assess the student for attainment of the competency.

Sr No.	Title of Practical Exercise	Course Outcome
1	Verify behavior of pure resistive circuit	EEH303.1
2	Verify behavior of Pure Inductive Series Circuit.	EEH303.1
3	Verify behavior of Pure Capacitive Circuit	EEH303.1
4	Verify behavior of R-L Series circuit	EEH303.2
5	Verify behavior of R-C Series Circuit.	EEH303.2
6	Verify behaviour R-L-C Series Circuit	EEH303.2
7	Verify Current divisions in R-L-C Parallel Circuit	EEH303.3
8	Verify Voltage divisions in R-L-C Parallel Circuit	EEH303.3
9	Verify Superposition Theorem on D.C. Supply.	EEH303.4

10	Verify Thevenin's Theorem on D.C. Supply	EEH303.4
11	Verify Norton's Theorem on D.C. Supply	EEH303.4
12	Verify Maximum power Transfer Theorem on D.C. Supply	EEH303.4
13	Verify Superposition Theorem on A.C. Supply.	EEH303-5
14	Verify Thevenin's Theorem on A.C. Supply	EEH303-5
15	Verify Norton's Theorem on A.C. Supply	EEH303-5
16	Verify Maximum power Transfer Theorem on A.C. Supply	EEH303-5
17	Verify relationship between Line & phase values of voltage & current in Star connected three phase system.	EEH303-6
18	Verification of relationship between Line & phase values of voltage & current in Delta connected three phase system.	EEH303-6
19	To Study a residential bill of electricity and calculate it after understanding the similar bill.	EEH303- 6

II. THEORY

Sr. No.	Topics / Sub-topics	Lect. (Hrs)	Theory (Marks)
Section -I			
<i>EEH303-1. Solve for ac circuit quantities of voltage, current and different factors.</i>			
1.	A.C. Fundamentals. # Basic terms related to AC fundamentals(IKS) 1.1 Generation of Alternating Current and Voltage using elementary alternator. 1.2 Important terms: waveform, Peak/maximum value, Average value, Effective/RMS value, Peak factor, Form Factor and its importance, Phase and phase difference. 1.3 Equations of Alternating Voltages and Currents. 1.4 Phasor representation of alternating quantities. Simple Mathematical operations. 1.5 Addition and subtraction of sinusoidal alternating quantities. 1.6 Simple Numerical on above.	09	12
<i>EEH303-2 : Solve ac series circuits and resonant circuit.</i>			
2.	A.C. Series Circuits: #Basic of resistance, inductance, capacitance (IKS) 2.1 Rectangular and polar forms of vectors with conversions from one form to other. 2.2 Response of A.C Supply to pure resistive circuit , pure inductive circuit and pure capacitive circuit. 2.3 Combinations of resistance, inductance and Capacitance in series. 2.4 R-L Series Circuits ,R-C Series Circuit and R-L-C	08	12

	Series Circuits.		
<i>EEH303-3 Solve ac parallel circuits and resonant circuit.</i>			
3.	A. C. Parallel Circuit 3.1 Impedances in parallel. 3.2 Concept of admittance. 3.3 voltage and current relations in Parallel circuits. 3.4 Calculation of currents in different branches. 3.5 Phasor diagrams (Numerical problem upto three parallel branches). 3.6 Resonance, resonant frequency, current, power factor, quality factor with numerical .	07	10

Section-2

<i>EEH303.4 Solve different Theorems on D.C.</i>			
4	DC Circuit 4.1 Revision of basic concepts related with d.c. circuits. 4.2 Nodal Analysis up to two nodes. 4.3 Superposition Theorem Numerical up to two loops. 4.4 Thevenin's theorem Simple Numerical. 4.5 Norton's theorem and simple Numerical.. 4.6 Maximum Power Transfer theorem and its application. 4.7 Star/delta and delta /star Transformations of Resistances. Only Numerical]	08	14
<i>EEH303-5 Apply network theorems to solve ac circuits.</i>			
5	A C network solution - Ohm's law(IKS) 5.1 Statements of the following laws and theorems on A.C. 5.1.1. Kirchhoff's laws. 5.1.2 Superposition Theorem 5.1.3 Thevenin's theorem. 5.1.4 Norton's theorem 5.1.5 Maximum Power Transfer Theorem. 5.2 Numerical solutions of two-loop ac circuits using the above theorems.	07	12
<i>EEH303.6 Polyphase circuits</i>			
6	Polyphase circuits 6.1 Generation of emf(IKS) 6.2 Concept of poly phase circuits 6.3 Three phase circuits and advantages of producing three phase voltages and their equations. 6.4 Star and delta connections in alternator. 6.5 Relation between line and phase values of voltages and currents in three phase delta and star connected systems. 6.6 Powers in three-phase circuits and their equations. 6.7 Units of different powers in polyphase circuits. 6.8 Billing unit of electricity and sample calculations Of electricity bill. (Sample simple calculation)	06	10

**** No questions will be asked on IKS learning subtopics in any question papers.**

G : LIST OF ACTIVITIES UNDER SLA

Suggested micro-project on electrical network are as follows:

- i. Micro project -Prepare model of star or Delta system using lamps, holders etc to verify relations.
- ii. Micro project -Prepare model of simple R,L and C series or parallel circuits using lamps, holders, rheostats etc to verify relations between them.
- iii. Survey Electrical network system available nearby offices, commercial places, industry etc.

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER ENDTHEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks Cognitive base (level wise)			Total Marks	Course outcome
		Remember	Understand	Application		
I / 1	A.C. Fundamentals	4	4	4	12	EEH303-1
I / 2	A.C. Series Circuits	4	4	4	12	EEH303-2
I / 3	A. C. Parallel Circuit	4	4	2	10	EEH303-3
I / 4	DC Circuit	4	8	4	14	EEH303-4
II / 5	A C network solutions	4	4	4	12	EEH303-5
II / 6	Polyphase circuits	4	4	2	10	EEH303-6

I :-ASSESSMENT CRITERIA

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE MATERIAL :

a) Books / Journals / IS Codes

Sr. No.	Author	Title
1.	E.Hudges	Electrical Technology
2.	B.L.Theraja	Electrical Technology-vol.1
3.	V.N,Mittal	Basic Electrical engineering
4.	B.H.Deshmukh	Electrical Technology
5.	V.K.Mehata	Electrical Technology
6.	Nagrath	Basic Electrical engineering

b) Websites

1. www.nptel.iitm.ac.in
2. [www.learningaboutelectrical](http://www.learningaboutelectrical.com) circuits.com
3. www.futurlec.com
4. [www.electricalcircuits](http://www.electricalcircuits.co.in) .co.in

COURSE NAME : ELECTRICAL MEASUREMENT & INSTRUMENTATION
COURSE CODE : EEH304
COURSE ABBREVIATION : HEMI

A.TEACHING/LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	3	4
	Tutorial Learning	--	
	Laboratory Learning	4	
	SLH-Self Learning	1	
	NLH-Notional Learning	8	

B.EVALUATION SCHEME:

PAPER DURATION IN HRS	THEORY			BASED ON LL&TL				BASED ON SLA		TOTAL	
	FA-TH	SA-TH	TOTAL	Practical		SA-PR	MAX	MIN			
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs for Sem. : 02 Hrs)

C.-ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal OnlineExamination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
 - If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
 - If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
 - Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
 - 1(one) credit is equivalent to 30 Notional hrs.
 - * Self learning hours shall not be reflected in the Time Table.
- * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. a) RATIONALE:

The course deals with the principle, construction and application of various electrical measuring instruments used in circuits for measurement of various electrical quantities in the area of industry as well as in electrical power systems. The topics included are meant to prepare the technicians to carry out the responsibilities of electrical engineer in day-to-day work.

This course also deals with various methods for measurement of non-electrical quantities in process industries, power plants, substations etc. for measurement of pressure, temperature, displacement etc.

b) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The main objective of this subject to know the students about electrical measuring unit & which instruments is useful for measurement of electrical quantities, how they construct, how they work & how they handle.

Carryout electrical and instrumentation-based measurements of different parameters

Cognitive: Understanding principles of measurements related to engineering fields

Psychomotor: Use relevant measuring techniques/ instruments for different electrical and some non-electrical quantities.

Affective: Attitude of i) Punctuality ii) Accuracy iii) Safety iv) precision.

E. COURSE OUTCOMES:

EEH304.1: Understand the basics concepts of electrical measuring instrument

EEH304.2: Carryout measurement of Voltage & Current by using relevant instruments and methods .

EEH304.3: Use different types of measuring instruments for measuring electric power & Energy.

EEH304.4: Use different types of electrical instruments for measuring various ranges of electrical parameters

EEH304.5: Use different transducer-based instruments for various measurements

EEH304.6: Use electronic instruments for electrical measurements and display.

COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-” :no correlation]

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
Competency :Carry out instrumentation and electrical measurement	3	1	1	2	2	1	3	1	1	
EEH304-1 : Check the working of electrical measuring instrument	2	1	2	3	2	1	2	1	-	
EEH304-2 Use different types of measuring instruments for measuring electric Voltage & Current.	3	-	1	2	2	1	1	1	1	
EEH304-3 : Use different types of measuring instruments for measuring electric power & Energy	3	-	2	2	1	1	2	1	1	
EEH304-4 Use Use different types of electrical instruments for measuring various ranges of electrical parameters	3	1	2	1	1	1	2	1	1	
EEH304.5:Use different transducer based instruments for various measurements.	3	1	2	2	1	1	2	1	1	
EEH304-6:Use electronic instruments for electrical measurements and display	3	1	1	3	2	1	2	1	1	

F. CONTENT:-

I. Practical exercises

The following practical exercises shall be conducted in the Laboratory **Electrical Measurement & Instrumentation** developed by the Institute in practical sessions batches of 20-22 students.

Laboratory experiments and related skills to be developed:

Sr. No	Title of Experiment	Course outcome
1.	Introduction to electrical measurement Lab	EEH304-1
2.	Study the different physical & Electrical measurements & Their Conversion.	EEH304-1
3.	Identify measuring instruments on the basis of symbols on dial, type, accuracy, class, position and scale	EEH304-1
4.	Measurement of Voltage & Current in single phase circuit by using voltmeter, ammeter & Multi-Meter	EEH304-2
5.	Identify the components of PMMC and PMMI instruments.	EEH304-2
6.	Troubleshoot PMMC and MI instruments.	EEH304-2
7.	Measurement of current by using Clamp-On meter.	EEH304-2
8.	Use of CT. for Extension of range of Ammeter.	EEH304-2
9.	Use of PT. for Extension of range of Voltmeter.	EEH304-2
10.	Measurement of power in single phases circuit by using wattmeter.	EEH304-3
11.	Measurement of power in three phases Balanced Load by using two-wattmeter method	EEH304-3
12.	Measurement of power in three phases Un-Balanced Load by using two-wattmeter method.	EEH304-3
13.	Measurement of reactive power in three phases Load by using two-wattmeter method.	EEH304-3
14.	Calibrate single phase energy meter by direct loading	EEH304-3
15.	Demonstrate of Single phase Electronic Energy meter.	EEH304-3
16.	Demonstrate the working of smart energy meter	EEH304-3
17.	Measurement of insulation resistance by Megger /Earth Tester	EEH304-4
18.	Use Voltmeter-Ammeter method for measurement of medium resistance.	EEH304-4
19.	Measurement of Medium resistance by Wheatstone Bridge method	EEH304-4
20.	Measurement of low resistance by Kelvin Double-bridge method.	EEH304-4
21.	Use of Rotating type Phase sequence indicator	EEH304-4
22.	Measurement of Temperature using Transducers.	EEH304-5
23.	Measurement of distance using LVDT.	EEH304-5
24.	Measure weights by using strain gauge	EEH304-5
25.	Measure pressure by using Bourdon tube pressure gauge	EEH304-5
26.	Measure voltage, current, Frequency, Amplitude using Cathode Ray Oscilloscope.	EEH304-6

II. Theory:-

Sr.No	Topic/Subtopic	Lect.in Hours	Theory Evaluation marks
EEH304-1: Basics of Electrical measuring instrument.			
Unit-1	INTRODUCTION & FUNDAMENTALS OF MEASURING INSTRUMENTS Old Measurement Methods (IKS) 1. Introduction to Electrical measuring system a. Def. of measurement b. Significance or Necessity of Measuring Instruments 2. Def. of Instruments a. Standards & units of measuring instruments b. Detail classification of Measuring Instruments. c. Essentials of Measuring Instruments 3. Characteristics of Measuring Instruments a. Static Characteristics b. Dynamic Characteristics 4. Error & Their Types 5. Necessity or Need of Calibration of Measuring Instruments	04	08

	with their procedure.		
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Sr.No	Topic/Subtopic	Lect. in Hours	Theory Evaluation marks
EEH304-2: Use different types of measuring instruments for measuring Voltage & Current			
Unit-2	MEASUREMENT OF VOLTAGE & CURRENT 1. Analog Instruments for Measurement of current & Voltage. a. Permanent magnet moving coil instrument (Working Principle, Diagram, Construction, Working, Advantages-Disadvantages & Application) b. Moving iron type instrument. (Attraction Type, Repulsion type) (Working Principle, Diagram, Construction, Working, Advantages-Disadvantages & Application) 2. Clamp-on Meter (in Detail) 3. Measurement of High Voltage & Current a. Current Transformer b. Potential Transformer 4. Range extension of Instruments a. Range Extension of Ammeter b. Range Extension of Voltmeter.	08	12

Sr.No	Topic/Subtopic	Lect. in Hours	Theory Evaluation marks
EEH304-3: Use different types of measuring instruments for measuring Power & Energy			
Unit-3	<p>MEASUREMENT OF POWER & ELECTRIC ENERGY</p> <p>A) Measurement of Power</p> <p>a. Def. of Power with their unit & Types of Power</p> <p>b. Introduction to watt-meters</p> <p>c. Classification of watt-meters</p> <p>d. Electrodynamometer Wattmeter (Working Principle, Diagram, Construction, Working, Advantages-Disadvantages & Application)</p> <p>e. Measurement of active, reactive power and power factor in three phase circuits by using two wattmeter method.</p> <p>f. Errors in wattmeter & their compensation.</p> <p>g. Maximum demand indicator.</p> <p>B) Measurement of Energy</p> <p>a. Def. of Energy with their unit.</p> <p>b. Calibration of energy meter</p> <p>c. Digital/Electronic Energy meters (Both single and three phase)</p> <p>d. Prepaid Energy meter</p>	09	14

Sr. No	Topic/Subtopic	Lect.in Hours	Theory Evaluation marks
EEH304-4: Use different types of measuring instruments for measuring of R-L-C			
	<p>Measurement of other electrical Parameters.</p> <p>A. Measurement of Resistance</p> <p>a. Classification of resistance (Low, Medium and high)</p> <p>b. Voltmeter-ammeter method.</p> <p>c. Wheatstone bridge.</p> <p>d. Kelvin double bridge method. (No derivation)</p>		

Unit-4	<p>Measurement of higher resistance (Insulation resistance) by Megger & its application.</p> <p>B. Measurement of Inductance</p> <p>a. Anderson bridge (no derivation no phasor diagram)</p> <p>b. Maxwell bridge (no derivation no phasor diagram)</p> <p>C. Measurement of capacitance by Schering bridge (No derivation no phasor diagram)</p> <p>Measurement of Inductance, capacitance and resistance by using digital LCR meter</p> <p>D. Special Type of Measuring Instruments</p> <p>a. Electrodynamometer type Power factor meters. (Single phase & three phase)</p> <p>b. Weston type Frequency meter</p> <p>c. Rotating type phase sequence indicator</p> <p>d. Synchroscope; Working and its application.</p>	10	16
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Sr.No	Topic/Subtopic	Lect.in Hours	Theory Evaluation marks
EEH304-1: Use different transducer-based instruments for various Physical measurements			
Unit-5	<p>Measurement of Non electrical Quantities by using TRANSDUCERS</p> <p>5.1 Introduction and classification of transducer</p> <p>5.2 Transducer selection factors</p> <p>5.3 Concept of Piezoelectric and photoelectric transducer</p> <p>5.4 Measurement of temperature.</p> <p>5.4.1 Resistance temperature detector.</p> <p>5.4.2 Thermistors</p> <p>5.5 Measurement of Displacement</p> <p>5.5.1 L V D T – construction, Operation, applications.</p> <p>5.6 Measurement of Pressure by Strain Gauges</p> <p>5.6.1 Unbounded type strain gauge</p> <p>5.6.2 Bounded type strain gauge</p> <p>5.7 Bourdon tube</p>	07	10

Sr.No	Topic/Subtopic	Lect.in Hours	Theory Evaluation marks
EEH304-6: Use electronic instruments for electrical measurements and display.(Signal Conditioning Instruments)			
Unit-6	<p>6.1 Block diagram of AC and DC signal conditioning systems in instrumentation.</p> <p>6.2 Digital Multi-meter.</p> <p>6.3 Function Generators</p> <p>6.4 Old Recording system (IKS)</p> <p>6.5 Recording Type Instruments</p> <p>6.5.1 Strip chart recorder,</p> <p>6.5.2 X-Y recorder</p> <p>6.6 Basic Oscilloscope [CRO], Controls, Their types & Applications of CRO</p>	07	10

** No questions will be asked on IKS learning subtopics in any question papers.

G. List of Assignments under SLA:-

Sr.No	List of Assignment (under SLA)	Hrs Allotted
1	Collect the information about units for measurement of physical quantities.	02
2	Make chart of the physical symbol & representation of electrical quantities.	02
3	Draw & Understand the constructional details of PMMC & PMMI Instruments.	03
4	Compare the measurement method of Energy(Induction Method, Electronic & Prepaid Method)	02
5	Detail study of diff ranges of resistance & their measurement method.	02
6	Problems solved based on two wattmeter method.	02
7	Study the different signal conditioning instruments.	02
	Total Hours	15

Or

The following suggested list given below for Micro project, concerned faculty can add similar microprojects

- Dismantle any PMMC and MI instrument available in the laboratory and identify different parts i.e. coil, spring, magnet, former etc and again assemble the same
- Dismantle different types of wattmeter available in the laboratory identify the pressure coil and current coil and again the assemble the same
- collect data of power consumption of various equipment installed in departmental laboratories of polytechnic using digital energy meter.
- Using CRO test all electronics and electrical circuits in laboratory
- Use tri-vector meter for its practical utilization in L.T consumers

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basics of Electrical measuring instrument.	2	4	2	08	EEH304-1
I / 2	Measurement of Voltage & Current	4	4	4	12	EEH304-2
I / 3	Measurement of Power & Electric Energy	4	4	6	14	EEH304-3
II / 4	Measurement of other Electrical Parameters.	4	8	4	16	EEH304-4
II / 5	Measurement of Non Electrical Quantities By Using TRANSDUCERS	2	4	4	10	EEH304-5
II / 6	(Signal Conditioning Instruments)	2	4	4	10	EEH304-6
Total Marks					70	

I.ASSESSMENT CRITERIA

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given in *Laboratory Manual*

Domain	Particulars	Marks out of 25
Cognitive	Preparation for practical	05
Psychomotor	Operating skills	05
	Observation and Recording	05
	Interpret Result and Conclusion	05
Affective	Safety Measures/ Discipline	05
TOTAL		25

J. Instructional Methods:

4. Lectures cum Demonstrations,
5. Class room practices.
6. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. .REFERENCE MATERIAL:

Books

1. Electrical Measuring Instruments - by D.B. Dhar.
2. Electrical Technology vol. I - by B.L. Theraja.
3. Measuring Instruments - by Satyanarayan.
4. Electrical & Electronics Measurements & Instrumentation - A. K. Sawhney.
5. Electronic Measurements & Instrumentation - Cooper and Helfrick.

COURSE NAME : TRANSFORMER
COURSE CODE : EEH305
COURSE ABBREVIATION : HTRF

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	3	4
	Tutorial Learning	-	
	Laboratory Learning	4	
SLH-Self Learning	1		
NLH-Notional Learning	8		

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical				MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	175
	30	70	100	40	25	10	25#	10	25	10	

(Total IKS Hrs for Sem. : 02 Hrs)

C: ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal OnlineExamination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.
 * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Electrical engineering students must be knowledgeable about transformers, especially their features. The course addresses the principles, characteristics, and uses of transformers. An individual with a diploma is required to operate in a variety of companies, including manufacturing, power generation stations, state electricity boards, etc. The student operates and maintains electrical transformers as part of his job. As a result, student ought to be familiar with the transformer's operation, features, and construction. This course covers the functioning of transformers, their performance characteristics, parallel operations, applications, etc. The various tests performed on transformers to analyze their various parameters are also covered in this subject.

Since technicians are expected to work with various electrical / electronic systems involving transformer, it is highly essential to provide them necessary knowledge about construction, operation & testing of transformer with mathematical background. This course aims at strategic development of students so that they can comprehend, operate, use, and test transformers in accordance with requirements.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

“Use single phase and three phase transformer in electrical power system.”

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH305-1 Recognize the single phase transformer.

EEH305-2 Suggest special purpose transformer for given application.

EEH305-3 Analyze the performance of ideal and practical transformer at different conditions.

EEH305-4 Determine the performance parameters of single phase transformer.

EEH305-5 Operate single phase transformers in parallel and carry out load sharing calculations.

EEH305-6 Identify three phase transformers and operate it in parallel.

Competency, course outcomes and programme outcomes / programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High) and “-” for no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
EEH305-1	3	2	1	2	2	1	2	2	1
EEH305-2	3	1	-	1	-	-	1	-	-
EEH305-3	3	1	1	1	1	-	2	2	2
EEH305-4	3	1	1	2	2	1	2	2	1
EEH305-5	3	2	2	2	2	1	2	2	1
EEH305-6	3	1	2	2	1	1	1	2	1

F. CONTENT:-

I) Practical exercises:

The following practical exercises shall be conducted in the *Transformer Laboratory* developed by the Institute in practical sessions of batches of about 20-22 students:

Sr. No.	Laboratory Experiences	CO
1	Identify the different parts of single phase transformer.	EEH305-1
2	Identify the different parts of Three phase transformer.	EEH305-1
3	Determine transformation ratio of single phase transformer.	EEH305-1
4	Identify the different parts of single phase autotransformer (Dimmerstat).	EEH305-2
5	Observe the performance of a given single-phase autotransformer.	EEH305-2
6	Identify the different parts of single phase isolation transformer.	EEH305-2
7	Identify the different parts of current transformer.	EEH305-2
8	Observe the performance of a given Current transformer	EEH305-2
9	Identify the different parts of potential transformer.	EEH305-2

10	Observe the performance of a given Potential transformer	EEH305-2
11	Identify the different parts of single phase welding transformer.	EEH305-2
12	Observe the performance of a given welding transformer	EEH305-2
13	Study design & constructional features of pulse transformer.	EEH305-2
14	Perform Open circuit (OC) test on a given transformer.	EEH305-4
15	Perform Short circuit (SC) test on a given transformer.	EEH305-4
16	Back to Back test on single phase transformer.	EEH305-4
17	Perform polarity test on a single phase transformer.	EEH305-4
18	Determine equivalent circuit parameters of single phase transformer by O. C. & S. C Test.	EEH305-4
19	Determine the efficiency & regulation of given transformer by O. C. & S. C Test.	EEH305-4
20	Determine the efficiency & regulation of given transformer by direct load test.	EEH305-4
21	Perform polarity test on a single phase transformer whose polarity markings are masked.	EEH305-4
22	Perform parallel operation of two single phase transformers to determine the load current sharing.	EEH305-5
23	Perform parallel operation of two single phase transformers to determine the apparent and real power load sharing.	EEH305-5
24	Three-phase transformer connections as per vector group.	EEH305-6
25	Scott-Connection of three phase transformer.	EEH305-6
26	Open-delta Connection of three phase transformer.	EEH305-6
27	Observe Distribution & Power transformers. (based on visit to transformer manufacturing industry)	EEH305-6

II) Theory

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning Evaluation Marks
CO: EEH305-1: Recognize the single phase transformer.			
1	Single Phase Transformer 1.1 Introduction (IKS) 1.2 Principle operation 1.3 Type of transformer according to different aspects 1.4 Construction: Parts and function 1.5 EMF equation of single phase transformer 1.6 Transformation ratio 1.7 Why transformer is rated in KVA 1.8 Losses in a transformer 1.9 Problems on 1.5, 1.6 & 1.8	7	14
CO: EEH305-2: Suggest special purpose transformer for given application.			
2	Special Purpose transformer 2.1 Transformer: Need of special purpose transformers 2.2 Single phase auto transformer- 2.2.1 Autotransformer as step down transformer 2.2.2 Autotransformer as step up transformer 2.2.3 Advantages and disadvantages of Autotransformer Application	8	12

	2.2.4 Copper saving in Autotransformer 2.2.5 Comparison between two winding and Autotransformer 2.3 Isolation Transformer- Basic Diagram, function and application 2.4 Instrument transformer: 2.4.1 Current transformer- Basic Diagram, working, application 2.4.2 Potential transformer-Basic Diagram, working, application 2.4.3 Welding transformer- Basic Diagram, function and application 2.4.4 Pulse Transformer Basic Diagram, function and application		
CO: EEH305-3: Analyze the performance of ideal and practical transformer at different condition.			
3	Phasor Diagram of ideal and practical transformer (No numerical on any subtopic) 3.1 Concept of ideal transformer 3.2 Ideal transformer – Phasor diagram 3.3 Phasor diagram of ideal transformer – 3.3.1 No load condition 3.3.2 On load condition 3.4 Phasor diagram of Practical transformer- 3.4.1 Phasor diagram on No load 3.4.2 Phasor diagram on load (resistive, capacitive and inductive load) 3.4.3 Phasor diagram of transformer on load with resistance and leakage reactance.	7	8
Total		22	34

Section –II

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH305-4: Determine the performance parameters of single phase transformers			
4	Performance & Operation of Transformer. 4.1 Equivalent circuit- referred to primary and referred to secondary. 4.2 Transformer Tests 4.2.1 Open – circuit or No load Test 4.2.2 Short – circuit or Impedance Test 4.2.3 Back-to-back test 4.2.4 Polarity test 4.3 Efficiency & Regulation of transformer 4.4 Condition for maximum efficiency 4.4 Determination of efficiency & regulation of transformer by direct loading method. 4.5 All-day-efficiency of a transformer (Numerical based on 4.2.1,4.2.2, 4.3 and 4.5)	7	12
CO: EEH305-5: Operate single phase transformers in parallel & carry out load sharing calculations			

5	Parallel operation of transformers 5.1 Need of parallel operation 5.2 Conditions to be satisfied for parallel operation. 5.3 Load-sharing calculations 5.4 Numerical on 5.3	5	8
CO: EEH305-6: Use three phase transformer and operate it in parallel.			
6	Three phase Transformers 6.1 Three phase transformer: Need 6.3 Power Transformer and Distribution transformer- types, applications, ratings etc. 6.2 Transformer Connections: star-star connection, delta-delta connection, star-delta connection, delta-star connection, Scott connection, Open-delta connection. 6.3 Basic of vector groups (identify vector group only) 6.4 Harmonics: Definition, third harmonic component concept and its effects in transformer connections. 6.5 K factor of transformer – Overheating due to non-linear load and harmonics 6.6 Conditions to be satisfied for parallel operation of 3- ϕ transformers. 6.7 Application of three phase transformers.	12	16
Total		23	36

** No questions will be asked on IKS learning subtopics in any question papers.

G : LIST OF ASSIGNMENTS UNDER SLA

Sr. No.	List of Assignment (under SLA)	Hrs Allotted
1	Survey of single phase transformer with its rating. Material, cost, types etc.	02
2	Problems on emf equation, transformation ratio of single phase transformer.	01
3	Problems on open-circuit test, short-circuit test, efficiency and regulation of transformer.	02
4	Collect photographs with details of various power/ distribution transformer and identify the parts (Specification, application, cost, features, manufacturers)	02
5	Collect detailed information of Special Purpose transformer (Specification, application, cost, features, manufacturers)	02
6	Visit to nearby substations to observe the power and distribution transformer and collect minimum 4 transformer information- specification, connection diagram, manufacturer, cost etc.	02
7	Load sharing calculation of transformer.	02
8	Industrial Visits to transformer repair workshop or manufacturing plant.	02
Total Hours		15

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Single phase transformer	4	8	2	14	EEH305-1
I / 2	Special Purpose transformer	2	8	2	12	EEH305-2

I / 3	Performance of ideal and practical transformer	2	4	2	08	EEH305-3
II / 4	Performance & Operation of Transformer	4	4	4	12	EEH305-4
II / 5	Parallel operation of transformers	-	4	4	08	EEH305-5
II / 6	Three phase Transformer	4	8	4	16	EEH305-6
Total Marks					70	

I:ASSESSMENT CRITERIA

i) Formative Assessment of Practical:

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

- a. Lectures cum Demonstrations,
- b. Class room practices.
- c. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Electrical Technology Vol-II	Theraja B. L.	S. Chand, New Delhi, 2012 or latest
2	Electrical Machines	Deshpande M. V.	PHI Learning,, New Delhi, 2012 or latest
3	Electrical Technology	Uppal, S. L.	Khanna Publication, New Delhi, 2012 or latest
4	Electrical Machine	Nagrath I. J. Kothari, D. P.	Tata McGraw Hill, New Delhi, 2012 or latest

5	Electrical Machine-I	Gupta, J. B.	S. K. Kataria & Sons, New Delhi, 2012 or latest
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M. LEARNING WEBSITE & SOFTWARE

- i) www.nptel.com/iitm/
- ii) www.howstuffworks.com/
- iii) www.virtual lab.com
- iv) www.sskphdmm.com
- v) <http://www.youtube.com/watch?v=RAc1RYilug>

COURSE NAME : TRANSMISSION & DISTRIBUTION OF ELECTRIC POWER.
COURSE CODE : EEH306
COURSE ABBREVIATION : HTDP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	--	
	Laboratory Learning	02	
SLH-Self Learning	02		
NLH-Notional Learning	08		

B. ASSESSMENT SCHEME :

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	125
	30	70	100	40	-	-	-	-	25	10	

(Total IKS Hrs for Sem. : 02 Hrs)

C. ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination
 Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

*

D. i) RATIONALE:

Transmission and distribution of power is a dynamically changing field of electrical engineering which deals with efficiently, economically and environment friendly transmission and distribution of electrical power from source to utility. This course will enable students to develop knowledge and skill-sets to identify and operate components in transmission and distribution system.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Apply the knowledge of electrical engineering to identify and operate components in transmission and distribution system.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH306-1 Identify the components in transmission and distribution system

EEH306-2 Calculate the constants of transmission line

EEH306-3 Calculate the performance of transmission lines.

EEH306-4 Select a suitable type of distribution system for a given application.

EEH306-5 Identify the major components in substation.

EEH306-6 Calculate the electricity bill for a given tariff & consumption.

COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[**Note : Correlation levels :** 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-” : no correlation]

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2
CO	Basic and Discipline specific knowledge	Problem Analysis	Design / Development of solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for society, sustainability and Environment	Project Management	Life long Learning	Maintain various types of electrical equipments	Maintain various sections of electrical power systems
EEH306-1	2	1	1	-	1	-	1	1	2
EEH306-2	3	3	1	-	-	-	-	-	-
EEH306-3	2	2	2	-	2	-	1	-	2
EEH306-4	2	2	1	-	1	-	-	2	2
EEH306-5	1	-	-	3	3	2	2	2	3
EEH306-6	2	2	2	-	2	-	1	-	2

F. CONTENT:

I) Practical Exercises

The minimum 80 percent of following practical exercises shall be conducted in the laboratory by the Institute in sessions of batches of about 20- 22 students:

Sr. no	Practical Exercises	Course outcome
1	Study and Drawing of Various Types of Insulators Used in Electrical Systems.	EEH306-1
2	Study and Drawing of Single Line Diagram of Electric Power Supply System.	EEH306-1
3	Calculation of String Efficiency and Study of Methods to Improve String Efficiency in Suspension Insulators.	EEH306-1
4	Calculation of Sag in Overhead Transmission Lines Under Different Loading and Weather Conditions	EEH306-2
5	Calculation of Voltage Regulation and Transmission Efficiency of a Short Transmission Line.	EEH306-3
6	Derivation and Study of ABCD Parameters of a Transmission Line.	EEH306-3
7	Study and Drawing of Radial and Ring Main Distribution Systems.	EEH306-4
8	Calculation of Voltage Drop and Efficiency of an AC Distributor Supplying Power to Two Consumers.	EEH306-4
9	Visit to 11KV/400V distribution Substation and write a report.	EEH 306-5
10	Calculation of Energy Bill for a Given Consumer Based on Tariff Structure.	EEH 306-6
11	Solving Numerical Problems on Power Factor Improvement Using Capacitor Banks.	EEH 306-6

Note:- Practical's will be evaluated but marks of practical evaluation should not be considered for the formative assessment of the course. Only SLA marks are considered.

II) Theory:

Section-I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH306-1 Identify the components in transmission and distribution system</i>			

1	<p>MECHANICAL ASPECTS OF TRANSMISSION LINES</p> <p>1.1 Electric Supply system: 1.1.1 Typical A.C. power supply scheme 1.1.2 Advantages of High Voltage Transmission 1.1.2 Comparison of H.V.A.C. and H.V.D.C.</p> <p>1.2 Main components of transmission lines: i. Components of Transmission line(IKS) ii. Types of commonly used conductors: advantages & applications iii. Types of line supports: basic information iv. Insulators for overhead line: types of material, desirable properties & causes of insulation failure v. Types of insulator: a) pin type, b) suspension type, c) strain type,d) shackle type. (applications, advantages and comparison) vi. Deciding factors for size of conductor and capacity of insulator to be used: voltage level, voltage drop, thermal loading and short circuit capacity.</p> <p>1.3 String efficiency: derivation and numerical upto 3 insulator disks only. Methods of improving string efficiency (no numerical).</p> <p>1.4 Sag in overhead line: i. Calculation of sag when supports are at equal levels ii. Effect of wind on sag iii. Effect of sag on conductor and supporting</p> <p>1.5 Corona: (no numerical) i. Formation of corona and its definition ii. Factors affecting corona iii. Important terms (definition & formula): Critical disruptive voltage, visual critical voltage, power loss. iv. Advantages & disadvantages v. Methods of reducing corona effect</p>	12	14
EEH306-2 Calculate the constants of transmission line			
2	<p>ELECTRICAL ASPECTS OF OVERHEAD LINES</p> <p>2.1 Constants of transmission lines: (No derivation) (Simple numerical) 2.1.1 Calculation of R: 1phase 2 wire & 3 phase 3 wire system 2.1.2 Calculation of L: 1phase 2 wire & 3phase 3 wire symmetrical system, concept of internal flux linkages, external flux linkages, GMR & GMD. 2.1.3 Calculation of C: 1phase 2 wire & 3 phase 3 wire symmetrical system, Electric potential at a charged single conductor.</p> <p>2.2 Transposition of conductors and its necessity.</p> <p>2.3 Skin effect, Proximity effect, Ferranti effects in transmission systems: Concept and its effect.</p>	07	08
EEH306-3 Calculate the performance of transmission lines.			

3	PERFORMANCE OF TRANSMISSION LINES 3.1 Classification of overhead lines based on voltage and length. 3.2 Concept of voltage regulation and efficiency of transmission line. 3.3 Performance of short transmission line: 3.3.1 Modeling of short transmission line (concept, circuit diagram & phasor diagram) 3.3.2 Calculation of voltage regulation and transmission efficiency (Simple numerical) 3.3.3 Effect of load power factor on regulation & efficiency 3.4 Performance of medium transmission line: i) End condenser method (No numerical) 3.4.1 Modeling (concept, circuit diagram & phasor diagram) 3.4.2 Relation between (V_S, I_S) and (V_R, I_R) ii) Nominal T method (No numerical) 3.4.3 Modeling (concept, circuit diagram & phasor diagram) 3.4.4 Relation between (V_S, I_S) and (V_R, I_R) iii) Nominal π method (No numerical) 3.4.5 Modeling (concept, circuit diagram & phasor diagram) 3.4.6 Relation between (V_S, I_S) and (V_R, I_R) 3.5 Introduction to Long transmission lines. 3.6 ABCD parameters of transmission line (no numerical): i) Basic concept of ABCD ii) Derivation of ABCD for short line model and end condenser line model	11	12
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Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH306-4 Select a suitable type of distribution system for a given application</i>			
4	Distribution System & Underground Cables 4.1 Design considerations in distribution System: 4.1.1 Voltage drop, thermal loading and short circuit capacity. 4.1.2 Concept of feeder, distributors and service mains 4.2 Classification of distribution: Nature of current; Type of construction, scheme of connection 4.3 Types of distribution: 4.2.1 Primary type: block diagram, concept 4.2.2 Secondary type: block diagram, concept 4.2.1 Radial type: block diagram, concept 4.2.2 Ring main type: block diagram, concept 4.4 Comparison overhead and underground transmission line. 4.5 Simple numerical on calculation of voltage drop and efficiency of AC distributor feeding maximum two consumers. 4.6 Underground Cables: 4.6.1 Construction	1 1	14

	4.6.2 Properties of insulating materials 4.6.3 Types of insulating material (application, advantages): impregnated paper, PVC, XLPE 4.6.4 Types of cable according to number of cores used		
EEH306-5 Identify the major components in substation			
5	Substations & Neutral grounding 5.1 Selection of site for substation 5.2 Classification of substation according to service requirement: Transformer substation, switching substation, power factor correction substations, frequency changer substations, converting substations. 5.3 Classification of substitution according to constructional features: Indoor substitutions, outdoor substitutions, pole mounted substations. 5.4 Comparison between outdoor and indoor substations. 5.5 Single line diagram of 66/11kV and 11kV/400V substation. 5.6 Comparison between AIS and GIS. 5.7 Importance of grounding in power system: Importance of equipment grounding, importance of system grounding. 5.8 Advantages of neutral grounding.	11	12
EEH306-6 Calculate the electricity bill for a given tariff & consumption			
6	Tariff & Power factor improvement 6.1 Desirable characteristics of tariff & objectives of tariff 6.2 Types of tariffs (Simple numerical on energy billing) 6.3 Causes and drawbacks of low power factors. 6.4 Power factor improvement equipment: i) static capacitors ii) synchronous condenser 6.5 Calculations of Power Factor correction. (Numerical)	08	10

**** No questions will be asked on IKS learning subtopics in any question papers.**

G. LIST OF MICRO-PROJECTS UNDER SLA

The following suggested list given below for Micro project, concerned faculty can add similar micro projects. Only one micro project is planned to be undertaken by a student that will be assigned at the beginning of the semester.

Micro project:-

- Prepare a model Showing the layout and components of A special and distribution system
- Prepare a model showing the different types of poles and lattice type of towers.
- Prepare model showing the different components of 66kv/11kv or 33 kv/11kv.
- Prepare a model showing the different components of 11 kv/ 415v Pole mounted substation.
- Collect samples of different types of ACSR (having different trade names) conductors available in the market / local supplier/ mahavitaran.
- Collect sample pieces of newest polymer insulator available in the market and write a detailed comparative report considering their specifications with traditional porcelain insulator.
- Make a report on different types of tariff with local electric power supplier by collecting electric bills of different types of consumers.
- Search and make a report on detail specifications, cost, rating, etc and supplier information about synchronous condenser from internet.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks Cognitive base (level wise)			Total Marks	Course outcome
		Remember	Understand	Application		
I / 1	Mechanical aspects of transmission line	04	04	06	14	EEH306-1
I / 2	Electrical aspect Of Overhead Lines	00	04	04	8	EEH306-2
I / 3	Performance Of Transmission Lines	02	04	06	12	EEH306-3
I / 4	Distribution System & Underground Cables	04	06	04	14	EEH306-4
II / 5	Substations & Neutral grounding	04	04	04	12	EEH306-5
II / 6	Tariff & Power factor improvement	04	02	04	10	EEH306-6

I. Assessment Criteria

Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating / analytical Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

1. Lectures and discussions.
2. Laboratory experiences and laboratory interactive sessions.
3. Time bound assignments

K. TEACHING AND LEARNING RESOURCES:

1. Chalk board
2. LCD presentations.
3. Demonstrative charts.

L. REFERENCE MATERIAL:

Sr.No	Title Of Book	Author	Publication
01	Principles of power system	V.K.mehta	S Chand and Co.New Delhi,ISBN: 9788121924962
02	A course in Electrical power	Soni, Gupta Bhatnagar	Dhanpat Rai and sons New Delhi ISBN: 9488177000207
03	A Course In Electrical Power	Gupta J.B	S.K katria and New Delhi.SBIN:9788788458523
04	A Textbook of Electrical Technology Vol. III	Theraja B.L, Theraja A.K.	S Chand and Co.New Delhi,ISBN: 9788121924900
05	A Course in Electrical Power	Uppal S.L.	S.K. Khanna Publisher, New Delhi ISBN: 9788174092380
06	Electrical Power Transmission and Distribution	Sivanagaraju S, Satyanarayana S.	Pearson ISBN: 831707911988131707913
07	Electrical Power System : A First Course	Ned Mohan	Wiley India Pvt. Ltd. New Delhi,ISBN:9788126541959
08	Power System Analysis and Design	Gupta B.R.	S Chand and Co.New Delhi,ISBN: 9788121922388
10	Electrical Power Distribution System	Kamraju V	Tata Mc. Graw Hill, New Delhi,ISBN: 9780070151413

M . LEARNINGWEBSITES

- a. https://energy.gov/sites/prod/files/2013/07/f2/Transmission_Woodall_0.pdf
- b. https://en.wikipedia.org/wiki/Electric_Power_transmission
- c. <https://www.electrical4u.com/performance-of-transmission>
- d. <https://www.slideshare.net/sumitKumar58/ppt-of-ehv-ac-transmission>
- e. <https://www.sildeshare.net/sagnikroychowdhury/hvdcpresentation-13232932>
- f. <https://www.slideshare.net/sammergupta8/hvdc-vs-hvac>
- g. <https://www.nctech.edu.lk/Download/Technology%20Zone/Disrtibution%20System%20-%20General..pdf>
- h. <https://www.slideshare.net/surajprasad12/distribution-system-44252619>
- i. <https://www.slideshare.net/pbknprabhakaran/power-transmission-distribution>
- j. <https://www.slideshare.net/gsgindia/construction-ehv-transmission-line>
- k. www.nptelvideos.in/electricalpower

COURSE NAME : APPLIED ELECTRONICS
COURSE CODE : EEH307
COURSE ABBREVIATION : HAET

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	-	
	Laboratory Learning	02	
SLH-Self Learning	01		
NLH-Notional Learning	06		

B.ASSESSMENT SCHEME:-

PAPER DURATION IN HRS	THEORY			BASED ON LL&TL				BASED ON SLA		Total	
	FA-TH	SA-TH	TOTAL	FA -PR		SA-PR		MAX	MIN		
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
	30	70	100	40	25	10			25	10	

IKS Hours=01

C.ABREVIATION:-CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

Electronic circuits are most widely used in industries, power systems, communication systems etc. Discrete components are widely used in electronics systems which a diploma engineer may need to maintain. The skills of operating/working on various types of electronic circuits and their applications are needed for every electrical engineer. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems in electrical engineering field.

i) INDUSTRY / EMPLOYER EXPECTED OUTCOME:

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

E. COURSE LEVEL LEARNING OUTCOMES (COs)

EEH307-1: Examine and use various types of amplifiers.

EEH307-2: Use different sinusoidal oscillators and multi-vibrators in electronic circuits.

EEH307-3: Illustrate the use of different regulated power supplies.

EEH307-4: Use op-amp in linear electronic circuits.

EEH307-5: Examine and Use various configuration of op-amp for different industrial applications.

EEH307-6: Verify the truth table of digital logic gates.

Course outcomes and programme outcomes/ programme specific outcomes(CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-“: No correlation]

COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimenta tion and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Managem ent	PO 7 Life- long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
EEH307-1 Examine and use various types of amplifiers	2	-	-	2	2	2	2	2	2
EEH307-2 Use different sinusoidal oscillators and multi-vibrators in electronic circuits	3	2	-	1	1	1	3	1	1
EEH307-3 Illustrate the use of different regulated power supplies.	3	2	-	2	2	1	2	2	2
EEH307-4 Use op-amp in linear electronic circuits.	3	-	-	1	-	-	3	1	1
EEH307-5 Examine and Use various configuration of op-amp for different industrial applications.	3	2	-	2	2	-	2	2	1

Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimenta tion and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Managem ent	PO 7 Life- long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
EEH307-6 Verify the truth table of digital logic gates.	3	1	-	2	1	1	3	2	2

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Applied Electronics developed* by the Institute in practical sessions of batches of about 20- 22 students:

(Any 10)

Sr. No.	Laboratory experiences	CO
1.	Find the specification of given transistor using datasheet.	EEH307-1
2.	Test the working of the BJT as an amplifier in single stage CE mode	EEH307-1
3.	Build the RC phase shift oscillator using BJT and measure the frequency	EEH307-2
4.	Build the Hartley oscillator using BJT and measure the frequency	EEH307-2
5.	Test the performance of Astable multivibrator using IC555	EEH307-2
6.	Test the performance of Monostable multivibrator using IC555	EEH307-2
7.	Test the performance of Regulator IC's: IC's 78XX, 79XX.	EEH307-3
8.	Measure output voltage swing of Op-amp IC741	EEH307-4
9.	Measure Input offset voltage and output offset voltage of Op-amp IC741	EEH307-4
10.	Test the performance of Inverting Amplifier using op-amp IC741	EEH307-5
11.	Test the performance of Non Inv. Amplifier using op-amp IC741	EEH307-5
12.	Test the performance of Adder using op-amp IC741	EEH307-5
13.	Test the performance of Subtractor using op-amp IC741	EEH307-5
14.	Verify the truth table of Basic Logic Gates: NOT, OR, AND Gates	EEH307-6
15.	Verify the truth table of Universal Logic Gates: NOR, NAND Gates	EEH307-6
16.	Verify the truth table of Special Gates: X-OR, X-NOR Gates	EEH307-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	<i>EEH307-1. Examine and use various types of amplifiers</i>		
1	Amplifiers 1.1 Load line- DC Load Line	8	12

	1.2 Q Point 1.3 Transistor Biasing Methods-Listing only 1.4 Types of amplifiers: Single stage and multistage Amplifiers 1.5 Single stage CE amplifier. 1.5.1 Circuit Diagram 1.5.2 Working (Function of each component) 1.5.3 Input Output Waveform 1.5.4 Frequency response and bandwidth 1.5.5 Applications 1.6. Types of coupling in multistage amplifiers 1.7 Circuit diagram ,working and applications of Multistage RC Coupled CE amplifier and direct/ transformer coupled amplifier.		
<i>EEH 307-2. Use different sinusoidal oscillators and multivibrators in electronic circuits.</i>			
2	Oscillators and multivibrators Basic of Oscillator(IKS) 2.1 Need of oscillators 2.2 Barkhausen Criteria 2.3 Classification of oscillator 2.4 Transistor circuit ,working, frequency Formula of following oscillators:- 2.4.1 RC-phase shift oscillator 2.4.2 Colpitts oscillator 2.4.3 Hartley oscillator 2.4.4 Crystal Oscillator 2.5 IC 555 : Features, pin out, block diagram and specification. 2.6 IC 723 voltage regulator 2.7 Operations of following with circuit diagram and relevant formula, associated waveforms 2.7.1 555 as monostable multivibrator 2.7.2 555 as astable multivibrator	8	12
<i>EEH307-3 Illustrate the use of different regulated power supplies</i>			
3	Regulated Power Supply 3.1 Block diagram of Regulated powers supply. 3.2 Load and Line Regulation 3.3 Types of IC voltage regulator-Fixed and Variable voltage regulator 3.4 IC 78xx & IC 79xx series of voltage regulators 3.4.1 Features 3.4.2 Pin diagram 3.4.3 Practical example with IC such as 7805,7812	6	10
	Sub-total	22	34

Section –II

	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH307-4: Use op-amp in linear electronic circuits</i>			
4	<p>Basics Of Operational Amplifier Need of Operational amplifier(IKS) 4.1 Block diagram of OP-Amp: 4.1.1 Input Stage 4.1.2 Intermediate Stage 4.1.3 Level Shifting Stage 4.1.4 Output Stage 4.1 Op-Amp IC-741 pin diagram and function. 4.2 Equivalent Circuit, Circuit Symbols And Terminals 4.3 Ideal OP-AMP and transfer curve 4.4 Electrical parameters of 741: Input offset voltage, Input offset current, Input bias current, Input capacitance, Input voltage range, CMRR, Large signal voltage gain, Output voltage swing, Output resistance, Power consumption, Slew rate</p>	8	12
<i>EEH307-5: Examine and Use various configuration of op-amp for different industrial applications</i>			
5	<p>Op-Amp Configuration and Feedback Amplifiers 5.1 Open Loop and closed loop configuration of op-amp comparison Circuit Diagram, operation, Equations and derivation for output for following:- 5.2 Open loop configuration – Inverting ,Non-inverting 5.3 Close loop configuration – Inverting, non-inverting, 5.4 Voltage follower, Inverter (Sign changer) 5.5 Inverting and non-inverting configuration of Adders (summing amplifier, scaling Amplifier, averaging amplifier) 5.6 Subtractor 5.7 Basic Integrator 5.8 Basic Differentiator</p>	8	12
<i>EEH307-6:Use Boolean arithmetic, laws and data converters as per need of industrial application</i>			
6	<p>Binary arithmetic and digital logic gates: 6.1 Decimal, Binary, Hexadecimal number system 6.2 Conversion: Decimal to Binary, Binary to Decimal, Decimal to Hexadecimal, Hexadecimal to</p>	7	12

Decimal, Binary to Hexadecimal and Hexadecimal to Binary. 6.3 Boolean Laws and A/D converter. 6.4 Binary arithmetic: Binary addition and subtraction, with simple numerical 6.5 Subtraction using 1's compliment and 2's compliment method with simple numerical 6.6 Basic Logic Gates: NOT, OR, AND (symbol and truth table) 6.7 Universal Logic Gates: NOR, NAND (symbol and truth table) 6.8 Special Gates: X-OR, X-NOR Gates (symbol and truth table)		
	23	36

G.LIST OF MICRO-PROJECTS UNDER SLA

- a) Construct doorbell using transistor
- b) Using transistor construct clap switch
- c) Construct small signal amplifier using transistor.
- d) Water level indicator
- e) IC based Simple Regulated Variable Power Supply
- f) Flashing Lamps using 555 Timer
- g) Build sound sensor circuit IC 741 and microphone
- h) Build Clamp switch using IC741
- i) Build shadow sensor circuit using IC741
- j) Develop tone generator using IC555
- k) Develop PWM LED Dimmer/Brightness control using IC555
- l) Small Hobby project using Digital IC

G. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY ASSESSMENT

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Amplifiers	4	4	4	12	EEH307-1
I / 2	Oscillators and multi-vibrators	4	4	4	12	EEH307-2
I / 3	Regulated Power Supply	4	2	4	10	EEH307-3
II / 4	Basics Of Operational Amplifier	4	4	4	12	EEH307-4
II / 5	Op-Amp Configuration and Feedback Amplifiers	4	4	4	12	EEH307-5

II / 6	Binary arithmetic and Digital Logic Gates	4	4	4	12	EEH307-6
Total Marks		24	22	24	70	

H. ASSESSMENT CRITERIA

i) Formative Assessment of Practical:

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

I. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations
2. Class room practices
3. Use of projector and soft material for demonstration
4. Virtual Laboratory

J. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

K. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Principles of Electronics	V. K. Mehta	S.Chand

2.	Basic Electronics	B. L. Theraja	S.Chand
3.	A text book of Applied Electronics	R.S.Sedha	S.Chand
4.	Linear Integrated Circuits	Ramakant Gaikwad	Prentice Hall, 2000
5.	Digital Principles and Applications:	Malvino and Leach	McGraw Hill
6.	Applied Electronics	G. K. Mithal	Khanna Publication
7.	Electronics Devices & Circuits	A. Motershed	PHI Publication
8.	Electronics Principles	Malvino	McGraw Hill
9.	Modern Digital Circuits	R P Jain	McGraw Hill

L. TEXT BOOKS

Sr. No	Name of Book	Author	Publication
1	Principles of Electronics	V. K. Mehta	S.Chand
2	Basic Electronics	B. L. Theraja	S.Chand
3	A text book of Applied Electronics	R.S.Sedha	S.Chand
4	Linear Integrated Circuits	Ramakant Gaikwad	Prentice Hall, 2000
5	Digital Principles and Applications:	Malvino and Leach	McGraw Hill
6	Applied Electronics	G. K. Mithal	Khanna Publication
	Electronics Devices & Circuits	A. Motershed	PHI Publication

M. LEARNING WEBSITE & SOFTWARE

- i) www.nptel.iitm.ac.in
- ii) www.datasheetcafe.com
- iii) www.learningaboutelectronics.com
- iv) www.radio-electronics.com
- v) www.bis.org.in
- vi) www.electrical4u.com
- vii) www.cadsoft.io
- viii) www.electronics-tutorials.com

Government Polytechnic Kolhapur

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering	
Programme Code	: EE	With Effect From Academic Year : 2025-26
Duration Of Programme	: Semesterr	Duration : 15 WEEKS
Semester	: Forth	Scheme : MPECS 2023

Sr No	Course Title	Abbreviation	Course Type	Course Level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning(Activity/Assignment/Micro Project)	Notional Learning Hrs/Week			Theory				Based on LL&TL				Based on Self Learning		Total Marks		
							CL	TL	LL					FA-TH	SA-TH	Total		Practical		SLA						
																Ma	Mi	Ma	Min	Ma	Min	Max	Min			
1	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2			2	4	2	1.5	30*#	70*#	100	40							25	10	125
2	Electrical Estimation and Contracting	HEEC	DSC	3	EEH308	2	4		4		8	4	3	30	70	100	40	25	10							125
3	Power Electronics	HPET	SEC	3	EEH309	1	4		2		6	3	3	30	70	100	40	25	10	25#	10					150
4	Energy Conservation & Audit	HECA	DSC	3	EEH310	2	4		2		8	4	3	30	70	100	40	25	10	25#	10	25	10			175
5	Rotating Machine-1(DC & IM)	HRM-1	DSC	3	EEH311	2	4		4		8	4	3	30	70	100	40	25	10	25#	10					150
6	Utilization of Electrical Energy	HUEE	DSC	3	EEH312	2	4		2		6	3	3	30	70	100	40	25	10	25#	10					150
Total						11	22		14	4	40	20		180	420	600		125		100		50			875	

Abbreviations: CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, FA-Formative Assessment, SA-Summative Assessment, IKS-Indian Knowledge System, SLA-Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note :

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL) hrs. *15 Weeks
- 1 credit is equivalent to 30 Notional hrs.
- *Self learning hours shall not be reflected in the Time Table.
- *Self learning includes micro project / assignment / other activities.

Course Category: Discipline Specific Course Core(DSC): 3, Discipline Specific Elective (DSE): 0, Value Education Course(VEC): 1, Intern./Apprenti./Project./Community(INP): 0, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE TITLE : ENVIRONMENTAL EDUCATION AND SUSTAINABILITY
COURSE CODE :CCH206
COURSE ABBREVIATION :HEES

A.LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	02
	Tutorial Learning	-	
	Laboratory Learning	-	
	SLH-Self Learning	02	
	NLH-Notional Learning	04	

B.ASSESSMENT SCHEME:-

PAPER DURATION IN HRS	THEORY			BASED ON LL&TL				BASED ON SLA		Total	
	FA-TH	SA-TH	TOTAL	Practical				MA X	MIN		
MA X				MIN	MAX	MIN	MAX			MIN	
1.5	30*#	70*#	100	40	-	-	-	-	25	10	125

IKS Hours=02

C.ABBREVIATION:-

CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination.

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
 - If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
 - If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
 - Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
 - 1(one) credit is equivalent to 30 Notional hrs.
 - * Self learning hours shall not be reflected in the Time Table.
- * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D.i. RATIONALE

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary

approach to study the environmental systems and sustainability approach to the diploma engineers.

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

E.COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant Environmental issues in specified locality.
- CO2 - Provide the green solution to the relevant environmental problems.
- CO3 - Conduct SWOT analysis of biodiversity hotspot
- CO4 - Apply the relevant measures to mitigate the environmental pollution.
- CO5 - Implement the environmental policies under the relevant legal framework.

Course outcomes and programme outcomes/ programme specific outcomes(CO- PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-“: No correlation]

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

F.CONTENT

I. PRACTICAL EXCERSISES:-

.....Not Applicable.....

II. THEORY CONTENT:-

Sr.N	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>CCH206.1</p> <p>1.1 Explain the need of studying environment and its components.</p> <p>1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions</p> <p>1.3 Explain the Concept of 5 R w.r.t. the given situation</p> <p>1.4 elaborate the relevance of Sustainable Development Goals in managing the climate change</p> <p>1.5 Explain the concept of zero carbon-footprint with carbon credit</p>	<p>Unit - I Environment and climate change</p> <p>1.1 Environment and its components, Types of Environments, Need of environmental studies</p> <p>1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization</p> <p>1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste</p> <p>1.4 Impact of Climate change, Factor contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives</p> <p>1.5 Zero Carbon footprint for sustainable development, (IKS-Environment conservation in vedic and pre-vedic India)</p>	Lecture Using Chalk-Board Presentations
2	<p>CCH206.2</p> <p>2.1 Justify the importance of natural resources in sustainable development</p> <p>2.2 Explain the need of optimum use of natural resources to maintain the sustainability</p> <p>2.3 Differentiate between renewable and non-renewable sources of energy</p> <p>2.4 Suggest the relevant type of energy source as a green solution to environmental issues</p>	<p>Unit - II Sustainability and Renewable Resources</p> <p>2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS- Concepts of Panchmahabhuta)</p> <p>2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources</p> <p>2.3 Energy forms (Renewable and non-renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel</p> <p>2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy</p>	Lecture Using Chalk-Board Presentations
3	<p>CCH206.3</p> <p>3.1 Explain the characteristics and functions of ecosystem</p> <p>3.2 Relate the importance of biodiversity and its loss in the environmental sustainability</p> <p>3.3 Describe biodiversity assessment initiatives in India</p> <p>3.4 Conduct the SWOT analysis of the biodiversity hot spot in India</p> <p>3.5 Explain the need of conservation of biodiversity in the given situation</p>	<p>Unit - III Ecosystem and Biodiversity</p> <p>3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem</p> <p>3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity</p> <p>3.3 Biodiversity Assessment Initiatives in India</p> <p>3.4 SWOT analysis of biodiversity hot spot in India</p> <p>3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity</p>	Lecture Using Chalk-Board Presentations Video Demonstration

4	<p>CCH206.4</p> <p>4.1 Classify the pollution based on the given criteria</p> <p>4.2 Justify the need of preserving soil as a resource along with the preservation techniques</p> <p>4.3 Maintain the quality of water in the given location using relevant preventive measures</p> <p>4.4 State the significance of controlling the air pollution to maintain its ambient quality norms</p> <p>4.5 Compare the noise level from different zones of city with justification</p> <p>4.6 Describe the roles and responsibilities of central and state pollution control board</p>	<p>Unit - IV Environmental Pollution</p> <p>4.1 Definition of pollution, types- Natural & Artificial (Man- made)</p> <p>4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation</p> <p>4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation</p> <p>4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area</p> <p>4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city</p> <p>4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities</p>	Lecture Using Chalk-Board Presentations
5	<p>CCH206.5</p> <p>5.1 Explain Constitutional provisions related to environmental protection</p> <p>5.2 Explain importance of public participation (PPP) in enacting the relevant laws</p> <p>5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem</p> <p>5.4 Explain the role of information technology in environment protection</p>	<p>Unit – V- Environmental legislation and sustainable practices</p> <p>5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts</p> <p>5.2 Public awareness about environment. Need of public awareness and individuals’ participation. Role of NGOs</p> <p>5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging</p> <p>5.4 Role of information technology in environment protection and human health</p>	Lecture Using Chalk-Board Presentations Video Demonstrations

G.SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution

Draft an article on India's Strategies to progress across the Sustainable Development Goals

Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source

Conduct the SWOT analysis of biodiversity hotspot in India

Prepare a mind-mapping for the zero carbon footprint process of your field

Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below:

-

Unit 1: Living with climate change

Unit 2 : Water Management and Climate Action

Unit 3: Energy Management and Climate Action

Unit 4 : Waste Management and Climate Action

Unit 5 : Bio-cultural Diversity and Climate Action

If students complete all the five Units they are not required to undertake any other assignment /Micro project/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

Technical analysis of nearby commercial RO plant.

Comparative study of different filters used in Household water filtration unit

Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainability and cost-benefit

IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion.

Visit a local polluted water source and make a report mentioning causes of pollution Any other activity / relevant topic related to the course suggested by the facilitator

Activities

Prepare a report on the working and functions of the PUC Center machines and its relevance in pollution control. Prepare and analyse a case study on any polluted city of India

Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority

Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers

Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool

Watch a video related to air pollution in India and present the summary

Any other assignment on relevant topic related to the course suggested by the facilitator

Note :

Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
 The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
 If a microproject is assigned, it is expected to be completed as a group activity.
 SLA marks shall be awarded as per the continuous assessment record.
 If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

H.SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	6	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	08	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	6	4	4	4	12
4	IV	Environmental Pollution	CO4	10	4	8	6	20
5	V	Environmental legislation and sustainable practices	CO5	5	4	4	4	10
Grand Total				30	20	24	26	70

I.LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

J.ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject /assignment/activities. (60 % weightage to process and 40 % to product)

Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered.

Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Micro project/assignment/activities. (60 % weightage to process and 40 % to product)

Assessment of Self Learning :- Based on work done by students as a self learning Activities such as micro projects , assignments and similar activities using proforma 1 marks of SLA can be calculated.

K.SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi

3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Environmental science	APH Publishing New Delhi (ISBN 978-8176485906)

L.LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://sdgs.un.org/goals	United Nation's website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-for-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Initiative for youth leadership for climate action

6	https://eepmoefcc.nic.in/index1.aspx?lsid=297&lev=2&lid=1180&langid=1	GOI Website for public awareness on environmental issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Initiative for online study material on Environmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Initiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India's Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Environmental studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on environmental studies which encompasses SDGs, Pollution, Climate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analysis-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrit university publication on Vedic and pre vedic environmental conservation

Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

COURSE NAME : ELECTRICAL ESTIMATION & CONTRACTING.
COURSE CODE : EEH 308.
COURSE ABBREVIATION : HEEC.

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	--	
	Laboratory Learning	04	
	SLH-Self Learning	--	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR(Oral)		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	125
03	30	70	100	40	25	10			...	...

(Total IKS Hrs for Sem. : 2 Hrs)

C: ABBREVIATIONS: CL- Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH- Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends:@Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal On line Examination Note

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA- PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project/assignment/other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Diploma Electrical Engineers need to be well conversant in the field of maintaining Electrical supply systems in Domestic, Commercial & Industrial units. This field is an ever changing one with new advancements coming up. This course will enable them to carry out the different activities such as contracting, & executing the works needed for the same. This course will empower the students with the necessary principles of planning, Follow electrical by laws, supply system and method of installations.

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME:

The aim of this course is to help the student to attain the Following industry identified outcome through various learning experiences:

1. Able to do design, read & draw electrical layout, related calculations and selection of material used to execute aesthetical electrical installation work with the necessary principles of planning, electrical safety & important bylaws.

D.COURSE LEVEL LEARNING OUTCOMES (CO'S):

Course outcomes:

EEH 308 -1 Apply the rules of IE-1962 & NEC-2011 electrical safety.

EEH 308-2 Prepare electrical Installation schemes, design & Estimate for Residential Building.

EEH 308-3 Prepare electrical Installation scheme, design & Estimate for Commercial Building.

EEH 308-4 Prepare electrical Installation scheme, design & Estimate for small scale industry.

EEH 308-5 Carry out testing of electrical wiring Installation.

EEH 308-6 Prepare valid contract & tender documents for execution of electrical Installation works.

Competency, course outcomes and programme outcomes/programme specific outcomes

(cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Program outcomes Competency Course Outcomes	PO 1 Basic & Discipline knowledge	PO 2 Problem analysis	PO 3 Design development of solution	PO 4 Engineering Tools, Experimentation & testing	PO 5 The engineering practices for society, Sustainability & Environment	PO 6 Project management	PO 7 Life long learning	PSO1 Maintain various types of Electrical equipment	PSO2 Maintain various sections of Electrical power systems
Able to Design, Install & Maintain Electrification Systems used in Domestic, Commercial & Industrial units.	3	...	3	2	3	2	3	3	1
EEH 308 -1 Apply the rules of IE-1962 & NEC-2011 electrical safety.	3	...	...	...	3	1	3	2	1
EEH 308-2 Prepare electrical Installation schemes design, Estimate for Residential Building.	3	...	2	2	3	1	3	2	1

EEH308-3 Prepare electrical Installation system Estimate for Commercial Building.	3	...	...	1	3	...	1	2	1
EEH308-4 Prepare electrical Installation system Estimate for small scale industry.	3	...	2	2	3	1	3	2	1
EEH308-5 Carry out testing of electrical wiring Installation.	3	...	...	2	3	1	3	2	0
EEH 308-6 Prepare valid contract & tender documents for execution of Electrical Installation works.	3	...	...	1	3	...	1	2	1

E. CONTENT:-

I. Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Electrical estimation and costing developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
01	Study of Electrical symbols, Tools & accessories used in wiring,	1. To remember Electrical symbols, Tools & accessories used in wiring.	EEH 308-1
02	Study and follow of IE rules, NEC codes of practices in wiring installation.	1. To follow IE rule in wiring installation. 2. Applying Safety rule. 3. Clearances in installation. 4. Earthing necessity	
03	Basic wiring circuits single line diagram, wiring diagram in details.	1. Practice of preparing single line diagram, wiring diagram.	
04	a) Study & enlist Purpose & Essential elements of Estimation & Costing, b) Qualities of good Estimator.	1. Able to follow essential elements for 'Estimation & Costing'. 2. Able to achieve qualities for good Estimator.	
05	a) Selection of rating of fuse, DP main switch, MCB, ELCB, RCCB, Wiring of Meter board, distributions board. b) Selection of types wires, cables & accessories.	1. Able to decide rating of wire, Meter, MCB, ELCB, RCCB, 2. Able to select rating for Meter, cut out, MCB's in distributions board. 3. Able to select rating cables & accessories etc.	EEH 308-2
06	EXAMPLE: a) Design electrical wiring Installation scheme for a given constructional plan of 1BHK flat/	1. Practice of solving example independently by each student. 2. To read the constructional plan of a Flat/Bungalow/house.	

	<p>bungalow /House.</p> <p>b) Prepare estimation and costing report.</p> <p>c) Draw wiring diagram and single line diagram</p>	<p>3. Marking of positions of main boards and sub main boards and all points in layout.</p> <p>4. Practice to calculate the length of wire Casing capping & accessories with simple assumptions.</p> <p>5. Preparing material schedule & preparing of cost estimation & report.</p> <p>6. To draw the wiring & single line diagram using AUTOCAD</p>	
07	IE rules & guidelines for commercial wiring installation selection of rating of main switch, MCB, ELCB, RCCB, distributions board and type's wires, cables & accessories.	<p>1. To decide frating of wire, Meter, MCB, ELCB, RCCB,</p> <p>2. To select rating for Meter, cut out, MCB's in distributions board.</p> <p>3. To select rating cables & accessories etc.</p>	
08	Mounting and positioning of Main switchboards, distribution boards, main switches, bus bar chamber, Sub main distribution board.	<p>1. Able to decide mounting scheme.</p> <p>2. Able to fix mounting clearances.</p>	
09	<p>a) Design electrical Installation scheme for a school of 2 story, contains 20 class room, Principles room, Office, Store room, Guest room, Teachers room, Lady teachers room of size 20'*20' each one, Gents, Ladies Washroom of size 30'*20', with corridor & Veranda.</p> <p>b) Prepare estimation and costing report.</p> <p>c) Draw wiring diagram and single line diagram.</p>	<p>1. Practice of solving example independently by each student.</p> <p>2. Able to read the constructional plan of a Flat/Bungalow/house.</p> <p>3. Marking of positions of main boards and sub boards and all points in layout.</p> <p>4. Practice to calculate the length of wire Casing capping & accessories with simple assumptions.</p> <p>5. Preparing material schedule & preparing of cost estimation & report.</p> <p>6. To draw the wiring & single line diagram using AUTOCAD</p>	EEH 308-3
10	To study types of motor & load current calculations. as per type of SSI unit [1 phase & 3 phase]. Their accessory and its ratings.	<p>1. Knowing various types of electric motor, their accessory used in industry.</p> <p>2. Load current calculations practice.</p> <p>3. Fixing the rating of relay & their relay's trip current setting.</p>	
11	Design and selection of rating switchboards, distribution boards, main switches, bus bar chambers, cables, Earthing systems and plate/pipe, wire.	<p>1. Students are able to decide scheme of installation.</p> <p>2. Able to select accessory, material and decide required specification.</p>	EEH 308-4
12	Mounting and positioning of accessory, Laying of cables in cable trench, Cable clamping on wall cable tray.	<p>2. Students are able to decide mounting scheme.</p> <p>2. Knowing mounting clearances.</p> <p>3. various procedures of cable laying, & on wall fitting, Student will be knowing Trenches, cable trays & their sizes,</p>	

13	<p>a) Design consideration of Electrical Installation in small scale Industry, Agriculture pump set, Saw mill, Flour mill, Machine workshop of Lathes & other machines.</p> <p>b) Prepare estimation and costing report.</p> <p>c) Draw wiring diagram and single line diagram</p>	<ol style="list-style-type: none"> 1. To decide & mark the positions of main switch boards and sub boards and all motors, operating control panels. 2. To fix the line of laying of cable. 3. Calculating the length of cable. 4. Costing of Earthing & measurement of earth wire. 5. To prepare schedule of material & cost estimation. 6. To Draw of single line diagram using AUTOCAD 	
14	Consideration of various types Protections systems, Earthing system for commercial & small scale industry.	<ol style="list-style-type: none"> 1. To select protection schemes using MCB, ELCB, RCCB, Overload relay protection, Earth fault protection, Fire alarm system 2. Types of Earthing and their material. 3. Earthing practices in substations. 	
15	To study testing procedures, handling testing equipments, and preparation of reports for wiring installation work.	<ol style="list-style-type: none"> 1. To follow testing procedures. 2. Able to select apparatus of testing of wiring. 3. Practice of test report writing. 	EEH 308-5
16	Prepare a test report after testing an electrical installation system.	Testing procedures for installation as per IS	
17	Prepare a tender notice& sample bill for electrical works.	<ol style="list-style-type: none"> 1. Prepare work specifications, 2. Completion reports. 3. Relevant documents for type of billing. 	EEH 308-06

II] Theory:

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
EEH308-1 Apply the rules of Electrical estimation.			
1	Elements Of Estimating General rules(IKS) 1.1 IE Rules: IE rules related to electrical wiring installation 1.2 Essential Elements & Purpose of Estimation & Costing. 1.3 Qualities of good Estimation.	08	08
EEH308-2 Prepare Electrical Installation system Estimate for Residential Building			
2	Residential Building Electrification 3.1 Old building Electrification (IKS) 3.2 Rating, Clearances, Quality of material & Safety practices. 3.3 Electrical load & load current calculations. 3.4 Principles of circuit design in lighting and power circuits. 3.5 Electrical rating selection: Cutout, Energy meter, Main switches, Wires & Accessories, Earthing provisions. 3.6 Preparing wiring & single line diagram. 3.7 Sequence of procedure for material schedule & cost estimate. 3.8 Examples on wiring & cost estimation for 1RK & 1BHK flat.	12	12
EEH308-3 Prepare Electrical Installation system Estimate for Commercial Building			
3	Electrification of commercial Installation 3.1 General idea of layout of commercial building e.g. School, Library hall, Bank, Office, Auditorium, Shopping mall, Cinema theatre. 3.2 Design considerations & guidelines for electrical Installation system in commercial building. 3.2.1 Nature of supply, Electrical load & load current calculations, 3.2.2 Mounting and positioning of Mains switch board – Cut out, Energy meter, Main & Sub-main, MCB Distribution board, ELCB/RCCB Protections, Earthing provision. 3.2.3 Cable laying, Lighting & Power circuits, Sample wiring their single line diagram 3.3 Sequence of procedure for material schedule & cost estimate. 3.4 Examples on wiring & cost estimation for any two types of commercial building [Refer above list].	10	14
		30	34

Section II

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
EEH308-4 Prepare Electrical Installation system Estimate for small scale industry			
4	<p>Electrification of small scale industry unit [Max Load 50kw]</p> <p>4.1 Types of motors for industry, Motor load current calculations. [1 phase & 3 phase]</p> <p>4.2 Design consideration guidelines of Electrical Installation in small Industry e.g. Agriculture pump set, Saw mill, flour mill, Machine workshop of Lathes & other machines.</p> <p>4.2.1 Calculation & selection of rating of service main, Wire/Cable sizes, Bus bar chamber, TPN-MCCB, ELCB. Fuse, Starter, Relay ratings & protection setting,</p> <p>4.2.2 Mounting and positioning of switchboards, distribution boards, main switches, bus bar chambers, Control panel, Cable trench, Clamping, Cable tray. Protections, Earthing,</p> <p>4.2.3 Deciding the cable route, length of wire / cable, conduit, Earthing provision, Connection of earth wire to machines.</p> <p>4.6 Motor wiring/cable layout diagram. Single line diagram.</p> <p>4.7 Sequence of procedure for material schedule & costing.</p> <p>4.8 Examples on electrification & cost estimation for any two types of industry units. [Refer above list].</p>	15	18
EEH308-5 Carry out testing of Electrical wiring Installation			
5	<p>Testing of Electrical installation.</p> <p>5.1 General practice of testing (IKS)</p> <p>5.2 Testing necessity and basic procedure.</p> <p>5.3 Testing equipment's for electrical installation.</p> <p>5.4 Testing of wiring Installation for verification of Earthing, insulation resistance and continuity as per IS & NEC.</p>	06	08
EEH308-6 Prepare valid contract & tender documents for execution of electrical installation works.			
6	<p>Contracting, Tendering</p> <p>6.1. Types of contracts, contractors.</p> <p>6.2 Valid Contracts, Contract documents.</p> <p>6.3 Tender and tender notices.</p> <p>6.4 Procedure for submission and opening tenders.</p> <p>6.5 Comparative statements, criteria for selecting contractors, General conditions in order form.</p> <p>6.6 Principles of Execution of works</p> <p>6.7 Administrative approval, Technical sanctions.</p> <p>6.8 Billing of executed work.</p> <p>6.9 Tendering process (IKS)</p> <p>6.10 E-tendering: Need, Procedure, Advantage & Disadvantage.</p>	09	10
Total		30	36

**** No questions will be asked on IKS learning subtopics in any question papers.**

F.LIST OF ASSIGNMENTS UNDER SLA

.....Not Applicable.....

G.SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION :

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Elements Of Estimating	04	04	....	EEH308-1	08
2	Residential Building Electrification	04	04	04	EEH308-2	12
3	Electrification of commercial Installation	04	04	06	EEH308-3	14
4	Electrification of small scale industry unit	04	06	08	EEH308-4	18
5	Testing of Installation	02	02	04	EEH308-5	08
6	Contracting, Tendering	06	04	....	EEH308-6	10

H.ASSESSMENT CRITERIA:

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical/Oral :

At the time of Practical Examination/oral assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course practical	05
2	Punctuality for practical /Oral	05
3	Neat& complete Diagram/Write up-Hand writing	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

I. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration
- 4.

J. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

K. REFERENCE BOOK

Sr. No.	Author	Title	Publisher
1.	K.B. Raina S.K. Bhattacharya	Electrical Design; Estimating and costing	New Age International (p) Limited, New Delhi
2.	Surjit Singh	Electrical Estimating and costing	Dhanpat Rai and company, New Delhi
3	B.D.Arora	Electrical wiring, Estimating and costing	R.B. Publication, New Delhi
3.	N. Alagappan S. Ekambaram	Electrical Estimating and costing	Tata McGraw Hill Publication, New Delhi
4.	S.L. Uappal	Electrical wiring Estimating and costing	Khanna Publication

M. LEARNING WEBSITE & SOFTWARE

1. IE Rules, NEC2011 eBook, PPT, pdf's, Handbook.
2. Websites:
 - i. <http://www.bestestimatepro.com/>
 - ii. bieap.gov.in/estimatingandcosting.pdf
 - iii. http://indiacatalog.com/web_directory/electrical/electrical.html
 - iv. <http://www.nptel.ac.in>
 - v. <http://www.howstuffworks.com>
 - vi. <http://www.electricaltechnology.org>

Course Name : Power Electronics
Course Code : EEH309
Course Abbreviation : HPET

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning		
	Laboratory Learning	02	
	SLH-Self Learning	-	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	-	-	150

(Total IKS Hrs for Sem. : 01 Hrs)

C. ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

D. i) RATIONALE:

Power electronics finds extensive applications in domestic, commercial, industrial front and electric utilities particularly in terms of efficient conversion, control and conditioning of electric power from its available input into the desired electrical output form. This course will enable the

diploma students to develop the knowledge and skill sets of operating and testing different power electronic devices and their applications

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Test the performance of power electronic devices and circuits.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

COURSE OUTCOMES:

EEH309-1 Test the functionality of a given power electronic device.

EEH309-2 Test the switching performance of a thyristor.

EEH309-3 Test the performance of given inverter.

EEH309-4 Test the performance of given controlled rectifier.

EEH309-5 Test the performance of given chopper.

EEH309-6 Use suitable power electronic circuit for given application.

COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-” : nocorrelation]

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO	Basic and Discipline specific knowledge	Problem Analysis	Design/ Development of solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for society, sustainability and Environment	Project Management	Life long Learning	Maintain various types of electrical equipments	Maintain various sections of electrical power systems
EEH309-1	2	1	-	1	-	-	2	1	2
EEH309-2	2	1	-	1	-	-	1	1	2
EEH309-3	2	2	1	2	-	-	1	1	3
EEH309-4	2	2	1	2	-	-	1	1	3
EEH309-5	2	2	1	2	-	-	1	1	3
EEH309-6	1	2	-	-	1	1	1	1	1

F. CONTENT:

I) Practical Exercises

The minimum 80 percent of following practical exercises shall be conducted in the *laboratory for Power Electronics developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Practical exercises	Course outcome
1	Identify given power electronic device	EEH309-1
2	Test the performance of SCR.	EEH309-1
3	Test the proper functioning of the IGBT.	EEH309-1
4	Test the effect of variation of resistance in R triggering circuit on the firing angle of SCR.	EEH309-2
5	Test the effect of variation of resistance and capacitance in RC triggering circuit on the firing angle of SCR.	EEH309-2
6	Perform the operation of Class F commutation circuit.	EEH309-2
7	Measure output voltage of single phase half wave controlled rectifier by using CRO/DSO.	EEH309-4
8	Measure output voltage of single phase full wave controlled rectifier by using CRO/DSO.	EEH309-4
9	Measure output voltage of single phase full wave bridge inverter by using CRO/DSO.	EEH309-3
10	Measure the output voltage of step up chopper by varying duty cycle.	EEH309-5
11	Measure the output voltage of step down chopper by varying duty cycle.	EEH309-5
12	Perform speed control of fan using TRIAC.	EEH309-6

II) Theory:

Section-I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH309-1 Test the functionality of a given power electronic device.</i>			
1	Power Electronic Devices 1.1 Power electronic system: general block diagram, need, advantages and disadvantages. 1.2 Switching in power electronic circuit: Need and its importance; Ideal switch and practical switch: concept, general characteristics, conduction losses, switching losses. 1.3 SCR: Construction, working principle, Static V-I characteristics, switching characteristics, and applications. 1.4 IGBT: Construction, working principle, Static V-I characteristics, switching characteristics, and applications. 1.5 Power MOSFET: Construction, working principle, Static V-I characteristics, and applications. 1.6 TRIAC: Construction, working principle, Static V-I Characteristics, and applications. Ancient terminology in power electronics (IKS)	10	12
<i>EEH309-2 Test the switching performance of a thyristor.</i>			
2	Protection and Firing Circuit of Thyristor 2.1 di/dt protection: need, snubber circuit 2.2 dv/dt protection: need, snubber circuit 2.3 Overvoltage protection: need, internal & external overvoltage, voltage clamping device 2.4 Overcurrent protection: need, electronic crowbar circuit 2.5 Thermal Protection of SCR: Need, thermal resistance, and heat sink specification 2.6 Firing circuit: Features and general layout of firing scheme 2.7 SCR turn-on methods: forward voltage triggering, gate triggering, dv/dt triggering, temperature triggering, and light triggering 2.8 SCR Firing circuit: resistance firing circuit (no derivation), RC firing circuit (no derivation), pulse transformer based triggering 2.9 SCR commutation techniques: load commutation (Class A), line commutation (Class F)	14	16
<i>EEH309-3 Test the performance of given inverter.</i>			
3	Inverter 3.1 Inverters: concept of voltage source inverter and current source inverter. 3.2 Single phase half bridge inverter with R, RL load: Circuit diagram, working, input-output waveforms. 3.3 Single phase full bridge inverter with R, RL load: Circuit diagram, working, input-output waveforms. 3.4 Pulse width modulation: importance/need, types; Sinusoidal pulse width modulation: concept, working principle and waveforms.	06	06

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH309-4 Test the performance of given controlled rectifier.</i>			
4	<p>Controlled Rectifier</p> <p>4.1 Basic terminologies: conduction angle, firing angle, output voltage, output current, voltage across switch, source current, source voltage</p> <p>4.2 Single phase half controlled rectifier with R, RL load: Circuit diagram, working, input-output waveforms, derivation for average output voltage, equations for output currents, voltages & power, and effect of freewheeling diode, simple numerical for calculation of output power for constant current load.</p> <p>4.3 Single phase full controlled bridge rectifier with R, RL load: Circuit diagram, working, input-output waveforms, derivation for average output voltage, equations for output currents, voltages & power, simple numerical for calculation of output power for constant current load.</p> <p>4.4 Three phase full controlled bridge rectifier: working principle with R load, input-output waveforms, equations for average output voltage, output currents, voltages & power.</p>	15	18
<i>EEH309-5 Test the performance of given chopper.</i>			
5	<p>DC-DC Converters</p> <p>5.1 Basic terminologies: duty ratio, turn on period, turn off period, chopping period,</p> <p>5.2 Control strategies of chopper: Constant frequency system, variable frequency system.</p> <p>5.3 Step up chopper: circuit diagram, working, waveforms and output voltage equation – simple numerical for calculation of output voltage.</p> <p>5.4 Step down chopper: circuit diagram, working, waveforms and output voltage equation – simple numerical for calculation of output voltage.</p> <p>5.5 Buck-Boost chopper: circuit diagram, working, waveforms and output voltage equation – simple numerical for calculation of output voltage.</p>	08	10
<i>EEH309-6 Use suitable power electronic circuit for given application.</i>			
6	<p>Applications of Power Electronics</p> <p>6.1 Charge Controller: Concept, types, applications in Photovoltaic (PV) system with block diagram.</p> <p>6.2 Speed control of ceiling fan using TRIAC: Working, Block Diagram, advantages.</p> <p>6.3 AC to AC converter using DC link: Concept, applications in Wind Power Generation. 6.4 HVDC converter station: Concept,</p>	07	08

Circuit Diagram		
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**** No questions will be asked on IKS learning subtopics in any question papers.**

D. LIST OF SELF LEARNING ACTIVITY:

.....**Not Applicable**.....

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks Cognitive base (level wise)			Total Marks	Course outcome
		Remember	Understand	Application		
I / 1	Power Electronic Devices	02	06	04	12	EEH309-1
I / 2	Protection and Firing Circuit of Thyristor	04	08	04	16	EEH309-2
I / 3	Inverters	02	04	00	06	EEH309-3
II / 4	Controlled Rectifiers	02	12	04	18	EEH309-4
II / 5	DC-DC Converters	02	04	04	10	EEH309-5
II / 6	Applications of Power Electronics	02	04	02	08	EEH309-6

a) ASSESSMENT CRITERIA

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating / analytical Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical/oral :

At the time of Practical/oral Examination assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05

5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

- a) Lectures and discussions.
- b) Laboratory experiences and laboratory interactive sessions.
- c) Time bound assignments

K. TEACHING AND LEARNING RESOURCES:

- a) Chalk board
- b) LCD presentations.
- c) Demonstrative charts.

L. REFERENCE MATERIAL:

Sr.No	Title Of Book	Author	Publication
01	Power Electronics Handbook	Muhammad H. Rashid	Butterworth-Heinemann Inc, ISBN:9780128114070
02	Power Electronics	P S. Bimbhra	KHANNA PUBLISHERS, ISBN: 978-8174092793
03	Power Electronics: Devices, Circuits, and Applications	Muhammad H. Rashid	Pearson Education, ISBN:978-8120345317
04	Power Electronics	M D Singh, K B Khanchnadani	Mc. Gram Hill, ISBN:9780070583894

M. LEARNING WEBSITES

- a. <https://nptel.ac.in/courses/108102145>
- b. <https://nptel.ac.in/courses/108105066>
- c. <https://nptel.ac.in/courses/108101038>
- d. <https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/>
- e. https://www.youtube.com/playlist?list=PLSnw1KE0TFkVu05Ws0Ax143gZYmxPMCoY&si=FWLw-jfnLxC_1-4j
- f. <https://www.youtube.com/playlist?list=PL4emuJKx0B8aREwkC5BE>
- g. <https://www.youtube.com/playlist?list=PL4emuJKx0B8aREwkC5BE>
- h. [Ow2OZ48puPyOG](https://www.youtube.com/playlist?list=PL4emuJKx0B8aREwkC5BE)
- i. <https://3dcircuits.engineering.dartmouth.edu/powani.html>

COURSE NAME : ENERGY CONSERVATION & AUDIT
COURSE CODE : EEH310
COURSE ABBREVIATION : HECA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	--	
	Laboratory Learning	02	
SLH-Self Learning	02		
NLH-Notional Learning	08		

B. ASSESSMENT SCHEME :

PAPER DURATION	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical/Oral						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR(Oral)		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	175
03	30	70	100	40	25	10	25#	10	25	10	

(Total IKS Hrs for Sem.: 02Hrs)

C. ABBREVIATIONS: CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @Internal Assessment, #External Assessment, *#Online Examination, @\$Internal Online Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marking FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are(CL+LL+TL+SL)hrs.*15Weeks
- 1(one) creditisequivalentto30Notionalhrs.
- *Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project/assignment/other activities.(Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE

The pressure on the natural resources of energy such as water, coal, gas, wood and other fuels has lead to the increasing costs of energy around the world. Efficient and judicious use of the available energy would lead to the easing of such pressures and drastic decrease in the operating costs of the organizations and industries. Thus it is necessary to save and conserve energy to the maximum possible extent. The process of energy audit will help to identify the various possible avenues in which savings of energy can be effectively affected. This course makes the diploma holder well conversant in the techniques of energy conservation in the fields of engineering. It also introduces him to the energy audit procedures

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Use environment friendly energy conservation techniques and assist in energy audits.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Course Outcomes:

- EEH310.1 Identify and specify the basics of energy conservation.
- EEH310.2 Implement energy conservation techniques in electrical machines devices /equipment.
- EEH310.3 Implement energy conservation techniques in electrical power distribution system.
- EEH310.4 Implement energy conservation techniques in electrical lighting systems.
- EEH310.5 Use and Energy conservation through Cogeneration and Tariff.
- EEH310.6 Carry out simple energy audits.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
Competency: Use environment friendly energy conservation techniques and assist in energy audits.	1	-	3	1	1	2	1			
EEH310 -1 Identify and specify the basics of energy conservation	2	1	2	2	1	1	2	1	1	
EEH310-2 Implement energy conservation techniques in electrical machines devices /equipment	1	3	2	2	3	1	1	1	2	

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
EEH310-3:..Implement energy conservation techniques in electrical power distribution system	-	3	2	2	1	-	1	3	1	
EEH310-4Implement energy conservation techniques in electrical lighting systems	-	2	3	1	1	-	1	3	2	
EEH310-5 Use and Energy conservation through Cogeneration and Tariff	1	2	2	1	2	-	1	2	2	
EEH310 -6: Carry out simple energy audits	1	3	2	-	2	2	2	2	2	

F. CONTENT:-

D)Practical exercises

The following practical exercises shall be conducted in the Energy conservation & Audit by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	To analyses Energy conservation building code 2007	EEH310-1
2	Identify star labelled electrical apparatus and compare the data for various star ratings	EEH310-1
3	Collect the information of various energy conservation equipment.(soft starter, Automatic star delta convertor, Variable Frequency Drives(VFD) Automatic power factor controller (APFC),Intelligent power factor controller (IPFC) ,Active harmonic filter(AHF)	EEH310-2
4	Collect the information of various energy conservation equipment (Maximum Demand Controller, kVAR Controller, Automatic Power factor Controller)	EEH310-3
5	Determine the reduction in power consumption by replacement of lamp in a classroom/ laboratory	EEH310-4
6	Determine the reduction in power consumption by replacement of Fans and regulators in a classroom/ laboratory	EEH310-4
7	Compare power consumption of tube light with electric choke, electronic ballast and also with LED lamps by direct measurements	EEH310-4
8	i) Visit a plant of cogeneration e.g. sugar industries , spinning mills , Heat processing unit ii) Prepare report on the cogeneration containing energy flow diagrams , economics and tariffs structure	EEH310-5

Sr. no	Laboratory experiences	CO
9	Collect electricity bill of an industrial consumer and suggest suitable tariff for energy conservation and its impact on energy bill.	EEH310-5
10	Collect electricity bill of a commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill.	EEH310-5
11	Collect electricity bill of a residential consumer and suggest suitable means for conservation and reduction of the energy bill.	EEH310-5
12	Prepare a sample energy audit questionnaire for the given industrial facility	EEH310-6
13	Prepare an energy audit report for your classroom/office/seminar hall	EEH310-6
14	Find out energy conservation by applying different energy conservation techniques for existing distribution system in your campus	EEH310-6

II. Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
EEH310-1 Identify and specify the basics of energy conservation			
1	Energy conservation basics: 1.1 Classification of Energy: Primary and secondary energy, Commercial and non-commercial energy, Renewable and Non-renewable energy 1.2 Energy demand and supply, National scenario 1.3 Energy conservation and Energy audit; concepts and difference 1.4 Indian Electricity Act 2001; relevant clauses of energy conservation 1.5 Salient features of Electricity Act 2003 1.6 BEE and its Roles, 1.7 MEDA and its Roles 1.8 Star Labeling: Need and its benefits. 1.9 Review of various energy sources (IKS learning)	06	06
EEH310-2 Implement energy conservation techniques in electrical machines and devices/ equipment's			
2	Energy Conservation in Electrical Machines 2.1 Need for energy conservation in induction motor and transformer. 2.2 Energy conservation techniques in induction motor by i) Improving Power quality, ii) Motor survey, iii) Matching motor with loading, iv) Minimizing the idle and redundant running of motor, v) Operating in star mode. vi) Rewinding of motor, vii) Replacement by energy efficient motor,	14	16

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	viii) Periodic maintenance 2.3 Energy conservation techniques in Transformer. i) Loading sharing, ii) Parallel operation, iii) Isolating techniques, iv) Replacement by energy efficient transformers. v) Periodic maintenance 2.4 Energy Conservation Equipment: i) Soft starters, ii) Automatic star delta convertor, iii) Variable Frequency Drives(VFD) iv) Automatic power factor controller (APFC), v) Intelligent power factor controller (IPFC) vi) Active harmonic filter(AHF) 2.5 Energy efficient motor: significant features, advantages, applications and limitations 2.6 Energy Efficient Transformer: a) Amorphous core transformers, b) Epoxy resin cast transformers/ Dry type of transformer c) Specialty of cores and windings of such transformers. 2.7 Improving mechanical power transmission efficiency by VFD(IKS Learning) 2.8 specialty of cores and windings of such transformers (IKS Learning).		
EEH310-3: Implement energy conservation techniques in electrical power distribution system			
3	Energy conservation in electrical distribution system 3.1 Aggregated Technical and commercial given losses (ATC) in power system, Distribution losses at global, national and state level, 3.2 Commercial and technical losses, causes, remedies and measures to minimize. 3.3 Energy conservation techniques a. Controlling I^2R line losses. b. Optimizing distribution voltage. c. Balancing phase currents. d. Compensating reactive power flow. e. Using energy efficient transformers. 3.4 Energy conservation equipment: a) Maximum Demand Controller, b) kVAR Controller, Old method of energy conservation(IKS Learning)	10	12
		Total	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
EEH310-4 Implement energy conservation techniques in electrical lighting systems			
4	Energy conservation in lighting system: 4.1 Assessing existing lighting systems, adopts and replace with efficient light sources, light control gears, Motion detectors, etc. 4.2 Installation of separate transformer/ servo stabilizer for lighting, 4.3 Regular survey and adequate maintenance programs, 4.4 Energy Conservation techniques in fans , Electric regulator Electronic regulators etc	08	12
EEH310-5 Use and Energy conservation through Cogeneration and Tariff			
5	Energy conservation through Co-generation and Tariff, 5.1 concept of cogeneration and Tariff, significance for energy conservation , Co-generation 5.2 Types of cogeneration on basis of sequence of energy use (Topping cycle, Bottoming cycle) 5.3 Types of cogeneration basis of technology (Steam turbine cogeneration, Gas turbine cogeneration, Reciprocating engine cogeneration). 5.4 Factors governing the selection of cogeneration system. 5.5 Advantages of cogeneration 5.6 Tariff: Types of tariff structure: Special tariffs; Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff.(No numerical) 5.7 Application of tariff system to reduce energy bill	12	16
EEH310-6: Carry out simple energy audits			
6	Energy audit : 6.1 Energy audit (definition as per Energy Conservation act), Specific energy consumption. 6.2 Energy audit instruments and their use. 6.3 Questionnaire for energy audit projects, ABC analysis. 6.4 Energy flow diagram (Sankey diagram) 6.5 Simple payback period (Numericals) Energy Audit procedure (walk through audit and detailed audit). 6.6 Energy Audit report format.	10	08

	6.7 Advantages of energy audit		
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**** No questions will be asked on IKS learning subtopics in any question paper.**

G: LIST OF ASSIGNMENTS UNDER SLA

Sr.No	List of micro projects/Assignments (under SLA)	Hrs Allotted
1	Energy efficient lamps: Prepare comparative charts with ratings, cost and manufacturer details	02
2	Energy conservation campaign: Prepare charts/slogans to create energy conservation awareness while using fans and tube lights in polytechnic.	02
3	Market survey of available IOT devices and technology.	02
4	Energy conservation policies: Prepare report on energy conservation policies of Govt. Maharashtra 2017.	02
5	Energy Manager and Energy Auditor: Identify from available resources their roles and responsibilities.	02
6	Collect and record electrical audit reports from nearby industries and commercial units/offices	02
7	Visit the nearby installation to collect information, rating, cost, supplier and maintenance of Automatic Power Factor controller (APFC).	02

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Energy conservation basics	02	04	-	06	EEH310-1
I / 2	Energy Conservation in Electrical Machines	04	08	04	16	EEH310-2
I / 3	Energy conservation in electrical installation system	04	04	04	12	EEH310-3
II / 4	Energy conservation in lighting system	04	04	04	12	EEH310-4
II / 5	Energy conservation in distribution systems	02	08	04	16	EEH310-5
II / 6	Energy audit	02	04	04	08	EEH310-6
					70	

I:-ASSESSMENT CRITERIA

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical/oral :

At the time of Practical/oral Examination assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat& complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

- a. Lectures cum Demonstrations,
- b. Classroom practices.
- c. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
1	Energy management	Murphy W.R.	Butterworth-Heinemann Publications
2	Art of Reading Electricity bill	Talware Yogendra	DnyatavyaPrakashan
3	Energy Management	Singh, Sanjeev, Rathire, Unmesh	S.K. Kataria and sons , New Delhi ISBN-13: 9789350141014
4	Efficient Use and Management of electricity in industry	Desai, B.G ,Rana, J.S, S.A. Dinesh V Paraman,R	Devki Energy Consultancy Pvt.Ltd.
5	Energy	Chakrabarti , Amlan	e-books Kindle Editions

	Engineering And Management		
6	Guide books no.1 to 4 for National certification Examination for Energy managers and Energy Auditors	Bureau of Energy Efficiency (BEE)	Bureau of Energy Efficiency (A Statuory body under Ministry of Power Government Of India) (Fourth Editions 2015)
7	Energy Management Handbook	Turner W.C.	Fairmount Press,2012 ISBN: 978- 019560659
8	Principle Of Power System	Mehta V.K	S. Chand & Co. New Delhi,2016 ISBN: 978812190594
9	Industrial Energy Conservation	D.A.Ray.	Pergaman Press

M. LEARNING WEBSITE & SOFTWARE

1. Website of bureau of energy and efficiency :www.bee.india.nic.in
2. Website of Akshay Urja News Bulletin: www,mnesnicin
3. Notes on energy management on: www.energy management training.com
4. www.greenbusinss.com
5. www.worldenergy.org
6. Maharashtra Energy Development Agency (MEDA):wwwmahaurja.com

Course Name : Rotating Machine-1 (DC& IM).
Course Code : EEH311
Course Abbreviation : HRM-1

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	4
	Tutorial Learning	-	
	Laboratory Learning	4	
	SLH-Self Learning	-	
	NLH-Notional Learning	8	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
03	30	70	100	40	25	10	25#	10	-	-	

(Total IKS Hrs for Sem. : 02 Hrs)

C. ABBREVIATIONS: CL- ClassRoom Learning , TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

The knowledge of DC and AC machines including their characteristics is necessary for students of Electrical Engineering. The subject deals with the concepts, characteristics & applications of DC and AC machine.

A diploma holder has to work in various fields such as manufacturing industries, State Electricity boards, Power Generation Stations, etc. His work involves operation control and maintenance of electrical machines. He should therefore know the working principle, constructional features, and performance of DC machines AC machine.

i) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Use DC and AC machines for given application

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH311-1 Identify the different parts along with materials in the d.c. machines

EEH311-2 Determine practically the performance characteristics of d.c. machines

EEH311-3 Select the relevant three phase induction motor.

EEH311-4 Determine the performance parameters using circle diagram

EEH311-5 Connect & use the proper device for starting & control of three phase induction motor.

EEH311-6 Interpret the single phase induction motor.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
EEH311-1	3	2	1	2	2	1	2	2	1	
EEH311-2	3	1	-	1	2	-	1	1	-	
EEH311-3	3	2	2	2	2	1	2	2	2	
EEH311-4	3	1	1	1	2	1	2	2	1	
EEH311-5	3	2	2	2	2	1	2	2	1	
EEH311-6	3	1	2	2	1	1	1	-	-	

F. CONTENT:-

I. Practical exercises

The following practical exercises shall be conducted in the *Laboratory Rotating Machine 1* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	Dissemble/Assemble DC machines identifying the parts.	EEH311-1
2	Connect and run DC motor by using Three-point Starters.	EEH311-1
3	Plot Speed-Torque characteristics of a DC shunt motor.	EEH311-2
4	Plot curve for Speed control of DC shunt motor using Flux Control method.	EEH311-2
5	Plot curve for Speed control of DC shunt motor using Armature Voltage Control method.	EEH311-2
6	Load characteristic of D.C. series motor.	EEH311-2
7	Identify the different parts of 3- ϕ induction motors- Squirrel cage and Slip ring Induction motor.	EEH311-3
8	Reverse the direction of rotation of 3- ϕ induction motor.	EEH311-3
9	Conduct No-load and Blocked-rotor test on given 3- ϕ squirrel cage induction motor and plot the Circle diagram.	EEH311-4
10	Connect and run the motor with DOL starter	EEH311-5
11	Perform Direct loading test on given three phase induction motor.	EEH311-5
12	Connect and run the motor with Star-delta starter.	EEH311-5
13	Control the speed of given three phase induction motor using Auto-Transformer.	EEH311-5
14	Control the speed of given three phase induction motor using rotor resistance Starter.	EEH311-5
15	Control the speed of given three phase induction motor using pole changing method.	EEH311-5
16	Connect and run given single phase induction motor	EEH311-6

Note:- All practical are compulsory.

II. Theory

Section I

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
CO: EEH311-1: Identify the different parts along with materials in the d.c. machines			
1	Ancient terms related to DC machine(IKS) D. C. Machines 1.1 Constructional Features of D C Generator		

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
	1.2 Principle of Operation of D C Generator. 1.3 Classification of D C Generator 1.4 EMF Equation of Generator 1.5 Numerical on 1.4 1.6 Load characteristic (Terminal voltage & load current) 1.7 Applications of D C Generator.	8	10
CO: EEH311-2: Determine practically the performance characteristics of d.c. machines			
2	D. C. Motor 2.1 Principles of Operation of D C Motor 2.2 Classification of D C Motor- DC Shunt motor, DC series motor, DC compound motor, Brushless DC motor, 2.4 Concept of Back e.m.f. Voltage equation 2.5 Torque equation of D C Motor 2.6 Load characteristics of D.C. Shunt and D.C. Series motors (Torque & speed, Torque & Current) 2.7 Speed control of D C Series motor and DC shunt Motor (by Flux and armature control method) 2.8 Need of starter for D.C. Motor 2.9 3-Point Starter 2.10 Applications of DC motors 2.11 Losses & Efficiency in D C machines Numerical based on 2.7& 2.11	10	12
EEH311-3: Select the relevant three phase induction motor.			
3	Performance of 3 phase induction motor Temple Engineering(IKS) 3.1 Types of induction motor – Single phase & Three Phase 3.2 Working principle of 3 phase induction motor 3.3 Construction of 3 phase induction motor (Stator & Rotor) Squirrel cage induction motor & Slip ring induction motor 3.4 Various parts of 3 phase induction motor 3.5 Production of rotating magnetic field by 3 phase Supply in 3 phase winding. 3.6 Concept of Synchronous speed, actual speed & slip. 3.7 Concept of rotor frequency, rotor induce emf & power factor at starting & running condition. 3.8 Concept of starting torque, full load torque and maximum torque and relation between them. 3.9 Ratio of full load torque to maximum torque, full load torque to starting torque and starting torque to maximum torque. 3.10 Condition for maximum torque under starting and running conditions.	12	12

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
	3.11 Characteristics of slip torque of 3 phase induction motor. 3.12 Power flow diagram of an induction motor (Simple numerical on ratio of various powers) 3.13 Equivalent circuit of an induction motor 3.14 Induction motor as a generalized transformer (phasor diagram) 3.15 Reversal of three phase induction motor.		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
EEH311-4: Determine the performance parameters using circle diagram.			
4	Circle Diagram 4.1 No load test & blocked rotor test 4.2 Concept of circle diagram- Series Rx and Parallel Rx branches 4.3 Construction of circle diagram 4.4 Numerical on circle diagram –To find current, power factor, rotor copper loss, rotor input, stator input, rotor efficiency , Motor efficiency at Full load condition. a) Maximum output condition b) Maximum torque condition. c) Rated Input condition.	12	14
EEH311-5: Connect & use the proper device for starting & control of three phase induction motor.			
5	Starting & Speed control of 3 phase induction motor Ancient Indian Knowledge System Equivalent to speed control of Induction motor.(IKS) 5.1 Necessity of starter 5.2 Types of starter a) D.O.L Starter b) Stator resistance Starter c) Auto transformer starter d) Star delta starter e) Rotor resistance Starter f) Soft starters. 5.3 Methods of speed control from a) Stator side – By changing supply voltage ,supply frequency & no. of poles. b) Rotor side – By changing rotor resistance, Effect of	14	16

	injection of emf in rotor circuit -cascade operation. 5.4 Applications of 3 phase induction motor a) Squirrel cage induction motor b) Slip ring induction motor		
EEH311-6: Interpret single phase induction motor			
6	Single Phase Induction Motor 6.1 Basic diagram and working of Single phase induction motor 6.2 Double field revolving theory. 6.3 Types of single phase Induction motor: Split phase, Capacitor Motor, Shaded Pole Motor.	04	06
Total		30	36

**** No questions will be asked on IKS learning subtopics in any question papers.**

G. LIST OF ASSIGNMENTS UNDER SLA

.....Not Applicable.....

H : SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	D. C. Machines	02	04	04	10	EEH311-1
I / 2	D. C. Motor	02	06	04	12	EEH311-2
I / 3	Performance of 3 phase induction motor	04	04	04	12	EEH311-3
II / 4	Circle Diagram	02	04	08	14	EEH311-4
II / 5	Starting & Speed control of 3 phase induction motor	04	08	04	16	EEH311-5
II / 6	Single Phase Induction Motor	2	4	-	06	EEH311-6
Total Marks					70	

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05

	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
10	Electrical Technology Vol-II	Theraja B.L.	S. Chand, New Delhi, 2012 or latest
11	Electrical Machines	Deshpande M.V.	PHI Learning,, New Delhi, 2012 or latest
12	Electrical Technology	Uppal, S.L.	Khanna Publication, New Delhi, 2012 or latest
13	Electrical Machine	Nagrath I.J. and Kothari, D.P.	Tata McGraw Hill, New Delhi, 2012 or latest
14	Electrical Machine-I	Gupta, J. B.	S. K. Kataria& Sons, New Delhi, 2012 or latest
15	Electrical Machines	Ashfaq Hussain	Dhanpat Rai and Company, New Delhi
16	Electrical Machinery	Bimbhra P. S.	Khanna Publishers, New Delhi, latest edition
17	Electrical Machines	Bhattacharya S.K.	Tata Mc graw-Hill
18	The performance & design of a.c.machines	Say M.G.	CBS Publication

M. LEARNING WEBSITE & SOFTWARE

- a. www.nptel.com/iitm/
- b. www.howstuffworks.com/
- c. www.virtual lab.com
- d. www.sskphdmm.com
- e. <http://www.youtube.com/watch?v=RAc1RYilugI>

COURSE NAME : UTILIZATION OF ELECTRICAL ENERGY.
COURSE CODE : EEH312.
COURSE ABBREVIATION : HUEE.

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	...	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR(Oral)		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
03	30	70	100	40	25	10	25#	10	...	...

(Total IKS Hrs for Sem. : 02 Hrs)

C: Abbreviations: CL- Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH- Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends:@Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal On line Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA- PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.*15Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- *Self learning hours shall not be reflected in the Time Table.

*Self learning includes micro project/assignment/other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

The Diploma electrical supervisor / technician is expected to maintain various heavy electric equipment in heating, welding, and drives systems. Their main job functions are to supervise the operation & control of various electrical drives, electrical furnaces, and electric utility equipments. In the present days of energy crisis, understanding this economics is important, not only for technician himself but also for social awareness. Hence he/ she should get acquainted with maintenance of such systems. This course deals with above job functions preparing the technicians to handle such heavy electrical energy equipment systems. Every diploma electrical engineer therefore should know to operate and maintain main electrical utilities for their efficient operations in domestic, commercial and industrial sector. The students will be able to make proper selection of equipment according to requirement to ensure economical and efficient use of electricity.

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the Following industry identified outcome through various learning experiences:

Able to operate and perform maintenance of heavy electrical power utilization systems and equipments.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH312-1: Select & use illumination lights & system.

EEH312-2: Use & operate power factor improvement equipments.

EEH312-3: Maintain electric welding equipment.

EEH312-4: Select and use electric drives.

EEH312-5: Maintain electrical resistance heating system like oven. & induction heating system

EEH312-6: Maintain components of substation of Traction systems.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Program outcomes ↓ Competency & Course Outcomes	PO 1 Basic & Discipline knowledge	PO 2 Problem analysis	PO 3 Design development of solution	PO 4 Engineering Tools, Experimentation & testing	PO 5 The engineering practices for society, Sustainability & Environment	PO 6 Project management	PO 7 Life long learning	PSO1 Maintain various types of Electrical equipment	PSO2 Maintain various sections of Electrical power systems
Able to operate and perform maintenance of heavy electrical power utilization systems and equipment's..	3	...	2	2	3	1	3	2	1
<i>EEH312-1: Select & use illumination lights & system.</i>	3	...	2	2	3	1	3	2	1

EEH312-2: Use & operate power factor improvement equipment's	3	...	2	2	3	1	3	2	1
EEH312-3: Identify parts & operations of welding equipment.	3	...	...	1	3	...	1	2	0
EEH312-4 : Select and use electric drives.	3	...	2	2	3	1	3	1	0
EEH312-5: Maintain electrical resistance heating system like ovens & induction heating.	3	...	...	2	3	1	3	2	0
EEH312-6 : Maintain components of substation of Traction systems.	3	...	...	1	3	...	1	2	1

F. CONTENT:-

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Utilization of Electrical energy developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Assignments and drawing sheet	Skill to be developed	Course outcome
1	Assignment on constructional diagram , working & rating with typical location based application of Low & High Pressure Mercury Vapour Lamps, High Pressure Sodium vapour lamps, Metal Halide Lamps, LED lamps	1] Able to select various lamps their rating on location based or requirement. 2] Connection &	EEH312 -1
2	Designing simplest lighting scheme on typical Hall, Road	1] Able to design lighting schemes. 2] Selection of lamps as per scheme.	EEH312 -1
3	Assignments on various types of Tariff schemes	1] Knowing Tariff & operations of energy calculation. 2] Knowing electricity bills for LT & HT type.	EEH312 -2
4	Assignments on various types of power factor improvement schemes.	1] Realize components useful to improve power factor. 2] Functioning and applications to improve power factor.	EEH312 -2
5	Draw labeled and describe in brief their applications various electric welding	1] Functions of welding machines. 2] To make choice of use of electrical	EEH312 -3

	machines. State comparative study considering advantages and disadvantages.	parts and material required. 3] Circuit diagram and connections. 4] Causes and faults with related maintenance.	
6	Study of various types of motors and their characteristics used as electrical drives. To draw and explain control equipment for starting, speed control and braking of motors.	1] Able to select motors as electrical drives 2] To choose their ratings for various types of loads/ Applications requirement in factory.	EEH312 -4
7	Draw labeled diagram and describe in brief their part list, working & applications various Resistance heating furnace, Arc furnaces. State comparative study, Study heating elements, considering advantages and disadvantages.	1] Functions of Resistance heating furnace, Arc furnaces. 2] Various parts their off. 3] Circuit diagram and connections.	EEH312 -5
8	Draw labeled diagram and describe in brief their part list, working & applications of various Dielectric heating furnace and eddy current heating State comparative study considering advantages and disadvantages	1] Functions of Dielectric heating furnace 2] Various parts their off. 3] Circuit diagram and connections.	EEH312 -5
9	Draw labeled diagram and describe in brief their part list, working & applications of Induction heating furnaces. State comparative study considering advantages and disadvantages	1] Functions of furnace and Induction heating furnaces. 2] Various parts their off. 3] Circuit diagram and connections	EEH312 -5
10	Comparative study of different systems of railway electrification viz. i) DC system, ii) Single phase AC system iii) Three phase system iv) Composite system	1] Follow various voltage levels in tractions. 2] Types of tractions. 3] To make choice of tractions.	EEH312 -6

II) Theory

Section I

EEH312-1: Select & use illumination lights & system.			
1	Illumination Terminology: 1.1 Law of Inverse Squares and Lambert's Cosine Law(Simple Numericals) 1.2 Types of Lamps-Low Pressure Mercury Vapour Lamps, High Pressure Mercury Vapour lamps, High Pressure Sodium vapour lamps, Metal Halide Lamps, LED lamps 1.3 Various Lighting Schemes. 1.4 Old Lighting system(IKS)	08	12
EEH312-2: Use & operate power factor improvement equipment's.			
2	Tariff & Power factor improvement: 2.1 Desirable Characteristics of Tariff; 2.2 Types of Tariff :- Block Rate Tariff, KVA Max Demand Tariff, TOD (Time Of Day Tariff)(No numerical) 2.3 Power Triangle, Disadvantage of low Power factor, Advantages of improved Power Factor; Causes of Low Power Factor, 2.5 Avoidance of Low power factor without using P.F. improving	14	14

	apparatus, improvement using Static Capacitor: Vector Diagram and Power Triangle, Advantages and Disadvantages.(Simple Numerical) 2.6 Most Economical Power factor: Location of P.F. improving, apparatus from Consumer and Electrical Supply Company point of view.		
EEH312-3: Identify parts & operations of welding equipment.			
3.	Electric Welding systems: 3.1 Resistance welding and Equipment's. 3.2 Electric Arc welding: Types and equipment's. 3.3 Comparison of AC & DC welding 3.4 Comparison of metal arc & carbon arc welding.	08	08
TOTAL		30	34

Section II

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluati on Marks
EEH312-4 : Select and use electric drives.			
04	Electric Drives & Elevator: 4.1 Traditional method of lifting(IKS) 4.2 Classification of electric drives 4.3 Factors governing selection of electric drives 4.4 Electrical characteristics Starting, Running characteristics & braking system-- Dynamic, Regenerative type. 4.5 Mechanical features and cost 4.6 Size & rating of motors- Duty cycle (Simple Numericals) 4.7 Motors for particular applications, Load equalization 4.8 Comparison between A.C. and D.C. Drives. 4.9 Advantages of electric drives. Safety in elevators, Lift and elevator Act	10	12
EEH312-5 : Maintain electrical heating system like resistance oven, furnaces			
5	Electric Heating systems (Resistance & Inductance): 5.1 Modes of heat transfer. 5.2 Methods of electric heating. 5.3 Resistance heating, Resistance Ovens. Requirements of heating element & heating materials Radiant & infrared heating. 5.4 Induction heating- 5.5.1 Core and coreless type induction heating 5.5.2 Ajax-Wyatt vertical core type furnace 5.5.3 Indirect induction furnace 5.5.4 High frequency eddy current heating 5.5 Dielectric heating 5.6 Heating by electric arc, Electric Arc furnace	14	16

	5.7 Specifications of Furnace.		
EEH312-6 : To maintain components of substation of Electric Traction system			
6	Electric Traction Systems: 6.1 AC and DC electrical traction systems. 6.2 High voltage supply system for traction 6.2.1 substations, Feeding Posts 6.2.2 Feeding and sectioning arrangements 6.2.3 sectioning and paralleling post 6.2.4 sub sectioning post. 6.2.5 Elementary sections. 6.2.6 Miscellaneous equipment's at control post or switching stations. 6.3 Major equipment's at substations.- 6.3.1 Transformer, 6.3.2 circuit breakers, 6.3.3 interrupter, 6.4 Protective system for AC traction-Transformer protection and 25 kV catenary protections. 6.5 Traction motors, 6.6 Comparison of AC and DC electrical traction systems.	06	08
TOTAL		30	36

**** No questions will be asked on IKS learning subtopics in any question papers.**

G. List of Assignments under SLA

.....Not Applicable.....

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Illumination Terminology	4	4	4	12	EEH312-1
I / 2	Tariff & Power factor improvement	4	4	6	14	EEH312-2
I / 3	Electric Welding systems	4	--	4	08	EEH312-3
II / 4	Electric Drives & Elevator	4	4	4	12	EEH312-4
II / 5	Electric Heating systems	4	6	6	16	EEH312-5
II / 6	Electric Traction Systems	--	4	4	08	EEH312-6
Total Marks					70	

J. Assessment Criteria

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical/oral:

At the time of Practical/oral Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course practical	05
2	Punctuality for practical /Oral	05
3	Neat & complete Diagram/Write up-Hand writing	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

B. Instructional Methods:

- a. Lectures cum Demonstrations,
- b. Classroom practices.
- c. Use of projector and soft material for demonstration

C. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

D. Reference Books:

S.N.	Name of Book	Author	Publication
1.	Generation and Utilization of Electrical Energy	S.Sivanagaraju M.Balasubba Reedy B.Srilatha	Pearson ISBN : 9789332515673 9332515670 8131733327 9788131733325
2.	Art and Science of Utilization of Electrical Energy	H. Partab	Dhanpat Rai and Sons, New Delhi, Latest edition - ISBN : 8177001442, 9788177001440.
3.	Utilization of Electric Power and Electric Traction.	J. B. Gupta	S. K. Kataria and Sons, New Delhi, Latest edition ISBN -10: 9350142589; ISBN -13: 978-9350142585
4.	Utilization of Electric Power and Electric Traction	G. C. Garg	Khanna Publishers, New Delhi, Latest edition ISBN . 8174091645.

5.	Fundamentals of Electrical Drives	G. K. Dubey	Narosa Publishing House. New Delhi, Latest edition ISBN , 8173190410, 9788173190414.
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E. Learning Website & Software

1. www.nptel.com/iitm/
2. www.howstuffworks.com/
3. [www.virtual lab.com](http://www.virtuallab.com)
4. www.sskphdmm.com
5. <http://www.youtube.com/watch?v=RAc1RYilugl>

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprentice. /Project. /Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

ELECTIVE-I COURSES

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem	Learning Scheme				Credits	Credits (Round Off)	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)			Notional Learning Hours/Week	Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
							C L	T L	L L						FA-TH	SA-TH	Total		Practical		SLA				
																	Max	Min	FA-PR	SA-PR	Max	Min	Max	Min	
ELECTIVE-I																									
1.	Industrial Organization and Management	HIOM	AEC	5	CCH502	5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100	
2.	Marketing Management	HMKM	AEC	5	CCH503	5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100	
3.	Project Management	HPRM	AEC	5	CCH504	5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100	

COURSE NAME : INTERNSHIP (16 WEEKS)
COURSE CODE : CCH505
COURSE ABBREVIATION: HINP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	--	10
	Tutorial Learning		
	Laboratory Learning		
	SLH-Self Learning		
	NLH-Notional Learning		

B. ASSESSMENT SCHEME: -

PAPER DURATION	THEORY			BASED ON LL&TL				BASED ON SLA		TOTAL
	FA- TH	SA- TH	TOTAL	Practical		MAX	MIN			
NIL				FA -PR	SA-PR					
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN		
	NIL	NIL	NIL	NIL	100	40	100#	40	-	-	200

*Note: Students have to register for Internship with the help of Govt. agency such as BOAT (Board of Apprenticeship Training).
 Students have to register Credits for Industrial Training are in-line of guidelines of NCrf : The industrial training is of 16 weeks considering 36-40 hours per week engagement of students (as per Guidelines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mento.*

C. ABBREVIATIONS: -

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# on Line Examination, @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
 2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
 3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
 4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
 5. 1(one) credit is equivalent to 30 Notional hrs.
 6. * Self learning hours shall not be reflected in the Time Table.
- * Self learning includes micro project / assignment / other activities

D. i.RATIONALE: -

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. The internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Apply skills and practices to industrial processes.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH505.1: Observe time/resource management and industrial safety aspects.

CCH505.2: Acquire professional experience of industry environment.

CCH505.3: Prepare report of assigned activities and accomplishments.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "--":no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 design/ development of solutions	PO 4 Engineering Tools, experiment and testing	PO 5 Engineering practice for society, sustainability and environment	PO 6 Project management	PO 7 Life-long learning	PSO1	PSO2
Competency:	2	-	-	-	-	3	-	1	2
CCH505.1	2	-	-	1	-	1	1	1	2
CCH505.2	2	-	1	1	-	2	1	1	2
CCH505.4	1	-	-	2	-	2	-	1	2

F. GENERAL GUIDELINES FOR ORGANIZING INDUSTRIAL TRAINING

The industry /organization selected for Industrial training/ internships shall be Government /Public Limited / Private limited / Startup /Centre of Excellence/ Skill Centers/ Skill Parks etc.

Duration of Training - 16 weeks students engagement time

Period of Time slot - Between 4th and 5th semester (16 weeks)

Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

G. ROLE(S) OF DEPARTMENT AT THE INSTITUTE:

Following activities are expected to be performed by the concerned department at the Polytechnics. Table of activities to be completed for Internship:-

S. N	Activity	Suggested Schedule WEEKS
1	Collection of information about industry available and ready for extending training with its offered capacity of students (Sample Format 1)	10 th to 12 th week of 4 th Semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15))	13 th week of 4 th semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	14 th week of 4 th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	15 th week of 4 th semester
5	Enrollment of Students for industrial training (Format 3)	Before 12 th week of 4 th semester
6	Issue of letter to industry for training along with details of students and mentor (Format 4)	After 4 th Semester
7	Organize Internship Orientation session for students	After completion of 4 th semester exam
8	Progressive Assessment of industry training by Mentor	Each week during training period
9	Assessment of training by institutional mentor and Industry mentor	5 th Semester ESE

Suggestions-

- Department can take help of alumina or parents of students having contact in different industries for securing placement.
- Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However, preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
- Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
- The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

H. ROLES AND RESPONSIBILITIES OF STUDENTS:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives, then the same may be utilized for securing placement for themselves and their peers.
2. Students must fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non- disciplinary action will be taken.
7. Students must maintain a weekly diary (Format 6) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.
8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to their mentor at the institute.
9. Prepare a final report about the training for submitting to the department at the time of presentation and viva- voce and get it signed from a mentor as well as industry training in charge.
10. Students must submit the undertaking as provided in Format 5.

I. TYPOGRAPHICAL GUIDELINES FOR INDUSTRY TRAINING REPORT

1. Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following
2. The training report shall be computer typed (English- British) and printed on A4 size paper.
3. Text Font -Times New Roman (TNR), Size-12 point
4. Subsection heading TNR- 12 point bold normal
5. Section heading TNR- 12 capital bold
6. Chapter Name/ Topic Name – TNR- 14 Capital
7. All text should be justified. (Settings in the Paragraph)
8. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
9. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.
10. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

J. FORMAT OF INDUSTRIAL TRAINING REPORT

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turnover and number of employees etc.)
Chapter 3	Types of Major Equipment/raw materials/instruments/machines/hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing techniques and methodologies and material handling procedures
Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.
Chapter 7	Details of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

K. LEARNING STRATEGIES DURING TRAINING AT INDUSTRY

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.

They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.

L. Table - Distribution of End-Semester-Examination (ESE) marks of Industrial Training

Internal Examiner			External Examiner	Total ESE marks
Marks for Industrial Training Report	Marks for Seminar/Presentation	Marks for Oral/Viva-voce		
25	25	25	25	100

Format-1*(To be obtained on Company's Letter Head)*

Collecting Information about Industry/Organization available for training along with capacity

- 1) Name of the industry/organization:
- 2) Address/communication details with email:
- 3) Contact person details:
 - a) Name:
 - b) Designation:
 - c) Email
 - d) Contact number/s:
- 4) Type:
 - a) Govt / PSU / Pvt /
 - b) Large scale / Medium scale / Small scale
- 5) Products/Services offered by industry:
- 6) a. Whether willing to offer Industrial training facility during June to August for Diploma in Engineering students: Yes / No.
 b) If yes, whether you offer 16 weeks training: Yes/No
 c) Possible Industrial Capacity:

Students	Programme name						Total
	Civil	Mechanical	Electrical	Information Technology	Metallurgy	Electronics & Telecommunication	
Male							
Female							
Total							

- 7) Whether accommodation available for interns Yes / No. If yes capacity: _____
- 8) Whether internship is charged or free:
 If charged please specify amount per candidate: _

Seal and signature of responsible person at Industry:

Format-2

(Obtaining Consent Letter from parents/guardians)

To,
The principal,
Government Polytechnic, Kolhapur

Subject: Consent for Industrial Training.

Respected Sir,

I am fully aware that -

- i. My ward studying in fourth semester at your Government Polytechnic, Kolhapur institute has to undergo 16 weeks of Industrial training for partial fulfillment towards completion of Diploma in _____
- ii. For this fulfillment he/she has been deputed at industry, located at _____
- iii. for Industrial training /internship for the period from _____ to _____.

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

- a. My ward will undergo the training at his/her own cost and risk during training and/or stay.
- b. My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
- c. My ward is NOT entitled to any leave during the training period.
- d. My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :

Name : _____

Address : _____

Phone Number : _____

Format-4

(Issue Letter to the Industry/Organization for the training along with details of students and mentors on Institute Letter Head)

To,
The HR Manager,

Subject: Placement for Industrial training of 16 weeks in your organization

Reference: Your consent letter no_____

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period.

Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.

Diploma programme in _____

Sr. No.	Roll No.	Name of Student	Name and designation of Mentor

Kindly extend all possible cooperation to the students for above. Thanking you.

Yours Sincerely,

Principal
Government Polytechnic, Kolhapur

CC- Mentor

Format-5

(Undertaking by the students)

To
The Principal,
Government Polytechnic, Kolhapur

Subject: Undertaking regarding Placement for Industrial training of 16 weeks duration

I _____ Roll No: _____ Son / Daughter of _____
studying in _____ department at your Institute, am fully aware of the Industrial Training requirement and related responsibilities and participation in the _____ Industrial training from: _____ To _____. I assure you that I will be of good behavior and be obedient to the staff and mentor during the Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the Industrial Training at my own risk and I will not hold the Institute responsible in any way in any eventuality namely Accident /Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place:

Date:

Signature of the student

GOVERNMENT POLYTECHNIC, KOLHAPUR

Evaluation Sheet for Formative Assessment of Internship

Academic Year:

Department: Electrical Engineering

Semester: V

Course – Internship

Course Code - CCH505

Name of Coordinator:

Enrollment No	Name of Student	Marks (5 marks each week) by Mentor & Industry Supervisor jointly																PA Marks by Mentor faculty (20 Marks) [B]	Total [Marks 100] [A]+[B]	
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16			Total [80 Marks] [A]

Name and Designation of Mentor

Name and Designation of Industry Supervisor

Week 1: From _____ To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor : _____

Signature of Industrial Supervisor : _____

The same format need to follow for every week of the industrial training.

Course Name : ENTREPRENEURSHIP AND START-UP
 Course Code : CCH501
 Course Abbreviation : HESU

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	1
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	--	
Self-Learning Hours (SLH)	01	
Notional Learning (NLH)	3	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL				Based on Self Learning		Total Marks
					Practical						
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
-	-	-	-	-					50	20	50

(Total IKS Hrs for Sem:1 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Globalization, liberalization and Privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is an immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast-growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

i) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

- 1) Understanding and applying business principles and labor laws.
- 2) Improved business skills, imagination and planning of enterprise.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

CCH501-1: Identify entrepreneurial attributes

CCH501-2: Identify the business opportunities that suits you

CCH501-3: Use the support systems to zero down to your business idea.

CCH501-4: Develop comprehensive business plans.

CCH501-5: Prepare plans to manage the enterprise effectively.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project management	PO 7 Life-long learning	PSO1	PSO2
Competency									
CCH501-1	2	2	2	-	-	3	2	-	3
CCH501-2	2	2	2	2	-	3	2	-	3
CCH501-3	2	2	2	2	-	3	2	-	3
CCH501-4	2	2	2	2	-	3	2	-	3
CCH501-5	2	2	2	2	-	3	2	-	3

F. CONTENT:

i. Practical Exercise:

Not Applicable

ii. THEORY

Sr. No.	Topics / Sub-topics	Lectures (Hours)
1	<p>Entrepreneurship Development- Concept and Scope Indian Knowledge System for entrepreneurship development(IKS)</p> <p>1.1 Concepts and Overview of Entrepreneurship. Evolution and Growth of Entrepreneurship in India. Role of Entrepreneurship in Economic Development. Entrepreneurship as a career.</p> <p>1.2 Traits of successful intrapreneur / entrepreneur: Consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking,</p> <p>1.3 Entrepreneurship: Scope in local and global market.</p> <p>1.4 Intrapreneur and entrepreneur.</p> <p>1.5 Types of enterprises and their features: Manufacturing, Service and trading.</p> <p>1.6 Steps in Setting up of a business</p>	03
2	<p>Entrepreneurial Opportunities and Selection Process:</p> <p>2.1 Product / Service selection: Process, core competence, product / service life cycle, new product / service development process, mortality curve, Creativity and innovation in product / Service modification / development.</p> <p>2.2 Process selection: Technology life cycle, forms and cost of transformation, Factors affecting process selection, Location for an industry, Material handling.</p> <p>2.3 Market study procedures: Questionnaire design, sampling, Market survey, Data analysis</p> <p>2.4 Getting information from concerned stake holders such as Maharashtra Centre for Entrepreneurship Development (MCED), National Institute for Micro, Small and Medium Enterprises (NI-MSME, Prime Minister Employment Generation Program (PMEGP), Directorate of Industries (DI), Khadi Village Industries Commission (KVIC).</p>	04
3	<p>Support Systems:</p> <p>3.1 Categorization of MSME, Ancillary Industries.</p> <p>3.2 Support System-Government Agencies: MCED, NI- MSME, PMEGP, DI, KVIC.</p> <p>3.3 Support agencies for entrepreneurship guidance, training, registration, technical consolation, technology transfer and quality control, marketing and finance</p> <p>3.4 Breakeven point, return of investment and return on sales.</p>	03
4	<p>BUSINESS PLAN PREPARATION:</p> <p>4.1 Sources of Product for Business: Feasibility study.</p> <p>4.2 Ownership, Capital, Budgeting, Matching Entrepreneur with the project, Feasibility report preparation and evaluation criteria.</p> <p>4.3 Business plan preparation.</p>	03

5	Managing Enterprise: 5.1 Unique Selling proposition (U.S.P.): Identification, Developing a marketing plan. 5.2 Preparing Strategies of handling Business: Policy making, negotiation and bargaining techniques. 5.3 Risk management: [planning for calculated risk taking, initiation with low-cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.	03
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G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

Sr. No.	Assignments	Relevant CO	Approx Hrs. Required
1	Submit a profile summary (about 500 words) of a successful entrepreneur indicating milestone achievement.	1	02*
2	Undertaking SWOC analysis to arrive at your business idea of a product / service.	1	02
3	Survey industries of your stream; grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	2	02
4	Visit a bank/Financial institution to enquire about various funding schemes for small scale enterprise.	2	02*
5	Collect loan application forms of national banks/other financial institutions.	2	02*
6	Compile the information from financial agencies that will help you set up your business enterprise.	3	02*
7	Compile the information from government agencies that will help you set up your business enterprise.	3	02*
8	Prepare Technological feasibility report of a chosen product/service.	3	02*
9	Prepare a set of short term, medium- and long-term goals for starting a chosen small-scale enterprise.	3	02*
10	Prepare marketing strategy for your chosen product/service.	4	02*
11	Compile the information about insurance schemes covering different risk factors.	4	02
12	Find the breakeven point for the business idea chosen by you.	4	02
13	Prepare a business plan for your chosen small-scale enterprise.	5	02
14	Organize funfair for your class and write report of profit/loss.	5	02
15	Visit report of any industry: Brief history, types and details of services/support assistance being given, any other information which is useful to self-employer/entrepreneur.	5	02

*-Suggested assignment for the students.

Complete any 8 assignments mentioned below given by subject teacher.

H. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Observation and recording	10
Affective	Discipline and punctuality	05
TOTAL		25

ii) **Assessment of SLA: -**

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Market Survey / Data collection	10
4	Team work	05
TOTAL		25

I. INSTRUCTIONAL METHODS:

- 1 Lectures cum Demonstrations,
- 2 Class room practices.
- 3 Use of projector and soft material for demonstration

J. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

K. REFERENCE BOOKS:

Sr. No.	Title of Books	Author	Publication
1	The entrepreneurial Instinct: How Everyone Has the Innate Ability to Start a Successful Small Business.	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich R. D.	McGraw-Hill Education, New Delhi, 2013, ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029169
4	Reading Materials of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad
5	Product Design and manufacturing	Chitale A.K.	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special Edition for MSBTE	CPSC, Manila	Tata McGraw Hill, New Delhi
8	Entrepreneurship Development Small Business Management	Khanka S. S.	S. Chand and sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S. Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

COURSE NAME : INDUSTRIAL ORGANISATION AND MANAGEMENT
COURSE CODE : CCH502
COURSE ABBREVIATION : HIOM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	2
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
1	15*#	35*#	50@\$	20	--	--	--	--	50	20	100

C. ABBREVIATIONS: -

CL-Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# OnLine Examination, @\$ Internal Online Examination.

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If a candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours be reflected in the Time Table.

* Self-learning includes micro project/assignment / other activities.

D. i.RATIONALE:

Management ability is a higher-grade ability, which every successful engineer must possess. This science has been developed in those days when it was treated as an art in earlier stages. It is impossible for an individual though technically sound to achieve goals of the organizations. Effective implementation of management policies is a tough task. The Diploma holder should learn these principles of management and various techniques.

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

To improve management ability of individual through teaching.

E. COURSE OUTCOMES (COs):

CCH502.1 Apply principles of management and carry out various functions of management

CCH502.2 Prepare organization structure for small and medium scale industry.

CCH502.3 Perform duties of stores in-charge and materials manager.

CCH502.4 Practice industrial safety rules, codes, practices and acts.

CCH502.5 Apply various modern management techniques

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 EngineerIng Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning		
Competency: The aim of this course is to improve management ability of individual through teaching.	3	3	2	2	3	3	3	3	3
CCH502-1	3	2	2	2	2	3	3	2	3
CCH502-2	3	3	2	3	2	3	3	3	2
CCH502-3	3	3	3	3	2	3	3	2	2
CCH502-4	2	3	3	3	2	3	3	3	3
CCH502-5	2	3	3	3	2	3	3	3	3

Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

F. CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

ii) THEORY

SECTION-I			
Sr. No.	Topics	Teaching (Hours)	Theory evaluation
Course Outcome CCH502-1: - Apply principles of management and carry out various functions of management			
1	PRINCIPLES OF MANAGEMENT 1.1 Concept of management 1.2 Principles of management 1.3 Objectives of management 1.4 Scope and importance of management 1.5 Levels of management 1.6 Managerial competencies: Communication, Planning and Administration, Team work, Strategic action and General awareness	04	4
Course Outcome CCH-502-1: - Apply principles of management and carry out various functions of management			
2	Functions of Management 2.1 Planning: Forms of planning, Strategic levels and Planning, Phases of Planning 2.2 Decision Making: Decision making conditions, Basic types of Decisions 2.3 Organizing: Introduction to Organization design, basic types of Departmentalization, Co-ordination, Authority 2.4 Motivation: Work Motivation, Three approaches to Motivation, 2.5 Leadership: Leadership and Power, Leadership Development 2.6 Communication: The Communication process, Impact of Information Technology, Hurdles to effective communication 2.7 Controlling: Foundations of control, creative Effective control, Primary methods	06	5
Course Outcome CCH502-1: - Apply principles of management and carry out various functions of management			
3	HUMAN RESOURCE MANAGEMENT. 3.1 Definition and concept, 3.2 Aim, Objectives and functions of HR dept. 3.2 Principles of personnel policy, details recorded in policy 3.3 Recruitment and selection of employees 3.4 Training: Objectives, benefits, types and methods 3.5 Workers Participation in Management	06	5

Course Outcome CCH502-2: Prepare organization structure for small and medium scale industry.			
4	FORMS OF BUSINESS ORGANISATION 4.1 Types of industrial sectors 4.2 Forms of business organization 4.3 Individual Proprietorship 4.4 Partnership 4.5 Joint stock companies 4.6 Co-operatives, Public sectors, Government undertakings.	05	5
SECTION II			
Course Outcome CCH502.3: Perform duties of stores in-charge, material and finance manager.			
5	MATERIALS MANAGEMENT 5.1 Importance of purchase 5.2 Functions and Objectives 5.3 Duties of purchasing officer 5.4 Methods of purchasing and procedure 5.5 Scope and importance of material management 5.6 Objectives of material management 5.7 Duties of Material manager 5.8 Concept of supply chain management 5.9 Modern trends in material management: MRP, ERP	05	4
6	FINANCIAL MANAGEMENT 6.1 Concept, Scope and Importance 6.2 Functions of financial management 6.3 Types of capital: Fixed, working 6.4 Factors affecting Working capital 6.5 Capitalization: over, under 6.6 Sources of Finance 6.7 Industrial taxation	05	4
CCH502.4: Practice industrial safety rules, codes, practices and acts.			
7	INDUSTRIAL ACT & SAFETY 7.1 Factory Act, Electricity Act, Workmen Compensation Act, ESI Act, pollution Control Act 7.2 Accidents: Economic aspects, direct and indirect cost of accidents Causes, Types, Remedies, Personal Protective Equipment's (PPE), Reporting & Investigation of accidents 7.3 Safety management: safety in industry, committees, programs, Safety codes, Safety training, 7.4 Occupational Safety and Health Administration – Promoting, norms and standards Housekeeping: definition, concept, necessity, advantages, procedure	05	4
CCH502.5: Apply various modern management techniques.			
8	MODERN MANAGEMENT TECHNIQUES 8.1 PERT & CPM 8.2 Various terms related with network analysis 8.3 Various Time estimates 8.4 Construction of Network Diagram Computation of Critical Path	04	4
	Total	40	35

Online Exam for this course.

G. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Course Outcome	Total Marks
		Remember	Understand	Apply		
1	Principles Of Management	02	02	--	CCH502.1	04
2	Functions Of Management	02	02	01	CCH502.1	05
3	Human Resource management	02	02	01	CCH502.1	05
4	Forms Of Business organization	02	02	01	CCH502.2	05
5	Materials Management	02	01	01	CCH502.3	04
6	Financial Management	02	01	01	CCH502.3	04
7	Industrial Act & Safety	02	01	01	CCH502.4	04
8	Modern Management Techniques	02	01	01	CCH502.5	04
TOTAL						35

H. INSTRUCTIONAL METHODS

- a. Lectures cum Demonstrations
- b. Classroom practices

I. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank.

J. REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1	Bangaand Sharma	Industrial Organisation & Management	Khanna Publisher
2	O P Khanna	Industrial Engg. & Management	DhanpatRai & sons New Delhi
3	P.C. Pandey & C. K. Sing	Management Science	DhanpatRai & sons New Delhi
4	Industrial Organisation	P.T. Ghan	Tata McGraw Hill
5	Management Information System	Waman S. Jawadekar	Tata McGraw Hill
6	P.C. Pandey & C. K. Sing	Management Science	DhanpatRai & sons New Delhi

K. LEARNING WEBSITE & SOFTWARE: -

- a. <https://nptel.ac.in/courses/122/106/122106031/>
- b. <https://nptel.ac.in/courses/110/105/110105154/>
- c. <https://nptel.ac.in/courses/110/101/110101150/>
- d. <https://nptel.ac.in/courses/110/101/110101153/>

COURSE NAME : MARKETING MANAGEMENT
COURSE CODE : CCH503
COURSE ABBREVIATION : HMKM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	2
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical		FA-PR	SA-PR	MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
1	15*#	35*#	50@\$	20	--	--	--	--	50	20	100

C. ABBREVIATIONS: -

CL-Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# OnLine Examination, @\$ Internal Online Examination.

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

- a. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- b. If a candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- c. Notional Learning hours be reflected in the Time Table.

* Self-learning includes micro project/assignment / other activities.

D.i. RATIONALE:

The globalization has lead to the requirement of multi-skilled personnel to execute the works and that too in a cost effective way. It is observed that the diploma holder in Engineering has wide spectrum for development, if the enters the marketing field. Provided he has the interest with proper initiative. Marketing now a day can provide fruitful employment to the diploma holder to make a career in marketing.

ii. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Work as a marketing personnel for electrical components or business.

E. COURSE OUTCOMES (COs):

CCH503-1:-Interpret different marketing techniques.

CCH503-2:-Identify different types of markets.

CCH503-3:-Carry out different marketing works/functions.

CCH503-4:-Assist in marketing work of industrial products.

CCH503-5:-Carry out market studies for products.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”]

Competency and Cos	Programme Outcomes POs and PSOs							PSO1	PSO2
	PO 1 Basic and Discipline specific knowledge	PO2 Problem Analysis	PO3 Design / Development of solutions	PO4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO6 Project Management	PO7 Life-long Learning		
Competency: Work as a marketing personnel for electrical components or business.	3	3	2	2	3	3	3	3	
CCH503-1:-Interpret different marketing techniques.	3	2	2	2	2	3	3	2	
CCH503-2:-Identify different types of markets.	3	3	2	3	2	3	3	3	
CCH503-3:-Carry out different marketing works/functions.	3	3	3	3	2	3	3	2	
CCH503-4:-Assist in marketing work of industrial products.	2	3	3	3	2	3	3	3	
CCH503-5:-Carry out market studies for products.	2	3	3	3	2	3	3	3	

F. CONTENT:

a. PRACTICAL EXERCISES - Not Applicable

b. THEORY

Section I			
Sr.No.	TOPICS Sub-Topics	Periods	Marks
CCH503-1: Interpret different marketing techniques.			
1	Marketing 1.1 Meaning and significance of marketing 1.2 Marketing system 1.3 Concept of marketing 1.4 Product selling 1.5 Trends in modern marketing	8	6
CCH503-2: Identify different types of markets.8			
2	Markets 2.1 Meaning of market 2.2 Types of market 2.3 Government and industrial market	8	6
CCH503-3: Carry out different marketing works/functions.			
3	Functions & Management 3.1 Marketing functions 3.2 Meaning of marketing 3.3 Management and functioning 3.4 Types of marketing organizations 3.5 Marketing manager and his duties	8	6

Section II			
Sr.No.	TOPICS Sub-Topics	Periods	Marks
CCH503-4: Prepare scheme for marketing industrial products.			
4	Marketing Industrial Products 4.1 Types of industrial products 4.2 Characteristics and marketing considerations 4.3 Marketing planning 4.4 Product decision 4.5 Pricing decision	8	6
CCH503-5: Carry out market studies for products.			
5	Strategies 5.1 Marketing strategy 5.2 Marketing mix 5.3 Market survey 5.4 Market information systems 5.5 Buying behaviors	8	6
CCH503-6: Devise proper advertising techniques for industrial products.			
6	Advertising 6.1 Role of advertising in marketing 6.2 Marketing management without advertising 6.3 Brief introduction to cost component of advertising	8	5
Total		40	35

G. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Total Marks
		Remember	Understand	Apply	
1	Marketing	2	2	2	6
2	Markets	2	2	2	6
3	Marketing Functions & Management	2	2	2	6
4	Marketing Industrial Products	2	2	2	6
5	Strategies	2	2	2	6
6	Advertising	2	2	1	5
TOTAL					35

H. INSTRUCTIONAL METHODS

- a. Lectures cum Demonstrations
- b. Classroom practices

I. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank

J. REFERENCE BOOKS:

- 1) Basic Marketing - by Cundiff & Still.
- 2) Marketing Management - by R. S. Davar.
- 3) Salesmanship, Sales Management & Advertising - by Satyanarayana.
- 4) Modern Marketing Management - by R. S. Davar.
- 5) Marketing Management (cases & Concepts) - by Dholakia, Khurana & Jain

Websites :

- i <https://nptel.ac.in/courses/122/106/122106031/>
- ii <https://nptel.ac.in/courses/110/105/110105154/>
- iii <https://nptel.ac.in/courses/110/101/110101150/>
- iv <https://nptel.ac.in/courses/110/101/110101153/>

COURSE NAME : PROJECT MANAGEMENT
COURSE CODE : CCH504
COURSE ABBREVIATION : HPRM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	2
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical		FA-PR	SA-PR	MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
1	15*#	35*#	50@\$	20	--	--	--	--	50	20	100

C. ABBREVIATIONS: -

CL-Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# OnLine Examination, @\$ Internal Online Examination.

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If a candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours be reflected in the Time Table.

* Self-learning includes micro project/assignment / other activities.

D. RATIONALE:

A diploma holder in Electrical Engineering now a day finds himself entrusted with managing projects or part thereof. The age at which he/she is entrusted such responsibilities is declining day by day as a result of which he is stressed much and expected to perform well. This course intends to introduce the elementary aspects of Scientific Project Management whose emphasis is on success, though everybody has his own style of managing projects successfully.

ii. EXPECTED OUTCOME:

Use the principles of project management as a supervisor in relevant works.

E. COURSE OUTCOMES (COs):

CCH504-1: Identify project types and the tools/techniques used in it.

CCH504-2: Identify actions for project manager using computer based project management systems as well.

CCH504-3: Assist in establishing a project.

CCH504-4: Carry out project control activities.

CCH504-5: Implement projects using different techniques.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

Competency and Cos	Programme Outcomes POs and PSOs							PSO1	PSO2
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning		
Competency: Use the principles of project management as a supervisor in relevant works.	3	3	2	2	3	3	3	3	3
CCH504-1	3	2	2	2	2	3	3	2	3
CCH504-2	3	3	2	3	2	3	3	3	2
CCH504-3	3	3	3	3	2	3	3	2	2
CCH504-4	2	3	3	3	2	3	3	3	3
CCH504-5	2	3	3	3	2	3	3	3	3

Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

F.CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

II) THEORY

Section I

Sr. no.	Topics / subtopics	Teaching (Hours)	Theory Marks
CCH504-1:Identify the tools and techniques used in project management.			
1	Project Management and its tools/techniques 1.1 Idea of project 1.2 Characteristics of project 1.3 Categories of projects 1.4 Project life cycle phases (definition of each phase) 1.5 Project life cycle curve. Tools And Techniques For Project Management 1.6 Selection techniques 1.7 Execution planning and techniques 1.8 Scheduling and co-ordination techniques 1.9 Cost and productivity control techniques. 1.10 Communication and clean up techniques	8	7
CCH504-2:Identify actions for project manager using computer based project management systems as well.			
2	Project Management System 2.1 Block diagram with brief description , Computer based project management 2.2 Rationale behind computerized project management systems Project Management 2.3 Need of project manager 2.4 Problems of project manager 2.5 Basic education for project manager 2.6 Roles and responsibilities of project management as a profession	8	7
Total			

Section II

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Marks
CCH504-3:Work in a group to establish a project.			
3	Establishing Project (Scope & Cost) 3.1 Guidelines given by planning commission (brief description about guidelines) 3.2 Financing arrangements, capital cost, sources of financing 3.3 Internal and external sources 3.4 Terms of finance Short, intermediate and long term 3.5 Names of financial institutions with their mode of working in brief 3.6 Preparation of cost estimates types of estimates with very brief description: Order of magnitude, study estimate, preliminary estimate, Definitive estimate, detailed estimate.	8	7

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Marks
CCH504-4: Carry out project control activities.			
4	Project Activities And Profitability 4.1 Project implementation schedule 4.2 Basis of time estimation 4.2.1 Time study 4.2.2 Previous project data 4.2.3 Estimates from the vendors/ contractors 4.2.4 Allocated time and committed time. Overall implementation schedule Bar chart Evaluation of project profitability methods 4.2.5 Pay-back period (PBP) return on investments (ROI) concept of zero date 4.3 Pre-project activities and advance actions (very brief description)	8	7
CCH504-5: Implement project task using different techniques.			
5	Implementation Control & Monitoring Implementation 5.1 Work breakdown structure 5.2 Project execution plan (brief description) Project procedure manual 5.3 Project control system 5.4 Need for flexibility 5.5 Project diary Control & Monitoring 5.6 Direction reviews meeting creativity techniques such as questioning 5.7 Attribute listing 5.8 Brain Communications in a project feed back and forward 5.9 Unscheduled meetings and social get-togethers	8	7
Total		40	35

G.SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Total Marks
		Remember	Understand	Apply	
1	Project Management and its tools/techniques	3	2	2	7
2	Project Management System	3	2	2	7
3	Establishing Project	3	2	2	7
4	Project Activities and Profitability	3	2	2	7
5	Implementation Control & Monitoring	3	2	2	7
TOTAL					35

H. INSTRUCTIONAL METHODS

- a. Lectures cum Demonstrations
- b. Classroom practices

H. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank

I. REFERENCE BOOKS:

1. Project Management - by S. Choudhury (Tata McGraw Hill Pub.)
2. Project Management - A System Approach to planning, Scheduling & Controlling By Harold Kerzner (CBS Publishers & Distributors)

J. Websites :

- i <https://nptel.ac.in/courses/122/106/122106031/>
- ii <https://nptel.ac.in/courses/110/105/110105154/>
- iii <https://nptel.ac.in/courses/110/101/110101150/>
- iv <https://nptel.ac.in/courses/110/101/110101153/>

COURSE NAME : PROJECT
COURSE CODE : EEH503
COURSE ABBREVIATION : HPRJ

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	-	2
	Tutorial Learning	-	
	Laboratory Learning	04	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY			BASED ON LL&TL				BASED ON SLA		TOTAL	
	FA-TH	SA-TH	TOTAL	Practical		MAX	MIN				
--	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	100
	-	-	-	-			50#	20	50	20	

C: Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

This course is intended to understand facts, concepts and techniques of electrical equipment in order to troubleshoot and repair. The student will be able to develop the skill of cost estimation, procurement, fabrication, manufacture, test, and install of various components used in the electrical field. This will help the student to acquire skills and attitudes so as to do the function of supervisor in industry and also can start his/her own small scale enterprise.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Carry out the selected project work as a group member.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH503-1 Plan and identify materials, processes and other resources optimally.

EEH503-2 Develop innovative and creative idea.

EEH503-3 Develop leadership, interpersonal skill and team work.

EEH503-4 Develop sense of environmental responsibility.

EEH503-5 Purchase raw material/standard parts and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.

EEH503-6 Prepare a structured report.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
EEH503-1 Plan and identify materials, processes and other resources optimally.	3.00	1.00	1.00	1.00	-	1.00	3.00	3.00	3.00
EEH503-2 Develop innovative and creative idea	3.00	3.00	3.00	2.00	-	1.00	2.00	3.00	3.00
EEH503-3 Develop leadership, interpersonal skill and team work.	-	--	-	-	2.00	2.00	-	3.00	3.00
EEH503-4 Develop sense of environmental responsibility.	2.00	-	-	1.00	2.00	-	-	-	-
EEH503-5 Purchase raw material/standard parts and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.	1.00	1.00	-	1.00	-	-	-	3.00	3.00
EEH503-6 Prepare a structured report.	2.00	1.00	1.00	1.00	-	2.00	2.00	3.00	3.00

F. CONTENT:-

Sr. No.	Topics/ Subtopics
CO: EEH503-1 Plan and identify materials, processes and other resources optimally.	
1	1.1 Literature survey 1.2 Project identification
CO: EEH503-2 Develop innovative and creative idea.	
2	2.1 Initial Design
CO: EEH503-3 Develop leadership, interpersonal skill and team work.	
3	3.1 Project Design
CO: EEH503-4 Develop sense of environmental responsibility.	
4	4.1 Identify impact of project on society and environment, if implemented in large scale.
CO: EEH503-5 Purchase raw material/standard parts and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.	
5	5.1 Project implementation 5.2 Project testing 5.3 Project installation or commissioning
CO: EEH503-6 Acquire knowledge and latest changes in technology.	
6	6.1 Report writing and presentation

G. Self-Learning Activities for Diploma Project Course

During the course of the project, several self-learning activities were undertaken to develop technical knowledge, practical skills, and project management abilities. These activities help enhance student understanding of the project domain and supported independent problem-solving. The key self-learning areas are summarized below:

1. **Understanding Project Background:**
 - Study similar projects, case studies, and past reports to understand the problem and solution approach.
2. **Tool and Software Learning:**
 - Learn essential tools such as Arduino IDE, AutoCAD, Proteus, and Excel through online tutorials and practice.
3. **Component Study and Selection:**
 - Gain knowledge of electronic and mechanical components by reading datasheets and specifications.
4. **Design and Simulation:**
 - Practice designing circuits and mechanical parts using simulation tools to validate project ideas before physical implementation.
5. **Practical Skill Development:**
 - Improve hands-on skills such as soldering, wiring, programming, and assembly through repeated practice.
6. **Data Analysis and Testing:**
 - Learn to collect and analyze project-related data, conduct basic testing, and interpret results for system improvement.
7. **Report Writing and Documentation:**
 - Understood the structure and format of technical project reports, including proper formatting, flowcharts, and referencing.
8. **Presentation and Communication Skills:**
 - Practice delivering project presentations and responding to viva questions by studying sample videos and mock sessions.
9. **Time and Team Management:**
 - Develop task schedules, allocated responsibilities, and monitored project milestones using planning tools like Gantt charts.

H. Assessment Criteria

i) Formative Assessment of Project Work :-

Sr. No.	Evaluation Criteria	Marks
1.	Literature survey/review	5
2.	Project identification	5
3.	Initial design/ synopsis	5
4.	Detailed design	10
5.	Project implementation	5
6.	Project testing and installation	10
7.	Report writing	5
8.	Presentation	5
Total		50

ii) Summative Assessment of Practical :

Sr.no	Criteria	Marks
1	Project demonstration & execution	20
2	Project presentation	20
3	Contribution in project	20
4	Subject knowledge	20
5	Question & answer	20
Total		100

I. Instructional Methods:

- a. Discussions.
- b. Industrial visits.
- c. Time bound assignments and work.
- d. Project Exhibition
- e. Mock presentation of project

J. Teaching and Learning resources:

1. Oscilloscope
2. Soldering station with drill machine
3. PCB formulation kit
4. Clip on meter/ multi-meter/ power supplies.
5. IC tester/ continuity tester/ Component tester
6. Auto-transformer
7. Other equipment as per the need of the project
8. Simulation tools
9. Computer

K. Reference Books:

1. Project related reference books.
2. Various electrical and electronics journals.
3. Company handbooks.

L. Learning Website & Software

- i. www.nptel.iitm.ac.in
- ii. <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/>

M. Guidelines for report writing

Arrangement of Contents:

1. Cover Page or Title Page
2. Declaration
3. Certificate by Guide
4. Acknowledgment
5. Preface
6. List of Symbols
7. List of Abbreviations
8. List of Tables
9. List of Figures
10. Table of Contents
11. Abstract
12. Introduction
13. Review of literature
14. Research Methodology
15. Data Analysis & Finding
16. Suggestion & Conclusion
17. Bibliography
18. Appendix

Paper & Typing dimension :

Page : A4 (ON ONE SIDE)

Margin : TOP 15mm

: BOTTOM 15mm

: RIGHT 15mm

: LEFT 30mm

Font : Times New Roman

Size : 12 points (except the cover page, title page, headings and titles)

Spacing between lines: 1.15 (except the change in paragraph, cover page, title page, headings and titles)

Header : Title of the project & Academic Year

Footer : Short name of institute, page number (on left side)

COURSE NAME : ROTATING MACHINE- 2
COURSE CODE : EEH401
COURSE ABBREVIATION : HRM2

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	08	3
	Tutorial Learning	-	
	Laboratory Learning	04	
	SLH-Self Learning	--	
	NLH-Notional Learning	12	

B. ASSESSMENT SCHEME :-

PAPER DUR	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	--	--	150

(Total IKS Hrs for Sem. : 02 Hrs)

C: Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
 Note :

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3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

The study of Special Machines is essential due to their wide applications in robotics, automation, electric vehicles (EVs), and renewable energy systems. These machines offer higher efficiency, precision, and control compared to conventional machines, making them crucial for modern industry. Understanding their design, operation, and integration with power electronics helps engineers develop advanced motor drive systems. With the rise of smart grids, AI-driven motor control, and industrial automation, expertise in special machines is increasingly valuable.

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Apply knowledge of rotating machines in CNC machines, conveyor systems, and medical equipment.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH401-1 Identify the parts of three phase alternator.

EEH401-2 Test the performance of three phase alternator.

EEH401-3 Operate three phase synchronous motor at a given set of conditions.

EEH401-4 Use BLDC motor for given industrial applications.

EEH401-5 Use PMSM, servo motor and linear induction motor for given industrial applications.

EEH401-6 Use stepper, switched reluctance, hysteresis and universal motors for given industrial applications.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
EEH401-1 Identify the parts of three phase alternator.	1.00	1.00	1.00	1.00	-	1.00	1.00	3.00	2.00
EEH401-2 Test the performance of three phase alternator.	3.00	2.00	2.00	2.00	-	1.00	1.00	3.00	2.00
EEH401-3 Operate three phase synchronous motor at a given set of conditions.	3.00	2.00	2.00	2.00	-	1.00	1.00	3.00	2.00
EEH401-4 Use BLDC motor for industrial applications.	3.00	2.00	2.00	2.00	1.00	1.00	3.00	3.00	-
EEH401-5 Use PMSM, servo motor and linear induction motor for industrial applications.	2.00	2.00	1.00	2.00	1.00	1.00	3.00	3.00	-
EEH401-6 Use stepper, switched reluctance, hysteresis and universal motors for industrial applications.	2.00	2.00	1.00	2.00	-	1.00	3.00	3.00	-

F. CONTENT:-

I) Practical exercises

The 80% of the following practical exercises shall be conducted in the *Laboratory for Machine* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	Identification of different parts of a three phase alternator, interpretation of the name plate of three phase alternator.	EEH401-1
2	To plot the open circuit characteristic [O.C.C.] and short circuit characteristic [S.S.C.] of three phase Alternator	EEH401-2
3	To determine the percentage regulation of the given three phase alternator by conducting direct loading test -with resistive load.	EEH401-2
4	To determine the percentage regulation of the given three phase alternator by conducting direct loading test -with inductive load.	EEH401-2
5	To determine the percentage regulation of the given three phase alternator by conducting direct loading test -with capacitive load.	EEH401-2
6	Determination of regulation of three phase alternator by synchronous impedance method.	EEH401-2
7	To study different starting methods of Synchronous motor.	EEH401-2
8	Conduct test to plot V and inverted V curve of 3 phase synchronous motor.	EEH401-3
9	Identify parts of BLDC motor	EEH401-4
10	Speed control of BLDC motor	EEH401-4
11	Identify parts of servo motor	EEH401-5
12	Speed control of servo motor	EEH401-5
13	Identify the parts of stepper motor.	EEH401-6
14	Speed control of stepper motor	EEH401-6
15	Speed control of universal motor	EEH401-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH401-1: Identify the parts of three phase alternator.			
1	Introduction to three phase alternator: 1.1 Construction of three phase alternator: Construction and function of each part- Stator frame, stator core, types of slot (open, semi-closed, closed), rotor (salient pole and smooth cylindrical), damper windings, armature winding. 1.2 Short pitch winding and pitch factor (simple numerical) 1.3 Distribution factor (simple numerical) 1.4 Equation of induced EMF (simple numerical)	8	12
CO: EEH401-2: Test the performance of three phase alternator.			
Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks

2	Performance of three phase alternator: 2.1 Effect of loading on terminal voltage (armature resistance, reactance and reaction) 2.2 Concept of armature reaction 2.3 Concept of synchronous reactance 2.4 Voltage regulation and related phasor diagrams 2.5 Determination of voltage regulation: synchronous impedance method (simple numerical) 2.6 Parallel operation of alternator 2.7 Concept of synchronizing power	8	12
CO: EEH401-3: Operate three phase synchronous motor at a given set of conditions.			
3	Three phase synchronous motor 3.1 Principle of operation 3.2 Methods of starting (small DC motor, pony motor, damper winding) 3.3 Power flow and equivalent circuit diagram of synchronous motor 3.4 Power developed by cylindrical type synchronous motor (simple numerical) 3.5 Effect of excitation and loading on the performance of synchronous motor 3.6 Characteristics and applications	8	10

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH401-4: Use BLDC motor for industrial applications.			
4	BLDC Motor 4.1 Basics of DC Motors and the need for brushless technology 4.2 Comparison between Brushed DC and Brushless DC motors 4.3 Construction and working principle of BLDC motors 4.4 Types of BLDC motors: Inner Rotor BLDC Motor and Outer Rotor BLDC Motor 4.5 Role of Hall-effect sensors and concept of position feedback 4.6 Concept of electronic commutation and its advantages over mechanical commutation 4.7 Torque-speed characteristics 4.8 Efficiency and power factor	11	14

	4.9 Comparison with PMSM (Permanent Magnet Synchronous Motor) 4.10 Control Technique for BLDC Motors: open loop 4.11 Applications of BLDC Motors		
CO: EEH401-5: Use PMSM, servo motor and linear induction motor for industrial applications.			
5	PMSM, servo motor and linear induction motor 5.1 Need for special machines 5.2 PMSM: construction, working principle, speed torque characteristics, applications. 5.3 Servo motor (DC): construction, working principle, speed torque characteristics, applications. 5.4 Linear induction motor: construction, working principle, speed torque characteristics, applications.	07	12
CO: EEH401-6: Use stepper, switched reluctance, hysteresis and universal motors for industrial applications.			
6	Stepper, switched reluctance, hysteresis and universal motors 6.1 Stepper motor: construction, working principle, speed torque characteristics, applications. 6.2 Switched reluctance motor: construction, working principle, speed torque characteristics, applications. 6.3 Hysteresis motor: construction, working principle, speed torque characteristics, applications. 6.4 Universal motor: construction, working principle, speed torque characteristics, applications. 6.5 Application of rotating system in Indian ancient establishments (IKS learning)	06	10

**** No questions will be asked on IKS learning subtopics in any question papers.**

G. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to three phase alternator	4	4	4	12	EEH401-1
I / 2	Performance of three phase alternator	4	4	4	12	EEH401-2
I / 3	Three phase synchronous motor	2	4	4	10	EEH401-3
II / 4	BLDC Motor	4	4	6	14	EEH401-4
II / 5	PMSM, servo motor and linear induction motor	4	4	4	12	EEH401-5
II / 6	Stepper, switched reluctance, hysteresis and universal motors	2	4	4	10	EEH401-6
Total Marks					70	

H. Assessment Criteria

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

I. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

J. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

K. Reference Books:

S.N.	Name of Book	Author	Publication
1	Electrical Technology Vol-II	Theraja B.L.	S. Chand, New Delhi, 2012 or latest
2	Electrical Machines	Ashfaq Husain	Dhanpat Rai & Co.
3	Electrical Machines	Deshpande M.V.	PHI Learning,, New Delhi, 2012 or latest
4	Electrical Technology	Uppal, S.L.	Khanna Publication, New Delhi, 2012 or latest
5	Electrical Machine	Nagrath I.J. and Kothari, D.P.	Tata McGraw Hill, New Delhi, 2012 or latest
6	Electrical Machine-I	Gupta, J. B.	S. K. Kataria& Sons, New Delhi, 2012 or latest

L. Learning Website & Software

- a. www.nptel.com/iitm/
- b. www.howstuffworks.com/
- c. www.virtual lab.com
- d. www.sskphdmm.com
- e. <http://www.youtube.com/watch?v=RAc1RYilugI>

COURSE NAME : MICROCONTROLLER & ITS APPLICATION

COURSE CODE : EEH408

COURSE ABBREVIATION: HMAA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	07	04
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	NLH- Notional Learning	10	

B. ASSESSMENT SCHEME:-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		Total
					Practical						
03	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	175
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
		30	70	100	40	25	10	25#	10	25		10

C. ABBREVIATIONS: - CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination .

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

A microcontroller is the sole of all embedded electronic types of equipment and is used in most areas of electrical where automation and monitoring are needed. They include product lines ranging from small consumer electronic products to sophisticated industrial process controllers. A electrical diploma engineer needs to maintain such systems. Programming practices will further enhance students' ability to develop local applications based on microcontrollers. Hence this course is designed to address the above.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Maintain electronic equipment/systems comprising of discrete electronic components.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

EEH408-1: Interpret the prominent features of different types of microcontrollers.

EEH408-2: Interpret the salient architectural features of 8051 microcontroller

EEH408-3: Develop and maintain assembly language program for different operations

EEH408-4: Interface and program different I/O devices with 8051 in assembly

EEH408-5: Interface and serial communication of I/O devices with 8051 in assembly

EEH408-6: Maintain different 8051 based applications

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-“ : No correlation]

Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentat ion and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Managem ent	PO 7 Life- long Learning	PSO1	PSO2
EEH408-1	1	1	2	-	-	-	2	2	2
EEH408-2	1	3	2	-	-	-	2	2	2
EEH408-3	-	3	3	1	-	-	2	2	2
EEH408-4	1	2	3	1	-	-	3	3	3
EEH408-5	1	2	-	-	-	-	2	3	3
EEH408-6	1	1	-	-	-	-	3	3	3

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Microcontrollers* by the Institute in practical sessions :

Sr. No.	Laboratory experiences	CO
1.	*Identification of various blocks of 8051 microcontroller development board.	EEH408-2
2.	Identify different menus available in compiler software KEIL and demonstrate their use.	EEH408-1
3.	*Develop an Assembly Language Program (ALP) for addition of two numbers using various addressing modes and assembler directives.	EEH408-3
4.	*Develop an ALP to perform arithmetic operations: addition, subtraction, multiplication and division on 8-bit data.	EEH408-3
5.	*Develop an ALP to perform arithmetic operations: addition, subtraction on 16-bit data.	EEH408-3
6.	*Develop an ALP to perform addition of BCD data stored at external and store result in internal memory.	EEH408-3

Sr. No.	Laboratory experiences	CO
7.	*Develop an ALP for sum of series stored in RAM locations 40-49H. Find the sum of the values at the end of the program the lower byte store in 30H the higher byte in 31H.	EEH408-3
8.	Develop an ALP to exchange block of data from source to destination location of internal/ external data memory.	EEH408-3
9.	*Develop an ALP for identifying smallest number from the given data bytes stored in internal/ external data memory.	EEH408-3
10.	Develop an ALP for identifying largest number from the given data bytes stored in internal/ external data memory.	EEH408-3
11.	*Develop an ALP for arranging numbers in ascending order stored in internal/ external data memory.	EEH408-3
12.	Develop an ALP for arranging numbers in descending order stored in internal/ external data memory.	EEH408-3
13.	*Interface LED with microcontroller and turn it 'ON' with microcontroller interrupt.	EEH408-4
14.	Interface 4 X 4 LED matrix with 8051 to display various pattern.	EEH408-4
15.	*Interface 7-segment display to display the decimal number from 0 to 9.	EEH408-4
16.	Interface relay with microcontroller and turn it 'ON' and 'OFF'.	EEH408-4
17.	Develop an ALP to generate delay using timer register.	EEH408-4
18.	*Develop an ALP to generate pulse and square wave by using timer delay.	EEH408-4
19.	*Develop an ALP to transfer 8 bit data serially on serial port.	EEH408-4
20.	*Interface LCD with 8051 microcontroller to display the characters and decimal numbers.	EEH408-5
21.	Interface ADC with 8051 microcontroller and verify input/output.	EEH408-5
22.	Interface Stepper motor to microcontroller and rotate in clockwise and anticlockwise direction at the Given angle	EEH408-6
23.	Design water level controller using any suitable open source simulation software to detect and control the water level in a tank.	EEH408-6

*-Atleast 6 practicals are mandatory. Other practicals can be done by students in self learning activity.

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	<i>EEH408-1 Interpret the prominent features of different types of microcontrollers.</i>		
1	Introduction to Microcontrollers 1.1 Evolution of Microcontrollers 1.1.1 Block diagram of Microcomputer 1.1.2 Elements of Microcomputer (Buses Microprocessor, Memory, I/O devices) 1.1.3 Types of buses (Address, Data and control bus) 1.2 Types of architectures: Von Neuman and Harward Architecture.	04	08

	<p>1.3 Comparison of Microcontroller and Microprocessor on basis of: Memory, Complexity, Type of Architecture, Cost, Applications, Typical examples of Microcontrollers and Microprocessors</p> <p>1.4 Need for Microcontrollers in Electrical Engineering (Power Systems, Smart Metering, Motor Control)</p>		
<i>EEH408-2 Interpret the salient architectural features of 8051 microcontrollers.</i>			
2	<p>Architecture of 8051 Microcontroller</p> <p>2.1.1 8051 Architecture: Features and Selections factors for Microcontroller</p> <p>2.1.2 Architectural Block diagram of 8051, function of each block</p> <p>2.1.3 Pin diagram, function of each pin</p> <p>2.1.4 Memory organization of Internal memory (RAM and ROM)</p> <p>2.1.5 Various registers and SFRs of 8051</p>	08	12
<i>EEH408-3 Develop and Maintain the assembly language program for different operations.</i>			
3	<p>8051 Instruction Set and Programs</p> <p>3.1 Overview of 8051 instruction set</p> <p>3.1.1 Instruction Format for 8051 Microcontroller</p> <p>3.1.2 Introduction to Assembler and Various addressing modes</p> <p>3.2 Classification of instructions</p> <p>3.2.1 Data transfer instructions</p> <p>3.2.2 Arithmetic instructions</p> <p>3.2.3 Logical instructions</p> <p>3.2.4 Branching instructions</p> <p>3.2.5 Bit manipulation instructions</p> <p>3.2.6 Stack, subroutine and interrupt related instructions</p> <p>3.2.7 Assembler Directives: ORG, DB, EQU, END, CODE, DATA</p> <p>3.3 Simple Programs based on above instructions and directives.</p>	08	14
	Sub-total	20	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
<i>EEH408-4 Interface and program different I/O devices with 8051 in assembly</i>			
4	8051 Internal Peripherals and Related Programs 4.1 Configuration and Programming of I/O Port :P0, P1, P2, P3 4.2 I/O interfacing: LED, Relays, Seven segment display 4.3 Timer/Counter programming 4.3.1 Timer / Counter logic and modes 4.3.2 Simple programs on timer to generate time delay and square wave.	06	14
<i>EEH408-5 Interface and serial communication of I/O devices with 8051 in assembly</i>			
5	Serial communication 5.1 Serial communication SFRs: SCON,SBUF,PCON 5.2 Modes of serial communication 5.3 Simple programs for serial communication	08	14
<i>EEH408-6 Maintain different 8051 based applications</i>			
6	Peripheral interfacing and Applications Interfacing diagram with programming of following with 8051 6.1 LCD display interfacing 6.2 8 bit ADC and DAC interfacing (0808/0809) 6.3 DC and Stepper Motor interfacing 6.4 Water Level controller design using 8051	08	08
Sub-total		22	36

G. Suggested micro-project / assignment/ activities for specific learning / skill development (SELF LEARNING)

Micro project

- a. Build a class period bell using microcontroller 8051.
- b. Build a circuit using 8051 microcontroller to blink LED.
- c. Build a circuit to display number 0 to 9 with a given delay.
- d. Build digital clock with 8051 microcontroller.
- e. Develop Fire Detection System using smoke and temperature sensor.

Student Activity

- a. Prepare power point presentation on applications of microcontroller.
- b. Undertake a market survey of different microcontrollers.

Assignment

- a. Prepare a chart of various features using data sheets of 8051 microcontroller and its derivatives.
- b. Prepare chart of stepper motor to display its features and steps for its operations using data sheets.
- c. Prepare a chart of various types of ADC and DAC to display its features and pin functions using data sheets.

- d. Prepare a chart of various types of LCDs to display its features , pin functions and steps of operations using data sheets.
- e. Prepare a power point presentation on 8051 interfacing/applications.

H. Specification table for setting question paper for semester end theory assessment

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Interpret the prominent features of different types of microcontrollers..	02	2	4	8	EEH408-1
I / 2	Interpret the salient architectural features of 8051 microcontrollers.	02	4	6	12	EEH408-2
I / 3	Develop and Maintain the assembly language program for different operations.	02	6	6	14	EEH408-3
II / 4	Interface and program different I/O devices with 8051 in assembly	02	4	8	14	EEH408-4
II / 5	Interface and serial communication of I/O devices with 8051 in assembly	02	6	6	14	EEH408-5
II / 6	Maintain different 8051 based applications	02	2	4	8	EEH408-6
Total Marks		12	24	34	70	

I. Assessment Criteria

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations
2. Class room practices
3. Use of projector and soft material for demonstration
4. Virtual Laboratory

K:- Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Kenneth, Ayala	8051 Microcontroller Architecture Programming and Application	PHI Learning
2	Deshmukh, Ajay	Microcontroller Theory and Application,	McGraw Hill.
3	Kamal, Raj,	Microcontroller Architecture Programming, Interfacing and System Design	Pearson Education India,
4	Mathur; Panda,	Microprocessors and Microcontrollers	PHI Learning
5	Krishna Kant,	Microprocessors and Microcontrollers: Architecture programming and System Design	PHI Learning

i. Text Books

Sr. No	Name of Book	Author	Publication
1	Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; MckinlayRoline D.	The 8051 Microcontroller and Embedded system	Pearson Education
2	Pal, Ajit,	Microcontroller Principle and Application	PHI Learning
3	Ayala Kenneth J	The 8051 Microcontroller	Thomson Delmar Learning, 2004 ISBN: 9781401861582
4	Chattopadhyay Santanu	Microcontroller and Applications	All India Council for Technical Education, 2023

M.Learning Website & Software

- i. www.nptel.iitm.ac.in
- ii. www.learningaboutelectronics.com
- iii. www.futurlec.com
- iv. www.bis.org.in
- v. www.electrical4u.com
- vi. www.cadsoft.io
- vii. www.electronics-tutorials.com

COURSE NAME : **ROBOTICS & AUTOMATION**
COURSE CODE : **EEH409**
COURSE ABBREVIATION : **HRAA**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	1
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	--	
	NLH-Notional Learning	05	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	50
--	--	--	--	--	25	10	25@	10	--	--	

(Total IKS Hrs for Sem. : Nil)

C. Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
 Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Industrial robots are widely used in many manufacturing industries, to make it more competitive and efficient. The most obvious impact of industrial robots is that they eliminate many dull, dirty, dear, difficult and dangerous tasks. The use of robot helpful in hazardous and challenging environments. The purpose of Industrial Robotics course is to respond the demands of workforce in industry. It is enormous need that students to learn Industrial Robotics to

become industry ready.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Operate industrial robot by developing program and using various sensors.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH409-1 Maintain safe practices while handling or working with robot.

EEH409-2 Identify basic components of industrial robot.

EEH409-3 Operate & Program robot for given application.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
EEH409-1 Maintain safe practices while handling or working with robot.	-	-	-	2.00	3.00	-	3.00	-	-
EEH409-2 Identify basic components of industrial robot.	1.00	2.00	-	-	-	-	-	2.00	-
EEH409-3 Operate & Program robot for given application..	-	3.00	3.00	2.00	-	-	2.00	-	-

F. CONTENT:-

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Robotics developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	Introduction to Industrial robotics lab and safety	EEH409-1
2	Demonstration operation of teach pendant	EEH409-2
3	Operation of Motor and drive	EEH409-2
4	Interfacing of end effectors	EEH409-2

Sr. no	Laboratory experiences	CO
5	Introduction to microcontrollers and PLC	EEH409-3
6	Robot programming basic- Basic Robot Program Instructions: MOVE, POINT, WAIT, SET, IF, ELSE, LOOP, HALT, JUMP	EEH409-3
7	Robot programming for Conditional Statements.	EEH409-3
8	Perform the sorting of packages using given robotic arm.	EEH409-3
9	Industrial robot program for Merged Movements, Circular and Arc Movements	EEH409-3
10	Setup, operating and Programming for Machine Tending with Industrial Robotic Arm	EEH409-3

Note:-Atleast 6 practicals need be completed.

II) Theory

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH409-1: Maintain safe practices while handling or working with robot.			
1	1.1 Introduction, Definition, need, brief history of Industrial Robots. 1.2 Introduction, need, brief & computer languages needed for computer programming of industrial robots 1.3 Automation: Type of automation, Need for automation 1.4 Application of Robots in Industries 1.5 Types of Robots 1.6 Safe Practices while operating the Robot, Safety Symbols, Safety Gear, Applicable Safety Standards, General Safety Information, Safety Symbols on the Robotic Arm, Robot Controller, and Teach Pendant. 1.7 Risk Assessment, Workspace, and Safety Zones, Personal Safety Equipment, Moving the Robot without Power, Residual Risks.	5	--
CO: EEH409-2: Identify basic components of industrial robot.			
2	2.1 Robot configurations- Polar (Spherical), Cylindrical, Cartesian Coordinate, Jointed arm (Articuted), SCARA (Selective Compliance Assembly Robot Arm). 2.2 Basic elements of Robot system (Robot Anatomy): - Base, Manipulator arm, End Effectors, Sensors and transducers, Actuators and Drives, Control systems 2.3 Robot specification: - Degree of Freedom, Work envelope, Load carrying capacity, Speed of movement, Accuracy, Repeatability, Control Resolution, Spatial resolution, 2.4 Basic Robot motions: - Vertical motions, Radial motions, Rotational motions, Pitch motions, Roll motions, Yaw motions. 2.5 Types mechanical joints used in Robotics system: - Linear Joint, Orthogonal joint, Rotational Joint, Twisting Joint, Revolving Joint (Symbol, Notations) 2.6 Robots End Effectors: Types of End Effectors - Gripper and Tools, Grippers, Mechanical, Pneumatic, Magnetic, Vacuum, adhesive, Considerations in gripper selection 2.7 Introduction to I/O and PLC: For connection of computer to	6	--

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	robot for programming of robot		
CO: EEH409-3: Operate & Program robot for given application.			
3	Three phase synchronous motor 3.7 Robot Operation, Switching Modes, Jogging, Homing the Robot 3.8 Managing Robot Errors and Faults, Logging in and Configuring I/O 3.9 Robot Programming & Operating: Brief Introduction to Teach Pendant, Robot Programming Instructions, Jogging of Robot, Overview of Teach Pendant, Robot Arm, and Robot Controller, Central Processing Unit (CPU), I/O Channels, CAN I/O Module, Removable Storage, Basic Robot Program Instructions: MOVE, POINT, WAIT, SET, IF, ELSE, LOOP, HALT, JUMP, 3.10 Introduction to programming industrial robot by interfacing and programming of programmable logic controller 3.11 Introduction to programming industrial robot by interfacing and programming of microcontroller	7	--

G. Assessment Criteria

Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

H. Instructional Methods:

7. Lectures cum Demonstrations,
8. Class room practices.
9. Use of projector and soft material for demonstration

I. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

J. Reference Books:

S.N.	Name of Book	Author	Publication
7	Robotics And Industrial	R.K. Rajput	S.Chand Limited New Delhi

	Automation		2022
8	Industrial Robotics - Technology ,Programming and Applications	Nicholas Odrey	McGraw Hill Education
9	Robotics and Control	R. Mittle	McGraw Hill Education
10	Robotics Technology and Flexible Automation	S. R. Deb	McGraw Hill Education

K. Learning Website & Software

- a. <https://nptel.ac.in/courses/112105319>
- b. <https://nptel.ac.in/courses/112105249>
- c. <https://www.gre.ac.uk/>
- d. <https://www.exeter.ac.uk/>

GOVERNMENT POLYTECHNIC KOLHAPUR

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Electrical Engineering		
Programme Code	: EE	With Effect From Academic Year	: 2025-26
Duration Of Programme	: 6 Semester	Duration	: 15 week
Semester	: Sixth	Scheme	: MPECS 2023

S r n o	Course Title	Abbr.	Course Type	level	Course Code	Total IKS Hrs for Sem	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment /Micro Project)	Notional Learning Hours /Week			Theory				Based on LL & TL				Based on Self Learning		
							C L	T L	L L					FA- TH	SA- TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1	Switchgear & Protection	HSWP	DSC	4	EEH402	2	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175
2.	Elective- 2(Dept. related courses)		DSE	4	EEH403/ EEH404/ EEH405/ EEH406 EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
3.	Basic Python Programming	HBPP	SEC	4	EEH410	-	2	-	2	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50
4.	Electrical Testing and Commissioning	HETC	DSC	5	EEH501	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
5.	Emerging Trends in Electrical Engineering	HETE	DSC	5	EEH502	-	3	-	-	1	4	2	3	30*#	70*#	100	40	-	-	-	-	25	10	125
6.	Internet of Things (IOT)	HIOT	SEC	5	EEH504	-	2	-	2	-	4	2	-	-	-	-	-	25	10	-	-	-	-	25
7.	Elective- 3		SEC	5	EEH505/ EEH506/ EEH507/ EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Total						8	22		12	6	40	20		150	350	500		150	125	100			875	

ELECTIVE-II COURSES (Departed related Courses)

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hours/Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
							C	T	L					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1.	Non conventional Power Generation	HNCG	GE	4	EEH403	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
2.	Substation Practices & Maintenance	HSPM	GE	4	EEH404	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
3.	Advanced Solar and Wind power Technologies	HASW	GE	4	EEH405	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
4.	Electrical Design Fundamentals	HEDF	GE	4	EEH406	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
5.	Electric Traction	HETR	GE	4	EEH407	2	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150

ELECTIVE-III COURSES

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/Assignment/Micro Project)	Notional Learning Hours/Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
							C	T	L					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	Max	Min	
1.	PLC and SCADA	HPLC	GE	5	EEH505	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
2.	Industrial Automation and Control	HIAC	GE	5	EEH506	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3.	Instrumentation and Signal Conditioning	HINS	GE	5	EEH507	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4.	Electric Vehicle	HELV	GE	5	EEH508	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\$ Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks

5. 1 credit is equivalent to 30 Notional hrs.

6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprentice. /Project. /Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE NAME : SWITCHGEAR & PROTECTION
COURSE CODE : EEH402
COURSE ABBREVIATION : HSWP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	3
	Tutorial Learning	--	
	Laboratory Learning	02	
SLH-Self Learning	01		
NLH-Notional Learning	06		

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs for Sem.: 02 Hrs)

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

Switchgear and protection systems are vital for the safety of electrical installations. They detect faults, isolate faulty sections, and prevent damage to equipment, reducing the risk of accidents, fires, and power outages. Training students in these systems ensures that they can design, maintain, and troubleshoot such systems effectively, enhancing safety in real-world applications.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME:

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Maintain Switchgear & Protection Schemes in Electrical Power System.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

EEH402-1: Identify different switchgear components.

EEH402-2: Select & maintain switchgears for different applications

EEH402-3: Identify & describe various faults in power system

EEH402-4: Identify & select protective components for electrical system.

EEH402-5: Elaborate the concepts of coordination and selectivity in protection systems

EEH402-6: Prepare protection system for different applications

Competency, Course Outcomes and Programme Outcomes / Programme Specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High), 0 - No correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
EEH402-1	2	2	1	2	2	1	2	2	2
EEH402-2	2	2	3	2	2	2	2	2	2
EEH402-3	1	2	2	1	2	1	1	3	3
EEH402-4	2	3	3	2	2	1	2	2	2
EEH402-5	1	2	2	2	2	1	2	2	2
EEH402-6	1	3	2	2	1	1	1	2	1

F. CONTENT:-

I) Practical exercises

Sr. No.	Laboratory Experiences	CO
1	Draw sectional views of various circuit breakers.	EEH402-1
2	Prepare layout of an outdoor substation.	EEH402-1
3	Test the given fuse.	EEH402-2
4	Test the given Miniature Circuit Breaker (MCB)	EEH402-2
5	Plot a characteristics of Induction type over-current relay.	EEH402-4
6	Determine Plug Setting and Time setting Multiplier of Induction type relay.	EEH402-4
7	Demonstrate differential protection scheme for different types of faults on Alternator. Draw scheme layout.	EEH402-5
8	Demonstrate differential protection scheme for different types of faults on Transformer. Draw scheme layout.	EEH402-5
9	Test single phase preventer for protecting three phase induction motor.	EEH402-6
10	Prepare protection schemes for feeders / transmission Lines.	EEH402-6

II) Theory

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH402-1: Identify different switchgear components.			
1	<p>Unit 1 Introduction to Switchgears</p> <p>1.1 Definition & Purpose of Switchgear</p> <ul style="list-style-type: none"> • Importance of Switchgear in Electrical Systems • Classification of Switchgear: High Voltage & Low Voltage Switchgear. <p>1.2 Types of Switchgear</p> <ul style="list-style-type: none"> • Air Break, Air blast, Oil CB, Vacuum CB, SF6 CB <p>1.3 Basic Operation of Switchgear</p> <ul style="list-style-type: none"> • Arc Interruption, Quenching Methods • Fault Detection and Isolation <p>1.4 Ratings of Switchgear</p> <ul style="list-style-type: none"> • Current Rating, Voltage Rating, Short-Circuit withstand Rating <p>1.5 Switchgear Applications</p> <ul style="list-style-type: none"> • Protection in Power Distribution and Industrial Installations 	9	14
CO: EEH402-2: Select & maintain switchgears for different applications			
2	<p>Unit 2 Circuit Interrupting Devices:</p> <p>2.1 Fuses:</p> <ul style="list-style-type: none"> • HRC fuses – Construction, working, characteristics and applications. <p>2.2 Isolators:</p> <ul style="list-style-type: none"> • Vertical break, Horizontal break and Pantograph type. <p>2.3 L.T. circuit breaker:</p> <p>Working and applications of :</p> <ul style="list-style-type: none"> • Air circuit breakers (ACB), • Miniature circuit breakers (MCB), • Moulded case circuit breakers (MCCB), • MPCB , RCBO and Earth leakage circuit breaker(ELCB) <p>2.4 HT circuit breakers:</p> <p>Working, construction, specifications and applications of:</p> <ul style="list-style-type: none"> • Sulphur-hexa Fluoride (SF6) CB, • Vacuum circuit breaker • Minimum Oil CB <p>2.5 Arc formation process, methods of arc extinction (High resistance and Low resistance).</p> <p>Arc voltage, Recovery voltage, Re-striking voltage, RRRV. (Numerical)</p> <p>2.6 Selection of LT and HT circuit breakers (ratings).</p> <p>Selection of MCCB for motors.</p>	9	14

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH402-3: Identify & describe various faults in power system			
3	Unit 3 Basics of Protection: 3.1 Necessity, functions of protective system. 3.2 Normal and abnormal conditions. 3.3 Types of faults and their causes. 3.4 Protection zones and backup protection. 3.5 Short circuit fault calculations in lines fed by generators through transformers. 3.6 Need of current limiting reactors and their arrangements.	4	6

Section –II

CO: EEH402-4: Identify & select protective components for electrical system.			
4	Unit 4. Protective Relays: 4.1 Basic relay terminology: Protective relay fundamental requirements, Relay time, Pick up, Reset current, current setting, Plug setting multiplier (PSM), Time setting multiplier (TSM) (Numerical). 4.2 Types of Protective Relays : <ul style="list-style-type: none"> • Construction, Principle of working, Applications of: Electromechanical Relays, Static Relays, Overcurrent, Differential, Distance, and Under-voltage Relays. 4.3 Relay Characteristics: <ul style="list-style-type: none"> • Time-Current Characteristics • Resetting and Operating Times 4.4 Microprocessor based protection relays: <ul style="list-style-type: none"> • Block diagram, working and protection features. 4.5 Digital Protection Systems: <ul style="list-style-type: none"> • Numerical Relays and Their Advantages • Communication Protocols in Protection (IEC 61850) 	8	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH402-5: Elaborate the concepts of coordination and selectivity in protection systems			
5	Unit 5 Protection Schemes: 5.1 Overcurrent Protection: <ul style="list-style-type: none"> Instantaneous and Time-Delayed Overcurrent Protection, Directional Overcurrent Protection 5.2 Differential Protection: <ul style="list-style-type: none"> Working Principle and Applications Transformer and Generator Differential Protection 5.3 Distance Protection: <ul style="list-style-type: none"> Impedance, Reactance, and Mho Relay Principles Application to Transmission Lines 5.4 Busbar Protection <ul style="list-style-type: none"> Differential Protection for Busbars Unit and Non-Unit Protection 5.5 Feeder Protection <ul style="list-style-type: none"> Distance, Overcurrent, and Under-frequency Protection 	8	12
CO: EEH402-6: Prepare protection system for different applications			
	Unit 6: Power System Protection 6.1 Protection of Power Transformers: <ul style="list-style-type: none"> Differential Protection, Buchholz Relay, and Overload Protection Protection for Tertiary Windings and Bushings 6.2 Generator Protection <ul style="list-style-type: none"> Protection Against Overcurrent, Earth Fault, and Loss of Excitation Rotor Earth Fault Protection 6.3 Line Protection <ul style="list-style-type: none"> Overcurrent, Distance, and Directional Protection for Transmission Lines 6.4 Motor Protection <ul style="list-style-type: none"> Overload, Earth Fault, and Stall Protection Thermal Protection and Motor Protection Relays 6.5 Application of Protection in Power Systems <ul style="list-style-type: none"> Coordination of Protection for Generating Stations and Substations <p style="color: red;">**Terminology related to Indian Knowledge System</p>	7	12

** No questions will be asked on IKS learning subtopics in any question papers.

G. List of Activities / Microprojects / Assignments under SLA

Sr. No.	List of Activities (under SLA)	Hrs Allotted
1	Write a report on causes of over-voltages in power system.	01
2	Write a report on Lightning phenomena.	01
3	Write a report on Protection of power system against travelling waves.	01
4	Write a report on different types of Lightning arrestors.	01
5	Write a report on arcing ground and Neutral grounding.	01

6	Microproject on Installation and commissioning of MCB / ELCB: Calculate load current and finalize the specifications of protection schemes for Electrical Engineering laboratory.	02
7	Microproject on Alternator/Transformer/Motor/Busbar and Transmission Line protection Relays: Prepare power point presentation on digital and multifunction protection relays used to protect feeder, motor, generator, busbar and Transmission line.	02
8	Microproject on development of training kit for Single-phasing preventer.	02
9	Microproject on IEC 61850 communication protocol : Prepare a power point presentation on communication protocol used to provide communication between different equipment located in a substation, such as protection, control, and measurement equipment, as well as (IEDs) intelligent electronic devices.	02
10	Microproject on Case study of past major grid power failure: Prepare a report after studying the previous power failure in India or abroad.	02

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to Switchgears	4	6	4	14	EEH402-1
I / 2	Circuit Interrupting Devices	4	6	4	14	EEH402-2
I / 3	Basics of Protection	2	2	2	06	EEH402-3
II / 4	Protective Relays	2	4	6	12	EEH402-4
II / 5	Protection Schemes	2	4	6	12	EEH402-5
II / 6	Power System Protection	-	6	6	12	EEH402-6
Total Marks					70	

I. Assessment Criteria:

i) Formative Assessment of Practical:

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr.No.	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05

4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Mehta V. K ; Rohit Mehta	Principles of Power System	S.Chand and Co., New Delhi., 2016 ISBN: 978-93-5501-077-3
2	Rao.Sunil S.	Switchgear and Protection	Khanna Publishers, New Delhi, 2015 ISBN: 978-93-87394-72-8
3	Gupta. J. B.	Switchgear and Protection	S. K. Kataria and Sons, New Delhi, 2015 ISBN: 978-93-5014-372-8.
4	Singh, R. P.	Switchgear and Power System Protection	PHI Learning, New Delhi, 2015 ISBN: 978-81-203-3660-5.
5	Ram, Badri Vishwakarma D. N.	Power System Protection and Switchgear	McGraw-Hill, New Delhi. 2015 ISBN : 978-00-7107-774-3
6	Veerapan, N., Krishnamurty, S. R.	Switchgear and Protection	S .Chand and Co., New Delhi. 2014 ISBN: 978-81-2193-212-7.

M. Learning Website & Software

- a. www.nptel.com/iitm/
- b. www.howstuffworks.com/
- c. www.virtual lab.com
- d. www.sskphdmm.com
- e. <http://www.youtube.com/watch?v=RAc1RYilugI>

Course Name : Non-Conventional Power Generation
Course Code : EEH403
Course Abbreviation : GNCG

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	-	
	NLH-Notional Learning	6	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
03	30	70	100	40	25	10	25#	10	--	--	

(Total IKS Hrs for Semester : 02 Hrs)

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
 2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
 3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
 4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
 5. 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) Rationale:

Energy plays a vital role in all sectors of a country's economy. The growing population and rising standards of living have led to an increased demand for energy, resulting in an energy crisis. Conventional energy sources alone are insufficient to meet these demands, making the adoption of alternative energy sources essential for sustainable power generation. With the increasing reliance on renewable energy, diploma engineers are expected to develop, operate, and maintain these systems efficiently. Therefore, it is crucial to understand the fundamentals of energy conversion, conservation, energy auditing, and waste heat recovery techniques to optimize energy use and promote sustainability.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Identify & suggest appropriate non-conventional energy use techniques.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH403.1 Select appropriate solar equipment based on specific application requirements such as residential, industrial, or agricultural use.

EEH403.2 Interpret terminologies of wind energy conversion and the use of wind energy conversion systems

EEH403.3 Build the bio-mass energy conversion systems for the specific application.

EEH403.4 Interpret different types of ocean energy conversion systems and tidal.

EEH403.5 Describe the other alternative energy sources.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Competency: Identify & suggest appropriate non-conventional energy use techniques.	03	01	02	02	02	01	02	01	01
EEH403- 1: Select appropriate solar equipment based on specific application requirements such as residential, industrial, or agricultural use.	03	01	02	02	02	01	02	01	01
EEH403-2: Interpret terminologies of wind energy conversion and the use of wind energy conversion systems	03	01	02	02	02	01	02	01	01
EEH403-3: Build the bio-mass energy conversion systems for the specific application	03	01	02	02	02	01	02	01	01
EEH403-4: Interpret different types of ocean energy conversion systems and tidal.	03	01	01	02	01	01	02	01	01
EEH403-5: Describe the other alternative energy sources.	03	01	02	01	02	01	02	01	01

F. CONTENT:-

III) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Non-conventional Energy sources developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr.No.	Laboratory experiences	Course outcome
1	Measurement of electrical parameters of the solar cells/panel.	EEH403-1
2	Observe the effect of load and inclination angle on solar panel output.	EEH403-1
3	Connect Series parallel connection of solar panels.	EEH403-1
4	Determine sizing of Solar panels required for a residential house having 500 W electrical load.	EEH403-1
5	Visit to wind power plant for observing the parts of wind mill.	EEH403-2
7	Demonstration of biogas operated plant. OR Visit to biogas operated Plant.	EEH403-3
8	Demonstration of geothermal power plant using video/animation.	EEH403-4
9	Demonstration of tidal power plant using video/animation.	EEH403-4
10	Demonstration of marine power plant and ocean thermal energy conversion (OTEC) plant using video/animation.	EEH403-5
11	Demonstration of small hydro power plant using video/animation. OR Visit to hydro power plant.	EEH403-5

IV) Theory

SECTION I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
EEH403-1 Select appropriate solar equipment based on specific application requirements such as residential, industrial, or agricultural use.			
	1. SOLAR ENERGY ** Ancient Energy Systems and Practices(IKS) 1.1 Major Sources of Energy: Renewable and Non-renewable. 1.2 Need and Prospectus of Alternate Energy Sources 1.3 Solar radiation Geometry: Declination, hour Angle, Altitude angle, incident angle, Zenith angle, solar Azimuth angle. 1.4 Instruments for measuring solar radiation. 1.5 Principle of conversion of solar radiation into Heat and Electricity. 1.6 Basic Photovoltaic system for power generation: Concept and Block Diagram	15	20

	1.7 Construction and working of typical flat plate collector and solar concentrating collector with their applications, advantages and limitations. 1.8 Working principle, diagram of Solar distillation, Solar pumping, Solar cooking.		
EEH403-2 Interpret terminologies of wind energy conversion and the use of wind energy conversion systems.			
	2. WIND ENERGY Traditional Wind Technologies (IKS) 2.1 Wind power scenario in the world and India. 2.2 Principle of Wind Energy Conversion. 2.2.1 Nature of the wind energy. 2.2.2 The Power in wind 2.2.3 Power coefficient 2.2.4 Maximum power in wind (without derivation) 2.2.5 Forces on the blades, Pitch Angle, Tip Speed Ratio. 2.3 Rotation principle: Lift and Drag principle 2.4 Selection of site for WECS/wind mill. 2.5 Classification of WEC systems. 2.6 Basic components of WECS 2.7 Advantages and limitations of WECS 2.8 Structure and components of wind mill 2.9 Types of Wind Turbine:- 2.9.1 Horizontal Axis Wind Turbines (HAWT) 2.9.2 Vertical Axis Wind Turbines (VAWT) (No types)	15	14
		30	34

SECTION II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
EEH403-3 Build the bio-mass energy conversion systems for the specific application.			
	3. BIO-MASS ENERGY **Decentralized Energy Concepts (IKS) 3.1 Concept of Biomass as a renewable energy source. 3.2 Anaerobic Digestion 3.3 Various factors affecting the production of biogas 3.4 Materials used for biogas generation. 3.5 Classification of Biogas Plants:- a) Fixed dome type Biogas plant b) Floating drum type biogas plant - KVIC c) Deenbandhu Biogas Plant d) Pragati Biogas Plant 3.6 Selection of site for Biogas Plant.	08	10

EEH403-4 Interpret different types of ocean energy conversion systems and tidal.			
	4. ENERGY FROM THE OCEANS 4.1 Ocean Thermal Electric Conversion- Basic Principle. 4.2 Methods of Power Generation a) Open cycle OTEC system b) Closed cycle OTEC system 4.3 Energy from Tides:- 4.3.1 Basic principle of Tidal power plant. 4.3.2 Components of Tidal Power Plants. 4.3.3 Operation Methods of utilisation of tidal energy. 4.3.4 Advantages and limitations for tidal power Generation. 4.3.5 Sites Requirements for tidal power generation.	08	10
EEH403-5 Describe the other alternative energy sources.			
	5. OTHER ALTERNATE SOURCES OF ENERGY 5.1 Geothermal Energy:- 5.1.1 Geothermal Resources. 5.1.2 Geothermal power plant: General arrangements, types (Dry type, Wet Type and Binary type), working principle, advantages and limitations 5.1.3 Geothermal occurrence in India. 5.2 Small Hydroelectric Plant (Mini and Micro hydel) Nature, Classification of SHP station 5.3 Hydrogen Fuel Cell- Principle of Operation, Advantages, Limitation and Application. 5.4 Magneto-Hydro Dynamic(MHD) Power Generation-Basic diagram and principle only.	14	16
		30	36

**** No questions will be asked on IKS learning subtopics in any question papers.**

G : List of Assignments under SLA (Group size- minimum 3-4 students)

Not Applicable

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks Cognitive based (level wise)			Total marks	Course outcome
		Remember	Understanding	Application		
I / 1	Solar Energy	10	04	06	20	EEH403-1
I / 2	Wind Energy	04	06	04	14	EEH403-2
II / 3	Bio-mass Energy	02	04	04	10	EEH403-3
II / 4	Energy from the Ocean	02	04	04	10	EEH403-4

II / 5	Other alternate sources of energy	06	06	04	16	EEH403-5
Total					70	

I :-Assessment Criteria

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

4. Lectures cum Demonstrations,
5. Class room practices.
6. Use of projector and soft material for demonstration
- 4.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

Sr.No.	Name of Book	Author	Publication
1.	Non-conventional energy Resources	Dr B.H.Khan	Tata McGraw Hill
2.	Non-conventional energy sources	G. D. Rai	Khanna publication
3	Solar energy	S. P. Sukhatme	Tata McGraw Hill
4	Solar energy	H. P. Garg	Tata McGraw Hill
5	Power plant engineering	Arora and Domkundwar	Dhanpat Rai & Co.

6	Industrial energy conservation	D. A. Ray	Pergaman Press
7	Energy management handbook	W. C. Turner	Wiley Press
8	Energy Technology,	O.P. Gupta	Khanna Publishing House, New Delhi (ISBN: 978- 9386173-683)

M. Learning Website & Software

- i) www.mahaurja.com
- ii) www.indiasolar.com
- iii) www.beeindia.in

Course Name : Sub-Station Practices and Maintenance
Course code : EEH404
Course Abbreviation : HSPM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	3
	Tutorial Learning	-	
	Laboratory Learning	2	
SLH-Self Learning			
NLH-Notional Learning	6		

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	30	70	100	40	25	10	25#	10			
											150

(Total IKS Hrs for Sem. : 02 Hrs)

C: ABBREVIATIONS: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 1(one) credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.
 * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

A Diploma Engineer to be employed as power engineer in the substations of power system has to be conversant with the operation, control, working of sub-stations to maintain an uninterrupted power flow. Power engineer should be in a position to take decisions; Select electrical equipment as per specification, follow standard installation procedures, Testing procedures, Monitoring and control actions in the substation and maintenance work as per checklist and keeping records for future references. The topics included are meant to prepare the technician to carry out these responsibilities in day-to-day work.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

“Operate and maintain substation equipment following safety practices”

E. COURSE LEVEL LEARNING OUTCOMES (COs)

EEH404-1: Follow safety rules for Substation.

EEH404-2: Maintain substation earthing and neutral grounding.

EEH404-3: Maintain the Sub-station Equipment and Bus bar layout

EEH404-4: Interpret single line diagram of substation.

EEH404-5: Maintain Gas insulated Substation

EEH404-6: Work as supervisor in the control room of substation.

Competency, course outcomes and programme outcomes / programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High) and “-” for no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
EEH404-1	3	2	2	2	2	1	3	3	2
EEH404-2	3	3	2	2	2	2	2	2	2
EEH404-3	3	2	2	2	2	1	2	2	2
EEH404-4	3	2	2	2	2	1	2	3	3
EEH404-5	3	2	2	2	2	1	2	3	3
EEH404-6	3	2	2	2	2	1	2	3	2

F. CONTENT:-

I) Practical exercises:

The following practical exercises shall be conducted in the *Transformer Laboratory* developed by the Institute in practical sessions of batches of about 20-22 students:

Sr. No.	Laboratory Experiences	CO
1	Power plant visit. To study different activities like installation, maintenance and working, its economic planning and monitoring of activities of plant.	EEH404-1
2	Visit to substation for understanding load distribution and control	EEH404-3
3	Prepare layout and assignment of procedure for installation and commissioning of a power transformer in a Substation	EEH404-3
4	Maintenance of substation equipment	EEH404-4
5	Use of CT/ PT, Current setting and time setting of over current induction type	EEH404-5

	relay. Write report on it.	
6	Control room visit to write report on different activity to control power at substation control room.	EEH404-6
7	Maintenance schedule of 11 kV pole-mounted substation	EEH404-4
8	Maintenance schedule of 33 / 11 kV substation	EEH404-4
9	Maintenance schedule of EHV substation	EEH404-4

II) Theory

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning Evaluation Marks
CO: EEH404-1: Follow safety rules for Substation.			
1	<p>Overview of Substations</p> <p>1.1 Need of electrical substation. Factors governing the selection of the site of the substation, Classification of sub-station based on voltage level, Indoor and Outdoor, configuration, application, various symbols used in single line diagram.</p> <p>1.2 Conductor used in main bus and auxiliary bus for 11KV, 33KV, 132KV substation.</p> <p>1.3 Typical earth resistance values of various substation and structures as per IE rules:- 11KV,33KV,132KV substation and double pole structure, transmission tower(tower foot resistance)</p> <p>1.4 General safety rules to be followed to minimize the risk of electrical hazards in substation.</p>	12	14
CO: EEH404-2: Maintain substation earthing and neutral grounding.			
2	<p>11 kV Substation</p> <p>2.1 Need for pole mounted and plinth mounted substation.</p> <p>2.2 11KV/440V Pole mounted substation Equipment and accessories: Functions and rating of: Three phase distribution transformer, Lightning arrester(LA), Metering Current transformer (CT), Metering voltage transformer PT, Air break switch (AB switch), Drop out (DO) fuse, insulators and Distribution box.</p> <p>2.3 Layout and Single line diagram of pole mounted substation.</p> <p>2.4 Insulation resistance measurement.</p> <p>2.5 Earthing: Equipment earthing and System earthing.</p> <p>2.6 Earth resistance measurement and method of improving earth resistance.</p> <p>2.7 Routine, preventive and breakdown maintenance..</p> <p>2.8 Safety practices followed during routine, preventive and breakdown maintenance.</p>	10	12
CO: EEH404-3: Maintain the Sub-station Equipment and Bus bar layout			
3	<p>33 kV Sub-Station</p> <p>3.1 Need of 33KV/11KVsubstation.</p>	8	8

	<p>3.2 33KV/11KV substation Equipment and accessories: Functions and rating of: Power transformer, Lightning arrester(LA), Instrument Transformer-Current transformer (CT) and Potential transformer (PT), HT fuses, Isolating switches (Isolator), Insulators, control and relay panel, station transformer, capacitor bank, battery and charger and circuit breaker.</p> <p>3.3 Layout and Single line diagram of 33KV substation.</p> <p>3.4 Earthing: Equipment earthing and System earthing</p> <p>3.5 Routine, preventive and breakdown maintenance.</p> <p>3.6 BDV (break down voltage) test on power transformer oil.</p> <p>3.7 Safety practices followed during routine, preventive and breakdown maintenance.</p> <p>3.8 Fire-fighting equipment for the different situations in the substation.</p>		
Total		30	34

Section –II

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH404-4: Interpret single line diagram of substation			
4	<p>132 kV Substation</p> <p>4.1 Need of 132KV/33KV substation.</p> <p>4.2 132KV/33KV substation Equipment and accessories: Functions and rating of: Power transformer, Lightning arrester (LA), Instrument Transformer-Current transformer (CT) and Potential transformer (PT), Capacitor voltage transformer (CVT), HT fuses, Isolating switches (Isolator), Insulators, control and relay panel, station transformer, capacitor bank, battery and charger, wave trap/wave drum, Power line carrier communication (PLCC) and circuit breaker.</p> <p>4.3 Single line diagram of 132KV/33KV substation.</p> <p>4.4 Earthing: Equipment earthing and System earthing.</p> <p>4.5 Step potential, touch potential, mesh potential, transferred potential, earth mat or grid.</p> <p>4.6 Routine, preventive and breakdown maintenance; Safety practices followed during routine, preventive and breakdown maintenance.</p> <p>4.7 Fire-fighting equipment for the different situations in the substation.</p> <p>4.8 Non-contact type thermal sensor to locate and record hot spot(s) in a substation.</p>	15	16
CO: EEH404-5: Maintain Gas insulated Substation			
5	<p>Gas insulated Substation (GIS)</p> <p>5.1 Need of gas insulated substation (GIS).</p> <p>5.2 Essential parts of GIS, advantages of GIS, drawbacks of GIS.</p> <p>5.3 Single line diagrams of GIS.</p> <p>5.4 Partial discharge monitoring.</p>	9	12

	5.5 Routine, preventive and breakdown maintenance of GIS. 5.6 Safety practices followed during routine, preventive and breakdown maintenance. 5.7 Firefighting equipment used in GIS.		
CO: EEH404-6: Work as supervisor in the control room of substation.			
6	Control room arrangement 6.1 General features of control boards 6.2 Control circuit wiring diagrams and markings **Indian Knowledge system related to Substation, safety and practices.	6	8
Total		30	36

**** No questions will be asked on IKS learning subtopics in any question papers.**

G . LIST OF ASSIGNMENTS UNDER SLA

Not Applicable

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Overview of Substations	4	8	2	14	EEH404-1
I / 2	11 kV Sub-Station	2	4	6	12	EEH404-2
I / 3	33 kV Sub-Station	2	4	2	08	EEH404-3
II / 4	132 kV Substation	4	6	6	16	EEH404-4
II / 5	Gas insulated Substation (GIS)	2	6	4	12	EEH404-5
II / 6	Control room arrangement	2	2	4	08	EEH404-6
Total Marks					70	

I.ASSESSMENT CRITERIA

i) Formative Assessment of Practical:

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. INSTRUCTIONAL METHODS

- a. Lectures cum Demonstrations,
- b. Class room practices.
- c. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publication
1	Elements of Electrical Power Station Design	M. V. Deshpande	Wheeler Publication
2	Power Stations & Sub-stations	L. Bapitdanev & Tarasov.	-
3	Switchgear & Protection	Sunil S. Rao	Khanna Publication
4	EHV Substation & Equipment	N. P. Bhoumick, B. Bhattacharya.	-

M. LEARNING WEBSITE & SOFTWARE

1. <https://electrical-engineering-portal.com> > books-and-guide
2. <https://www.substation-safety.com>
3. <https://easyengineering.net>

COURSE NAME : ADVANCED SOLAR AND WIND POWER TECHNOLOGIES.

COURSE CODE : EEH 405

COURSE ABBREVIATION : HASW

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning		
	NLH-Notional Learning	6	

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		Practical		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10			150

(Total IKS Hrs for Sem. : 02 Hrs)

C. Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

The contemporary energy generation landscape includes diverse sources such as hydro, thermal, wind, and solar. Wind and solar technologies are gaining popularity, especially in India, where abundant solar days offer significant potential. Leveraging wind and solar power reduces reliance on conventional energy resources. The course on Advanced Solar and Wind Technologies equips students with the skills

to manage and operate solar and wind plants, preparing them for meaningful contributions to the renewable energy sector and promoting sustainable development.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Maintain solar and wind power plants.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH 405-1. Identify the components of different solar Photovoltaic systems.

EEH 405-2. Maintain solar PV systems.

EEH 405-3. Identify the parts of small and large wind turbines.

EEH 405-4. Diagnose major electrical faults and its remedies.

EEH 405-5. Maintain small wind turbines.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
EEH 405-1 : Select components for off-grid solar domestic PV systems	1.00	-	1.00	1.00	-	2.00	1.00	2.00	2.00
EEH 405-2: Assemble solar PV systems.	2.00	3.00	3.00	3.00	1.00	2.00	2.00	3.00	3.00
EEH 405-3 : Install solar PV off- grid small capacity systems	1.00	-	1.00	1.00	-	2.00	1.00	2.00	2.00
EEH 405-4 : Maintain solar on-grid systems	-	1.00	-	-	3.00		2.00	-	-
EEH 405-5: Maintain Small wind turbine	2.00	2.00	2.00	2.00	-	2.00	2.00	2.00	2.00

F. CONTENT:-

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for COMPUTER Simulation LAB/Field Visit/Wind or Solar Simulator Test Kit* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1.	Identify different types of solar power systems	EEH 405-1
2.	Identify different components of PV solar systems	EEH 405-2
3.	Simulation/Video show on assembly of a solar off-grid PV system (DC-DC)	EEH 405-2
4.	Simulation/Video show on assembly solar On-grid PV system (DC-AC).	EEH 405-2
5.	Simulation/Video show on assembly solar PV system with smart metering.	EEH 405-2
6.	Test solar PV panel on Solar PV Simulator Test kit	EEH 405-2,4
7.	Test solar PV Energy Conversion Analysis using Solar PV Simulator Test kit	EEH 405-2,4
8.	Test DC-DC solar PV system using Solar PV Simulator Test kit.	EEH 405-2,4
9.	Test DC-AC off-grid solar PV system Solar PV Simulator Test kit.	EEH 405-2,4
10.	Simulation of Troubleshooting analysis the solar PV system	EEH 405-4
11.	Identify the parts of a direct drive and geared small wind turbine	EEH 405-3,5
12.	Study direct drive small wind turbine using Wind Energy Simulator Test kit	EEH 405-3,5
13.	Study geared small wind turbine using video/simulation/ demonstration	EEH 405-3.5
14.	Identify major parts of a large wind turbine using video/simulation/ demonstration	EEH 405-3,5
15.	Check the electrical performance of wind power system at field visit/simulation	EEH 405-3,5
16.	Check the performance of direct drive small wind turbines at field visit/simulation	EEH 405-3,5
17.	Check the performance of geared small wind turbines at field visit/simulation	EEH 405-3,5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 405-1. Identify the parts of different solar power systems,			
1	1. Solar energy conversion 1.1 Renewable energy sources: Energy scenario in India and Maharashtra. 1.2 Types of solar systems: solar heating systems, solar PV systems, concentrated solar power (CSP) systems 1.3 Photovoltaic cell: Construction, types, compare. 1.4 Specifications: Typical specifications of solar cells like Voc, Isc, Wpeak	15	18

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.5 Solar thermal power conversion: Working principle, types and their block diagram. 1.6 Low temperature solar energy applications: Domestic water and space heating systems. 1.7 Ancient Solar Energy Application (IKS learning)		
CO: EEH 405 -2 Maintain PV System			
2	2. Solar PV power plants 2.1 Solar PV panels: Series and parallel connections of solar modules. 2.2 Performance: Influencing factors: tilt angle, solar radiation, I-V, P-V characteristics, maximum power point tracking (MPPT), and conversion efficiency. 2.3 DC-DC and DC-AC solar PV plants: Load estimation and selection of suitable solar panels, charge controller, batteries, switchgear and cables. 2.4 On-grid solar PV systems: Working principle of grid- tied dc-ac inverter, grid synchronization and active power export. 2.5 Working principle of Off-grid Solar PV System, battery Integration, Hybrid Energy Storage Systems 2.6 Net metering: main features. 2.7 Economics, potential and environmental impact : domestic active solar water heating, passive solar heating and day lighting 2.8 Way of Electricity formation in traditional era (IKS learning)	15	16

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 405-3. Identify the parts of a small and large wind turbine.			
3	3 Wind power technology 3.1 Energy in the wind, wind power density, wind maps. 3.2 Vertical axis and horizontal axis small wind turbines. 3.3 Drag and lift principle of working. 3.4 Power curves of wind turbines, MPPT. 3.5 Parts of a large wind turbine. 3.6 Aerodynamic control: Stall, pitch and active stall control of wind turbines. 3.7 Environmental impact. 3.8 Usage of Wind Energy Application in old times (IKS learning)	10	12
CO: EEH 405-4. Diagnose major electrical faults and its remedies.			

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
4	4. Components of wind power plants 4.1 Electrical generators in small wind turbines: permanent magnet synchronous generator, induction generator. 4.2 Electrical generators in large wind turbines: Squirrel-Cage rotor Induction Generator, Wound-Rotor Induction Generator, Doubly-Fed Induction Generator, Synchronous Generator. 4.3 Power electronic converters in different types of wind turbines. 4.4 Common electrical faults in small and large wind turbines.	10	14
CO: EEH 405-5. Maintain solar and wind power systems			
5	5. Maintain Solar and Wind Turbines. 5.1 Routine and preventive maintenance procedures of Small wind turbines. 5.2 Maintenance of rooftop and streetlight solar PV systems. 5.3 Elements, Configuration of wind solar hybrid system (Block Layout Diagram Representation). 5.4 Historical Information of Hybrid Energy. (IKS learning)	10	10

**** No questions will be asked on IKS learning subtopics in any question papers.**

**G : List of Assignments under SLA
Not Applicable**

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Identify the parts of different solar systems.	4	6	8	18	EEH405-1
I / 2	Maintain solar PV systems	4	6	6	16	EEH405-2
II / 3	Identify the parts of small and large wind turbine	6	6	4	12	EEH405-3
II / 4	Diagnose major electrical faults and its remedies	4	-	4	14	EEH405-4
II / 5	Maintain solar and wind power systems	4	4	4	10	EEH405-5
Total Marks					70	

I :-Assessment Criteria

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Solar Photovoltaic Technology And Systems - A Manual For Technicians, Trainers And Engineers	Solanki, Chetan Singh	Prentice Hall India (PHI) learning ISBN: 9788120347113
2	Non-conventional energy sources and utilization	Rajput R.K.	S.Chand and company Pvt. Ltd. ISBN:9788121939713
3	Wind Electrical Systems	Bhadra, S.N., Kastha, D., Banerjee, S.	Oxford University Press ISBN: 9780195670936
4	Wind Power Technology	Joshua Earnest	Prentice Hall India (PHI) learning ISBN: 9788120347786
5	Principles of Solar Engineering	Frank Kreith, Jan F Kreider	McGraw-Hill, New York ; 1978, ISBN: 9780070354760.

M. Learning Website & Software

- a. www.mnre.gov.in
- b. www.mahaurja.com
- c. www.solar mango.com
- d. www.ireda.gov.in
- e. www.seci.gov.in
- f. www.mahadiscom.in/SolarRoofTopNetMetering.shtm
- g. www.indianwindpower.com/

COURSE NAME : ELECTRICAL DESIGN FUNDAMENTALS.
COURSE CODE : EEH 406
COURSE ABBREVIATION : HEDF

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning		
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
03	30	70	100	40	25	10	25#	10			

(Total IKS Hrs for Sem. : 02 Hrs)

C. Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Diploma in Electrical Engineering students must design and fabricate magnetic coils for various applications, such as small transformers, contactor coils, and choke coils. To excel in these tasks, they need to understand the principles and techniques of magnetic coil and circuit design. The "Electrical Design Fundamentals" course provides students with the necessary skills to calculate and design parameters for single-phase and three-phase transformers, as well as induction motors. This knowledge prepares students to handle and design these machines effectively, enhancing their practical skills and industry readiness.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Design Parameters and component sizing of Electrical Machines especially Induction Motor and transformer.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH 406-1: Design of magnetic coil.

EEH 406-2: Design small single phase transformer.

EEH 406-3: Design single phase transformers.

EEH 406-4: Carry out cooling systems calculations for single phase and three phase transformer.

EEH 406-5: Design three phase induction motor up to 20 HP.

EEH 406-6: Design single phase induction motors.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/ps) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
EEH 406-1: Design of magnetic coil.	3.00	2.00	1.00	2.00	-	2.00	2.00	2.00	-
EEH 406-2: Design small single phase transformer.	3.00	2.00	1.00	2.00	-	2.00	2.00	2.00	-
EEH 406-3: Design single phase transformers.	3.00	2.00	1.00	2.00	-	2.00	2.00	2.00	-
EEH 406-4: Carry out cooling systems calculations for single phase and three phase transformer.	2.00	2.00	1.00	2.00	2.00	2.00	2.00	3.00	3.00
EEH 406-5: Design three phase induction motor up to 20 HP.	3.00	2.00	1.00	2.00	-	2.00	2.00	2.00	3.00
EEH 406-6: Design single phase induction motors.	3.00	2.00	1.00	2.00	-	2.00	2.00	2.00	3.00

F. CONTENT:-

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for COMPUTER Simulation LAB/Field Visit/Drawing sheet developed* by the Institute in practical sessions of batches of about 20-22 students:

Sr. no	Laboratory experiences	CO
1.	Design and prepare data sheet of single phase magnet coil parameters like dimension, winding, core etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-1
2.	Design of prepare drawing sheet small single phase transformer parameters like dimension, winding, core etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-2, 3
3.	Design of simulate small single phase transformer parameters like dimension, winding, core etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-2, 3
4.	Design of prepare data sheet small single phase Induction Motor parameters like dimension, winding, core etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-4
5.	Design of prepare data sheet small single phase Induction Motor Stator and Rotor Core Design etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-5
6.	Design of prepare drawing sheet small single phase Induction Motor parameters like Cooling Requirement using Electrical design software (Autocad, AnSYS etc)	EEH406-1
7.	Study Comparative Analysis of Various Design parameters available in Market Product of Single-Phase induction Motor (Web/ Market Survey)	EEH406-2, 3
8.	Study Comparative Analysis of Various Design parameters available in Market Product of Single Phase Transformer (Web/ Market Survey)	EEH406-4
9.	Study Comparative Analysis of Various Design parameters available in Market Product of Three Phase induction Motor (Web/ Market Survey)	EEH406-5
10.	Study Comparative Analysis of Various Design parameters available in Market Product of Three Phase Transformer (Web/ Market Survey)	EEH406-1
11.	Design of prepare data sheet Three phase Transformer parameters like dimension, winding, core etc. using Electrical design software (Autocad, AnSYS etc)	EEH406-2, 3
12.	Design of prepare drawing sheet Three phase Transformer parameters like Cooling Requirement using Electrical design software (Autocad, AnSYS etc)	EEH406-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 406-1. Design of magnetic coil			
1	1. Design of magnet coils 1.1 Types of magnets 1.2 Construction of magnets 1.3 Design of magnet coil 1.4 Current capacity 1.5 Turns winding section 1.6 Temperature rise 1.7 Space factor 1.8 Design problems.	10	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.7 Magnet Origin and Historical background (IKS learning)		
CO: EEH 406 -2 Design small single phase transformer			
2	2. Design of small transformers 2.1 Core design 2.2 Winding design 2.3 Window area 2.4 Design problems 2.8 Way of Electricity Transformation in traditional Era (IKS learning)	10	8
CO: EEH 406-3. Identify the parts of a small and large wind turbine.			
3	Design of single phase transformers 3.1 Magnetic loading. 3.2 Electrical loading. 3.3 Core construction. 3.4 Types of cores. 3.5 Advantages of using stepped Core over rectangular cores. 3.6 Limb section 3.7 Yoke construction 3.8 Output equation of 3 phase and single phase transformers Design problems on single phase transformers.	10	14

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 406-4. Carry out cooling system calculation for single phase and three phase transformer.			
4	4 Cooling of transformers 4.1 Cooling systems. 4.2 Temperature rise in plane walled tanks 4.3 Transformer oil as a cooling medium. 4.4 Transformer tank and calculation of number of cooling tubes 3.8	10	14
CO: EEH 406-5. Design three phase induction motor (Upto 20hp)			
5	5 Introduction to Design of Induction Motor (3 Phase, Squirrel Cage) 5.1 Construction 5.2 Design considerations, Specific loading 5.3 Output equations 5.4 Choice of average flux density in the air gap 5.5 Choice of ampere conductors per meter 5.6 Efficiency and power factor Main dimensions design.	08	6

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Appropriate Technology in Rotational Energy Conversion (IKS learning)		
CO: EEH 406-6 Design single phase induction motors..			
6	Introduction to Design of Single Phase Induction Motors 6.1 Types of motors 6.2 Starting characteristics. 6.3 Construction 6.4 Output equation 6.5 Main dimensions 6.6 Relative size of single phase and three phase motors 6.7 Design of stator 6.8 Rotor design concept Problems for the determination of main dimensions 6.9 Historical Background and origin of Induction Motor.(IKS learning)	12	16

**** No questions will be asked on IKS learning subtopics in any question papers.**

G : List of Assignments under SLA

Not Applicable

H : Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Design of Magnet Coils	4	4	4	12	EEH406-1
I / 2	Design of Small Transformers	2	2	4	08	EEH406-2
I / 3	Design of Single Phase Transformers	4	6	4	14	EEH406-3
II / 4	Cooling of Transformers	4	6	4	14	EEH406-4
II / 5	Design of Single Phase Induction Motors	--	--	4	06	EEH406-5
II / 6	Design of Three Phase (Sq.Cage)Induction Motor Three Phase	4	6	6	16	EEH406-6
Total Marks					70	

I. Assessment Criteria

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05

	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical :

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Performance & Design of A.C. Machines	M. G.Say.	Publisher : CBS (1 January 2002) ISBN : 8123910274
2	A Course in Electrical Machine Design	A .K.Sawhney.	Publisher : Dhanpat Rai & Co. (P) Limited ISBN : 8177001019
3	Electrical Machine Design	Balbir singh	Publisher Vikas Book Co., ISBN 0706918053,

M. Learning Website & Software

1. <https://www.electriceasy.com>
2. www.electrical4u.com
3. www.nptel.iitm.ac.in
4. <https://circuitglobe.com/induction-motor.html>
5. www.nptel.iitm.ac.in

Course Name : ELECTRICAL TRACTION
Course Code : EEH407
Course Abbreviation : HETR

A. LEARNING SCHEME

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning		
	NLH-Notional Learning	06	

B. EVALUATION SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	150
03	30	00	70	00	25	10	25#	10			

(Total IKS Hrs for Sem. : 02 Hrs)

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
 2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
 3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
 4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
 5. 1(one) credit is equivalent to 30 Notional hrs.
 6. * Self learning hours shall not be reflected in the Time Table.
- * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

The study of Electrical Traction Systems is vital in today's rapidly growing transportation and infrastructure sectors. This subject equips diploma students with essential knowledge and skills related to electric-powered transportation, especially railways and metro systems.

With increasing emphasis on energy efficiency, eco-friendly transportation, and modernization of railway systems, electrical traction has become the backbone of high-speed and urban transit. Understanding this system helps students contribute to the design, operation, and maintenance of electric locomotives, metro trains, and trams. This course also introduces students to key components like traction motors, power supply systems, speed control, regenerative braking, and protection systems. The knowledge gained here aligns well with career opportunities in Indian Railways, metro projects, electric vehicle sectors, and other transport-related industries.

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME:

The main objective of this subject to gain **practical and theoretical skills** that are directly applicable in sectors using or supporting electrical traction systems.

Maintain heavy electrical power traction systems.

E. COURSE OUTCOMES:

EEH 407-1 Understand the basic concepts and advantages of electrical traction compared to conventional systems.

EEH 407- 2 To operate and maintain power, Over head equipment’s (OHE).

EEH 407-3 Understand the classification, construction, and working principles of different types of locomotives (steam, diesel, and electric).

EEH 407- 4 Carryout maintenance of electric locomotive using standard procedures

EEH 407- 5 Follow safety standards, preventive maintenance schedules, and documentation practices used in railway workshops and depots.

EEH 407-6 Awareness of modern trends and technologies in locomotive maintenance, including predictive maintenance and automation

Competency, course outcomes and programme outcomes/programme Specific outcomes

(cp-co-po/ps) matrix. [Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”]

Program outcomes ↓ Competen &Course Outcomes	PO 1 Basic & Discipline knowledg e	PO 2 Proble m analys is	PO 3 Design develop ment of solution	PO 4 Engineeri ng Tools, Experime ntation & testing	PO 5 The engineering practices for society, Sustainability & Environment	PO 6 Projec t manag ement	PO 7 Life long learni ng	PSO1 Maintain various types of Electrical equipment	PSO2 Maintain various sections of Electrical power systems
Understand & Maintain heavy electrical Traction systems.	3	3	2	3	3	3	1	3	2
EEH407-1 Understand the basic concepts and advantages of electrical traction compared to conventional systems.	3	1	-	2	1	2	2	2	2
EEH407-2 To operate and maintain power, Over head equipment’s (OHE)	3	3	2	3	2	2	2	1	2
EEH407-3 Understand the classification, construction, and working principles of different types of locomotives (steam, diesel, and electric).	3	2	1	2	1	-	2	2	3
EEH407-4 Carry out maintenance of electric locomotive using standard procedures.	2	3	3	3	2	3	3	3	2

EEH407-5 Follow safety , preventive maintenance schedules, and Monitoring practices used in railway workshops and depots.	2	3	3	2	2	3	3	2	3
EEH407-6 Awareness of modern trends and technologies in locomotive maintenance, including predictive maintenance and automation	2	2	3	2	3	1	3	3	3

F. CONTENT

A) Practical Exercises

The following practical exercises shall be conducted as Term Work as detailed in the *Laboratory Manual for Electrical power utilization & traction* developed by the Institute in practical sessions of batches of about 22 students. Term work: Laboratory Practice / Assignments/Drawing sheets/Group discussions (Minimum 8 practical to be performed)

Sr. no	Assignments and drawing sheet	Course outcome
1	Comparative study of different systems of railway electrification viz. i) DC system, ii) Single phase AC system iii) Three phase system iv) Composite system	EEH407-1
2	Study of various types of motors used for electric traction purpose.	EEH407-1
3	Torque / Current, Speed / Torque Characteristics of AC/DC motors.	EEH407-1
4	Study of current collection systems from overhead lines from traction. [Use and study websites video's]	EEH407-2
5	Sketch of labelled electric traction power circuit and auxiliary circuit diagram and explain function of each component, specifications, tests associated, and applications. [Use and study websites video's]	EEH407-3
6	Prepare a report /chart on various types of traction systems.	EEH407-4
7	Visit a railway loco shed to observe various components and working of electric locomotive and prepare a technical report.	EEH407-5
8	Prepare a comparative chart of two different manufacturing company in India for any two Lift/Elevator with technical data	EEH407-6

B. Theory :

Sr. no.	Topics / subtopics	Teaching (Hours)	Theory Marks
EEH 407- 1 Understand the basic concepts and advantages of electrical traction compared to conventional systems			
1	Basics of Traction: 1.1 General description of Electrical Traction system in India.		

	<p>1.2 Advantages and Disadvantages of Electric Drive, 1.3 AC and DC electrical traction systems. 1.4 High voltage supply system for traction, substations, Feeding Posts, 1.5 Feeding and sectioning arrangements, Sectioning and paralleling posts sub sectioning post. Elementary sections. Miscellaneous equipment's at control post or switching stations 1.6 Major equipment's at substations.- Transformer, circuit breakers, Interrupter, 1.7 Protective system for AC traction-Transformer protection and 25 kv catenary protections. Traction motors, 1.8 Comparison of AC and DC electrical traction systems</p>	10	8
EEH 407- 2 To operate and maintain power, Over head equipment's (OHE)			
2	<p>Over head equipment's : 2.1 Over head equipment's (OHE) 2.2 Composition of OHE, 2.2.1 Height and Gradient of contact wire 2.2.2 Encumbrance, Span length. 2.2.3 Effect of speed on OHE. 2.4 Automatic weight tension and temperature compensation. 2.5 Un-insulated and Insulated Overlaps 2.6 Neutral sections, section insulators 2.7 Polygonal OHE :- Catenary constructions. 2.8 System of supplying power in electric traction:- 2.8.1 Third rail or conductor rail system, 2.8.2 Trolley collector or pole collector, 2.8.3 Bow collector, 2.9 Operation of Pantographs: Diamond, and Faiveley Type. 2.9.1 Maintenance of OHE and pantograph.</p>	08	12
EEH407- 3Understand the classification, construction, and working principles of different types of locomotives (steam, diesel, and electric).			
3	<p>Electric Locomotive: 3.1 Power Circuit Equipment's : 3.1.1 Pantograph, Circuit breaker, 3.1.2 Tap- changer, Traction Transformer, Rectifier, Smoothing Choke, 3.2 Traction Motor their Types suitable for traction and their characteristics. 3.2 Auxiliary Circuit Equipment's: 3.2.1 Head Light, Flasher Light, Horn, Marker Light, 3.3 Arno Converter, Blowers, Exhausters, Compressors,</p>		

	<p>3.4 Selsyn Transformer. Contactors and Relays used for electric locomotive.</p> <p>3.3 Train lighting: System and Requirement of train lighting, 3.3.1 Obtaining Unidirectional Polarity , 3.3.2 Constant output obtaining 3.3.3 Single battery output, 3.3.4 Double battery Parallel Block System.</p> <p>3.4 Three Phase Locomotive: Three phase power supply arrangement for Traction motor and auxiliary Machines in Three Phase Locomotive.</p> <p>3.5 Locomotive Maintenance: Need of Maintenance, Means of Maintenance.</p> <p>3.6 Electrical Faults and Their Causes.</p>	12	14
EEH 407- 4 Carryout maintenance of electric locomotive using standard procedures			
4	<p>Maintenance of Locomotives: 4.1 – Locomotive Maintenance 4.2 – Need of Maintenance and Policy of Obselence. 4.3 – Defects. 4.4 – Ideal Maintenance: - Means to Improve the Reliability of Locomotive. - Means to Improve Availability of Locomotive. - Means to Reduce Maintenance Cost. - Maintenance Record. - Training Facility. - Characteristics of Efficient Maintenance. 4.5 – Electrical Faults and Their Causes. 4.6 – Fault Localisation. 4.7 – Necessity of Testing. - Testing Procedure. - Individual Equipment Tests.</p>	10	10
EEH-407 -5 Follow safety standards, preventive maintenance schedules, and documentation practices used in railway workshops and depots.			
5	<p>Protection of Electric Locomotive: 5.1 – Introduction. 5.2 – Broad Strategy For Protection. 5.3 – Surge Protection: - Direct Lightening Strokes. - Switching Surges: External and Internal. 5.4 – Overload Protection of Main Power Circuit. 5.5 – Earth Fault Protection of Power and Auxiliary Circuit. 5.6 – Protection from Over Voltage and Under Voltage. 5.7 – Differential Current Protection of Traction Circuits. 5.8 – Protection Against High and Low Air Pressure in the Compressed Air Circuit. 5.9 – Temperature Monitoring. 5.10 – Protection of Transformer By Buchholz’s Relay. 5.11 – Monitoring of Ventilation System of Key Locomotive Equipments. 5.12 – Protection Against Accidental Contact with HT Equipment. 5.13 – Protection Against Fire. - Fire Prevention Strategy.</p>	10	12
EEH407-6 Awareness of modern trends and technologies in locomotive maintenance, including predictive maintenance and automation			

6	Application of Computers in Management of Electric Traction: 6.1 – Introduction. 6.2 – Computer’s Capability Relevant to Electric Traction Management. 6.3 – Areas of Computer Application in Traction System Management: - Optimisation of OHE and Power Supply Installation Designs. - Computer Aided Locomotive Designs. - Monitoring of Maximum Demand. - Energy Saving Driving Approach. - Training of Drivers on Simulators. - Aiding Drivers and Maintenance Depot Through On Board Computers - History of Locomotive and OHE Equipment. - Failure Analysis. - Monitoring Execution of Trip Inspection - Schedules of Locomotives. - Inventory Control. 6.4 – Possible Other Areas for Computer Controlled Monitoring. 6.5 – Advantages of Use of Computers for Management of Electric Traction System.	10	14
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**G. List of Assignments under SLA
Not Applicable**

H. Specification table for setting question paper for semester end theory examination

Section / Topic No	Name Of Topic	Distribution of Marks (level wise)			Total Marks
		Remember	Understand	Application	
I / 1.	Traction Systems	2	4	2	08
I / 2	Over head Equipment’s	4	4	4	12
I / 3	Electric Locomotives	4	4	4	14
II / 4	Maintenance of Locomotives	2	2	4	10
II / 5	Protection of Electric Locomotive	2	6	4	12
II/6	Application of Computers in Management of Electric	4	4	6	14

I. Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given in *Laboratory Manual*

Domain	Particulars	Marks out of 25
Cognitive	Preparation for practical	05
	Operating skills	05

Psychomotor	Observation and Recording	05
	Interpret Result and Conclusion	05
Affective	Safety Measures/ Discipline	05
TOTAL		25

J. Instructional strategies:

4. Lectures cum Demonstrations,
5. Class room practices.
6. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE MATERIAL:

a) Books

- 1) Modern Electric Traction by H Pratab
- 2) A Course in Electrical power by S.L. Uppal.
- 3) A Course in Electrical power by Soni, Gupta and Bhatnagar.

b) Websites

- i. www.nptel.iitm.ac.in
- ii. www.futurlec.com
- iii. www.bis.org.in
- iv. www.electrical4u.com
- v. www.cadsoft.io

COURSE NAME : BASIC PYTHON PROGRAMMING.
COURSE CODE : EEH 410
COURSE ABBREVIATION : HBPP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	2
	Tutorial Learning	--	
	Laboratory Learning	02	
SLH-Self Learning	--		
NLH-Notional Learning	04		

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	50
00	--	--	--	--	25	10	25@	10	--	--	

C: Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
4. 1(one) credit is equivalent to 30 Notional hrs.
5. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:-

Electrical Systems based industries needs to deal with creating circuits design, simulation, Automation and control systems which can be developed using Python. This course deals with the basics of python to enhance the programming skills of diploma students. The course will enable students to write python programs as well as use different python libraries to solve industry facing real-world problems.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry/employer expected outcome through various teaching learning experiences:

Develop programs using python to solve wide-reaching electrical engineering related problems..

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH 410-1. Develop script to demonstrate use of basic building blocks of python.

EEH 410-2. Implement conditional and looping statements for given problem statement.

EEH 410-3. Perform operations on sequence structures in python.

EEH 410-4. Implement basics of object oriented programming concepts.

EEH 410-5. Create modules and packages for given purpose.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Develop programs using python to solve wide-reaching electrical engineering related problems..	2	-	-	2	-	-	2	-	-
EEH 410-1. Develop script to demonstrate use of basic building blocks of python.	2	-	-	-	-	-	1	-	-
EEH 410-2. Implement conditional and looping statements for given problem statement.	2	-	-	1	-	-	2	-	-
EEH 410-3. Perform operations on sequence structures in python.	1	1	1	2	-	2		-	-
EEH 410-4. Implement basics of object oriented programming concepts.	1	2	2	2	-	2		-	-
EEH 410-5. Create modules and packages for given purpose.	1	1	1	2	-	2		-	-

F. CONTENT:-

I. Practical exercises

The following any 12 practical exercises shall be conducted in the Computer *Laboratory developed* by the institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1.	Install and configure Python IDE. Write Python program to display message on screen.	EEH 410-1
2.	Write simple Python program to calculate equivalent registers connected in series and parallel. Accept values of R1, R2 and R3 from the user.	EEH 410-2
3.	Write simple Python program to calculate value of voltage by applying Ohm's law. Accept value of Current(I) and Resistance(R) from the user	EEH 410-2
4.	Write program to check whether entered frequency is radio frequency or audio frequency.	EEH 410-2
5.	Write program to display various radio frequency bands using if..elseif ladder.	EEH 410-2
6.	Write program to display resistor color code using switch statement.	EEH 410-2
7.	Write a simple Python program to demonstrate use of control loops: i) while ii) do while	EEH 410-3
8.	Create a simple program, to demonstrate use of: for loop in Python (e.g.: various pattern building, printing multiplication table, checking palindrome number etc.)	EEH 410-3
9.	Write Python program to perform following operations on List: a) Create b) Access c) Update d) Delete elements from list.	EEH 410-3
10.	Write Python program to perform following operations on List: a) Create b) Access c) Update d) Delete elements from list.	EEH 410-3
11.	Develop Python program to perform following operations on Tuples: a) Create b) Access c) Update d) Delete Tuple elements	EEH 410-4
12.	Write Python program to perform following operations on Set: a) Create b) Access c) Update d) Delete Access Set elements	EEH 410- 4
13.	Create a program to perform following operations on Dictionaries in Python: a) Create b) Access c) Update d) Delete e) Looping through Dictionary	EEH 410-4
14.	Create python program to demonstrate use of math built-in function. and string built-in function.	EEH 410-4
15.	Write python programs to define function with arguments. a) Calculate factorial of a number b) Swapping of two variables	EEH 410-4
16.	Write programs to define function with default arguments.	EEH 410-5
17.	Create a program to demonstrate use of: Built-in module (e.g. numeric, mathematical functional and programming module) in Python.	EEH 410-5
18.	Write program to create a user-defined module (e.g.:building calculator) in python.	EEH 410-5
19.	Develop Python program to demonstrate use of NumPy package for creating, accessing and performing different array operations.	EEH 410-5
20.	Write program to demonstrate the use of user-defined packages in Python.	EEH 410-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 410-1. Develop script to demonstrate use of basic building blocks of python			
1	Unit - I Basic Python's Constructs 1.1 Introduction to Python- Python as scripting Language, Programming language Vs Scripting Language (C vs Python), Python's Technical Strength, Application indifferent domains 1.2 Python's building blocks- Identifiers, Keywords, Variables, Constants, Indentation, Comments in python 1.3 Python's Data Types – Numbers, Strings, List, Tuples, Dictionaries, Sets 1.4 Input and Output statements in python 1.5 Operators in Python- Operators as Arithmetic, Assignment, Unary Minus, Relational, Logical, Boolean, Bitwise, Membership, Identity, Operator precedence and Associativity	04	-
CO: EEH 410-2. Implement conditional and looping statements for given problem statement.			
2	Unit - II Control Statements in Python 2.1 Types of Control Statements – Decision making statements, Looping statements 2.2 Decision Making Statements: - if, if....else, else-if ladder , nested if and switch statement 2.3 Looping statement: - while loop, for loop, nested loop 2.4 Manipulating Loops- use of break, continue and pass statements	04	-

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: EEH 410-3. Perform operations on sequence structures in python.			
3	Unit - III Data Structures in Python 3.1 List- Defining List, Creating list, Accessing values from list, Updating the elements of a list, Concatenation of two lists, Repeating of Lists, Membership in list, Aliasing and cloning Lists, Methods to process Lists, Nested Lists 3.2 Tuples- Defining Tuple, Creating Tuples, Accessing the Tuple elements, Inserting elements in a Tuple, modifying elements of a Tuple, Deleting elements from a Tuple, Basic operations in Tuples, Functions to process Tuples, Nested Tuples 3.3 Sets- Defining Set, Creating a Set, Accessing Elements from set, Add and update Set, Remove an elements from aSet, Built in functions with Set, Set	10	-

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	methods to perform mathematical operations, other relevant set methods 3.4 Dictionaries- Defining Dictionary, Creating Dictionary, Accessing elements from Dictionary, Add and update Dictionary, Delete an element from a Dictionary, Built in functions of Dictionary, Methods to perform Dictionary		
CO: EEH 410-4. Implement basics of object oriented programming concepts.			
4	Unit - IV Functions with Basic OOP concepts 4.1 Python Functions- Use of python built in functions (e.g. type/data conversion functions, math and string functions), User defined function- Function definition, function calling, function arguments and parameter passing, Return statement, scope of variables (Global and Local Variables) 4.2 Basic OOP concepts- Introduction to object-oriented programming, Creating classes and objects, Constructors and Destructors in python, Data abstraction and Encapsulation	06	-
CO: EEH 410-5. Create modules and packages for given purpose.			
5	Unit - V Modules and Packages in Python 5.1 Modules- Writing modules, importing module, python built in modules (Numeric and mathematical module, Functional Programming Module) 5.2 Python packages- Introduction, Writing python packages, using standard packages (NumPy, matplotlib) and user defined package statements	06	-

G .Specification table for setting question paper for semester end theory examination

Not Applicable

I . Assessment Criteria

i) Formative Assessment of Practical :-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05

	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) **Summative Assessment of Practical :**

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat & complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

M. Reference Books:

S.N.	Name of Book	Author	Publication
1	Natural Computing with Python	Giancarlo Zaccone	BPB, ISBN:9789388511612
2	Python: The Complete Reference	Martin C. Brown	Tata McGraw Hill ISBN: 9789387572942
3	Let Us Python	Yashwant Kanetkar	BPB, ISBN: 978-9391392253
4	Python Programming: A modular approach	Kumar Naveen, Taneja Sheetal	Pearson, ISBN: 978-9352861293
5	Principles of Solar Engineering	Frank Kreith, Jan F Kreider	McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
6	Learning Python	Mark Lutz and David Ascher	O'Reilly, ISBN: 978-1449355739
7	Head First Python	Paul Barry	O'Reilly, ISBN: 978-1449382674
8	Introduction to Computation and Programming Using Python	John Guttag	MIT Press, ISBN: 978-0262529624
9	Python Essential Reference	David Beazley	Addison-Wesley Professional, ISBN: 978-0672329784
10	Core Python Programming	Dr. R. Nageswara Rao	DREAMTECH PRESS, ISBN: 978-9386052308

M. Learning Website & Software

- a) <https://www.programiz.com/python-programming>
- b) <https://python-iitk.vlabs.ac.in/Introduction.html>

- c) <https://www.geeksforgeeks.org/python-programming-language/>
- d) <https://intellipaat.com/academy/course/introduction-to-python-programming-free-course/>
- e) <https://www.w3schools.com/python/>
- f) <https://www.tutorialspoint.com/python/index.htm>
- g) <https://www.python.org/>
- h) https://spoken-tutorial.org/tutorial-search/?search_foss=Python+3.4.3&search_language=English

Course Name : Electrical Testing and Commissioning
Course Code : EEH 501
Course Abbreviation : HETC

A. LEARNING SCHEME

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
SLH-Self Learning	02		
NLH-Notional Learning	08		

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	25	10	175

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

- 1.FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- 2.If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- 3.If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- 4.Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
- 5.1(one) credit is equivalent to 30 Notional hrs.

* Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i)RATIONALE

This is technology level subject with application in Industry, commercial, public utility departments such as PWD, Irrigation, electricity supply agencies, water supply & sewage board etc. this course arms the diploma in electrical engineering student to inspect various types of installations, test and commission electrical machines as per prevailing standards. He / She will also be able to carry out different types of maintenances of electrical equipment. He will follow all the safety practices while doing these functions. Further the student will also become well conversant with the techniques of Total Productive Maintenance (TPM).

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Carry out maintenance of electrical machines/equipment following safety practices.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH 501-1 Follow safety practices while working and install electrical machines after selecting/executing the relevant foundations.

EEH 501-2 Prepare maintenance schedules and strategies for electrical machines/equipment

EEH 501-3 Maintain motional electrical machines/systems.

EEH501-4 Maintain single phase and three phase transformers.

EEH 501-5 Maintain insulation systems of electrical equipment.

EEH501-6 Troubleshoot electrical machines/switchgear.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co- po/psa) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline-specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation, and Testing	PO 5 Engineering Practices for society, sustainability, and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
Competency: Carry out maintenance of electrical machines/ equipment following safety practices.	3	2	2	2	1	2	2	3	3
EEH 501-1: Follow safety practices while working and install electrical machines after selecting/executing the relevant foundations.	3	2	2	2	2	1	3	3	2
EEH501-2: Prepare maintenance schedules and strategies for electrical machines/equipment	3	3	2	2	1	2	1	3	2
EEH501-3: Maintain motional electrical machines/systems	3	2	2	2	1	1	2	3	2
EEH501-4: Maintain single-phase and three-phase transformers	3	2	2	2	1	1	2	3	3
EEH501-5: Maintain insulation systems of electrical equipment	3	2	2	2	1	1	2	2	3
EEH501-6: Troubleshoot electrical machines/switchgear	3	2	2	2	1	1	2	2	2

F. CONTENT

I. Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Electrical Testing and Commissioning* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Practical's	Skills developed	CO
1	Perform an OC test on a single-phase Induction motor	1) Connect the circuit as per the circuit diagram 2) Perform the test as per the instructions 3) Calculate the required parameters from observation 4) Conclude the result	EEH 501-3
2	Perform OC and SC test on a three-phase Induction motor	1) Connect the circuit as per the circuit diagram 2) Perform the tests as per the instructions 3) Calculate the required parameters from observation 4) Conclude the result	EEH501-3
3	Perform an insulation resistance test on any motor/ transformer	1) Connect the circuit as per the circuit diagram 2) Perform the test as per the instructions 3) Calculate the required parameters from observation 4) Conclude the result	EEH501-4
4	To perform phasing out and polarity out tests on three phase transformer.	1) Connect the circuit as per the circuit diagram 2) Perform the test as per the instructions 3) From the test find the polarities	EEH501-4
5	Perform a temperature rise test on a single-phase transformer	1) Connect the circuit as per the circuit diagram 2) Perform the test as per the instructions 3) Calculate the required parameters from observation 4) Conclude from the result	EEH501-4
6	To perform a back-to-back test on two identical single-phase transformers	1) Connect the circuit as per circuit diagram 2) Perform the tests as per the instructions 3) Calculate the required parameters from observation 4) Conclude the result	EEH501-4
7	Prepare maintenance schedule & trouble shooting chart for 3ph Induction motor	1) Carry out preventive maintenance & trouble shooting charts for 3 ph induction motors. 2) Procedure to be followed in the preventive maintenance of the 3ph motors.	EEH501-3,5,6
8	Prepare maintenance schedule & trouble shooting chart for 3ph Transformers	1) Carry out preventive maintenance & trouble shooting charts for 3 ph transformers. 2) Procedure to be followed in the preventive maintenance of 3ph transformers.	EEH501-4,5,6

II. Theory

SECTION – I

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
CO: EEH 501-1: Follow safety practices while working and install electrical machines after selecting/executing the relevant foundations.			

1	<p>Safety & Prevention of Accidents: Ancient things related to testing and commissioning.(SLA) 1.1.1 Important definitions related to electrical safety:- Safety, hazard, accident, major accident hazard, responsibility, authority, accountability, and monitoring. 1.1.2 I.E. Act & statutory regulations for the safety of persons & equipment working on electrical installations. 1.1.3 Dos and don'ts for substation operators as listed in IS, causes of electrical accidents. 1.1.4 Factors on which the severity of electric shock depends. 1.1.5 Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration. 1.1.6 Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers. 1.2 Installation: 1.2.1 Factors involved in designing the machine foundation. 1.2.2. Requirements of different dimensions of foundation for static & rotating machines. 1.2.3. Procedure for leveling and alignment of two shafts of directly & indirectly coupled drives and effects of misalignment. 1.2.4. Installation of rotating machines as per I.S. 900-1992.</p>	10	12
CO: EEH501-2:Prepare maintenance schedules and strategies for electrical machines/equipment.			
2	<p>Maintenance 2.1 Objectives of testing, significance of I.S., tolerance, routine tests, type tests, special tests. 2.2 Methods of testing a) Direct, b) Indirect, c) Regenerative. 2.3 Routine, preventive, and breakdown maintenance, 2.4 Advantages of preventive maintenance, developing a preventive maintenance schedule, and factors affecting it. 2.5 Total productive maintenance.</p>	08	10
CO: EEH 501-3: Maintain motional electrical machines.			
3	<p>3.1 Tests before Commissioning of machines. 3.2 Type, routine, and special tests of single-phase and three-phase induction motors as per relevant IS 990-1965 and IS 325-1970. 3.3 Routine, preventive, and breakdown maintenance of single-phase and three-phase induction motors as per IS 9001:1992 3.4 Maintenance schedule of alternators and synchronous machines as per IS 4884-1968</p>	10	12
Total		28	34

SECTION-II

Sr.no.	Topics / Subtopics	Teaching (Hours)	Theory evaluation Marks
CO: EEH501-4: Maintain single-phase and three-phase transformers.			
4	Tests before Commissioning of Transformers: 4.1 Type, routine, and special tests as per IS 2026-1981 4.2 Procedures for conducting the following tests: Measurement of winding resistance, no load losses, & no load current, impedance voltage, load losses, insulation resistance, induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, temperature rise test of oil & winding, different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. 4.3 Preventive and routine maintenance of distribution transformer as per IS 10028(part III): 1981, periodic checks for replacement of oil, silica gel.	13	14
CO: EEH501-5: Maintain insulation systems of electrical equipment.			
5	5.1 Classification of insulating materials as per IS 8504(part III) 1994, factors affecting the life of insulating materials, measurement of insulation resistance, and interpretation of the condition of insulating. 5.2 Methods of measuring the temperature of internal parts of windings/machines and applying the correction factor when the machine is hot. 5.3 Properties of good transformer oil, list the agents that contaminate the insulating oil, and understand the procedure of following tests on oil as per IS 1692-1978. Acidity, sludge, crackle, and flash point tests. 5.4 Filtration of insulating oil, protection of electrical equipment (insulation) during the period of inactivity. 5.5 Methods of cleaning the insulation covered with loose, dry dust, sticky dirt, & oily viscous films, procedure for cleaning, washing & drying of insulation & revarnishing 5.6 Methods of internal heating and vacuum impregnation.	11	12
CO: EEH501-6: Troubleshoot electrical machines/switchgear.			
6	Troubleshooting of electrical machines & switch gear: 6.1 Procedures for troubleshooting of electrical machines. 6.2 Internal and 0external causes of failure of equipment. 6.3 Types of faults (mechanical, electrical, and magnetic) in electrical machines and their causes. 6.4 Tools/instruments: Bearing puller, filler gauge, dial indicator, spirit level, megger, earth tester, growler, multimeter, 6.5 Troubleshooting charts: single-phase and three-phase induction motors, single-phase and three-phase transformers. 6.6 Common troubles in electrical installations and cables. Maintenance and troubleshooting of LV switchgear, like MCCB, ELCB, contactors, and batteries.	08	10
	Total	32	36

G. List of SLA/ Microproject

Microproject suggested by the Subject teacher.

H. Specification table for setting the question paper for semester-end theory examination

Section-Topic	Name Of Topic	Distribution of Marks (level-wise)			Total Marks
		R	U	A	
I - 1	Safety and prevention of accidents..	02	04	06	12
I - 2	Maintenance	02	04	04	10
I /-3	Testing and maintenance of rotating machines.	02	04	06	12
II - 4	Testing and maintenance of transformers.	02	04	08	14
II - 5	Maintain insulation systems of electrical equipment.	02	04	06	12
II - 6	Troubleshooting of electrical machines and switch gear	02	04	04	10
		12	24	34	70

I. Industrial Exposure

1. Visits to transformer testing and maintenance sections of industrial units.
2. Visit to Testing division of Electricity Supply company
3. Visit to Switchgear maintains station /Industry.
4. Visit to Fire extinguisher Manufacturing Company

J. Criteria for Continuous Assessment of Practical work and Progressive Skill Test

i) Continuous Assessment of Practical Assignments :

Every practical assignment shall be assessed for 25 marks as per following criteria :

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Progressive Skill Test :

One mid-term *Progressive Skill Test* of 25 marks

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05

2	Preparedness for Practical/Drawing/	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work/Drawing work and completion of task	05
TOTAL		25

Final marks of Practical examination shall be awarded as per *Assessment Pro-forma III/IV*.

Instructional strategies:

- 1) Lectures and discussions.
- 2) Industrial Visits
- 3) Time bound Assignments

K. Teaching and Learning resources, including references

- 1) Interactive Boards
- 2) Demonstrative kits,
- 3) Videos
- 4) Demonstrative Charts

L. Books

Sr. No.	Title	Author	Publisher
1	Relevant IS codes.	Bureau of Indian standards.	Government Of India
2	Electrical Technology Volumes To IV	B. L. Theraja	S. Chand & Co., New Delhi
3	Operation & Maintenance of Electrical Machines Volume - I	B. V. S. Rao	Media Promoters & Publisher Ltd. Mumbai
4	Operation & Maintenance of Electrical Machines Volume - II	B. V. S. Rao	Media Promoters & Publisher Ltd. Mumbai
5	Electrical machines	S.K.Bhattacharya	Tata McGraw Hill

M. Learning Websites

- i. www.lce.com/pdfs/The-PMPdM-Program-124.pdf
- ii. www.iapa.ca/pdf/prevent.pdf
- iii. <http://cercind.gov.in/ElectSupplyAct1948.pdf>
- iv. www.pfeiffereng.com/Principals%20of%20Electrical%20Grounding.pdf

COURSE NAME : EMERGING TRENDS IN ELECTRICAL ENGG.
COURSE CODE : EEH502
COURSE ABBREVIATION : HETE

A. LEARNING SCHEME:

Scheme component	Hours	Credits
Actual Contact Hours / week	Classroom Learning	03
	Tutorial Learning	-
	Laboratory Learning	-
	SLH-Self Learning	01
	NLH-Notional Learning	04

B. ASSESSMENT SCHEME :

Paper duration in Hrs.	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30*#	70*#	100	40	-	-	-	-	25	10	125

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On-Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D.) RATIONALE:

Emerging technologies evolve rapidly in all the field of engineering and it is essential for technologists to stay updated on these aspects to face the day to day challenges in the industry as well as in the society. This course aims to prepare Diploma Engineers with insights into the emerging technological trends like smart systems, AI, intelligent motor controls and digitization.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOMES:

The aim of this course is to help the student to attain the following industry identified outcomes through various learning experiences:

Acquire relevant knowledge of Emerging techniques in electrical engineering fields.

E.COURSE LEVEL LEARNING OUTCOMES (COs):

EEH502-1. Suggest the relevant IoT technologies for electrical systems.

EEH502-2 Elaborate the use relevant IoT and SCADA for Automation of electrical Grid systems.

EEH502-3 Implement electrical engineering related emerging trends to develop smart city.

EEH502-4 Suggest the relevant IMCC for the given application (s).

EEH502-5 - Select the relevant improved tariff and billing solution for the specified type of consumer.

Competency, Course Outcomes (CO) and Programme Outcomes (POs) / Programme Specific Outcomes (PSOs):

(CP-CO-PO/PSO) Matrix:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
EEH502-1. Suggest the relevant IoT technologies for electrical systems.	2	2	2	2	3	1	2		3
EEH502-2 Elaborate the use relevant IoT and SCADA for Automation of electrical Grid systems.	2	1	1	1	1	1	3		3
EEH502-3 Implement electrical engineering related emerging trends to develop smart city.	2	3	2	2	2	1	3	2	3
EEH502-4 Suggest the relevant IMCC for the given application (s).	1	1	1	2	1		3		3
EEH502-5 - Select the relevant improved tariff and billing solution for the specified type of consumer.	1	2	1	1	1	1	3		1

F.CONTENT:**I) Practical exercises: -NIL-****II) Theory:****Section I**

Sr. No.	Topics/Subtopics	Learning (Hours)	Marks
EEH502-1. Suggest the relevant IoT technologies for electrical systems.			
1	Unit - I Digitization beyond Automation 1.1 Industrial Revolutions: Versions 1.0, 2.0, 3.0 and 4.0; the driving force for these revolutions. 1.2 Components of Industrial Revolution 4.0: Digitization, CPS (Cyber Physical Systems), IoT (Internet of Things), Cloud Computing and Cloud Manufacturing. 1.3 Role of 5G Communication, Machine learning (ML) and AI in Industry 4.0. 1.4 Industry Revolution 5.0: Introduction and Key Features. 1.5 IoT: Principle and features. 1.6 Applications of IoT in Industrial drives, Transmission System, Distribution System, grid system, Illumination system and Renewable energy.	08	12
EEH502-2 Elaborate the use relevant IoT and SCADA for Automation of electrical Grid systems.			
2	Unit - II Smart Grid 2.1 Smart Grid: Need and evolution, layout and its components, advantages and barriers, Smart Grid projects in India. 2.2 Micro-Grid: Need and formation of Micro Grid. 2.3 Distributed Energy Resources: Distributed generation systems and distributed generation technologies. 2.4 Role of distributed generation in Smart Grid and Micro Grid. 2.5 Substation Automation System (SAS): Need, layout and components, salient features of substation automation. 2.6 SCADA application in Grid systems.	06	10
EEH502-3 Implement electrical engineering related emerging trends to develop smart city.			

3.	<p>Unit - III Smart City (Electrical Features)</p> <p>3.1 Smart City: Features, components, objectives and challenges of smart cities in India.</p> <p>3.2 Intercity Transportation: EV / Metro: Types, data-driven operations, automated train operation (ATO), autonomous driving technology, efficient charging infrastructure, wireless charging: opportunities and challenges.</p> <p>3.3 Comparison between various types of Electric Vehicles: technology, type of motor, efficiency, batteries etc.</p> <p>3.4 Smart Home: Features and components, role of AI powered illumination system and advancement in luminaries. smart appliance control principles (block diagram/s).</p> <p>3.5 Renewable Energy: Role, opportunities, government policies: center / state.</p>	08	12
Section II			
EEH502-4 Suggest the relevant IMCC for the given application (s).			
4.	<p>Unit - IV Intelligent Motor Control Centers</p> <p>4.1 Conventional Motor Control Center (MCC): Role in motor protection and management, typical block diagram and architecture, components: symbols and functions.</p> <p>4.2 Intelligent or Smart MCCs (IMCCs): Need and evolution from traditional MCCs. Functional block diagram and general arrangement, integration of industrial IoT (IIoT) and cloud-based real-time monitoring.</p> <p>4.3 Applications, advantages and limitations in modern MCCs including lack of networking and diagnostics.</p> <p>4.4 Basic Components of Intelligent Systems: Microprocessor / microcontroller-based control; networking technologies (Ethernet / IP, Modbus, PROFINET) replacing hard wiring, enhanced diagnostics, AI-based predictive maintenance, smart sensors, and edge computing for real-time diagnostics and wireless communication (Bluetooth, Zigbee) for remote control.</p> <p>4.5 IMCC Components and Devices: Intelligent relays, digital fuses, cybersecurity features, dedicated software and advanced control devices.</p> <p>4.6 Selection of MCC: Comparison between Intelligent and conventional MCC; Energy efficiency, cybersecurity, networking, and automation. Smart power management with power factor correction (PFC) and harmonic filtering for efficiency.</p>	13	20
EEH502-5 - Select the relevant improved tariff and billing solution for the specified type of consumer.			

5.	Unit - V Tariff and Smart Billing 5.1 Tariff: Power purchase, Power purchase agreements (PPA), Power purchase cost. 5.2 Tariff Design: Key factors for tariff design, major components of an electricity bill, various slabs in billing, electricity duty, tax on electricity and cross subsidy. 5.3 Recent MSEDCL tariff 5.4 Smart Metering: Components working principle, types of smart meters, features, communication technologies, advantages, challenges, role in Grid System. 5.5 Metering and Bill Management: Working of net metering and gross metering, MERC rules for net-metering bill (Latest Amendment), application of net metering for integration of micro-generators with grid system.	10	16
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**** No questions will be asked on IKS learning subtopics in any question papers.**

G.List of Assignments under SLA:

Sr. No.	List of Assignment (under SLA)	Hrs. Allotted
1	Assignment on Topic 1: Digitization beyond Automation	05
2	Assignment on Topic 2: Smart Grid	05
3	Assignment on Topic 3: Smart City (Electrical Features)	05
4	Assignment on Topic 4: Intelligent Motor Control Centers	05
5	Assignment on Topic 5: Tariff and Smart Billing	05

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Digitization beyond Automation	4	4	4	12	EEH502-1
I / 2	Smart Grid	4	4	8	10	EEH502-2
I / 3	Smart City (Electrical Features)	4	4	4	12	EEH502-3
II / 4	Intelligent Motor Control Centers	6	6	8	20	EEH502-4
II / 5	Tariff and Smart Billing	4	4	8	16	EEH502-5
Total Marks						

I.Assessment Criteria:

- i) Formative Assessment of Practical: Nil**
- ii) Summative Assessment of Practical: Nil**

J. Instructional Methods:

1. Lectures cum Discussions
2. Class room practices
3. Presentations and demonstrations

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Control of Electrical Machines	S K Bhattacharya	New Age International ISBN13: 8122409970, 9788122409970
2	Smart Grid: Fundamentals, Design, Technology, Applications, Communication and Security, An Indian Adaptation	Akihiko Yokoyama	Wiley, 1 April 2021 Edition ISBN-13: 978-9354243219
3	Electrical Motor Control Systems	Frank D. Petruzella	McGraw-Hill College, 22 November 2019, ISBN-13: 978-1260439397
4	Encyclopaedia of Applied Intelligent Control of Induction Motor Drives	Merizalde	Auris Reference (1 April 2018) ISBN-13: 978-1788022651
5	IOT (Internet of things) and Its Application	P K Pandey	T Balaji Publication (1 January 2020) ISBN 13:978-8194136385
6	Artificial Intelligence in Industry 4.0 and 5G Technology	Pandian Vasant	Wiley 30 June 2022 ISBN-13: 978-1119798767

M. Learning Website & Software:

4. <https://www.nsgm.gov.in/en/sgkc>
5. <https://e-amrit.niti.gov.in/ev-awareness-web-portal/>
6. <https://www.sap.com/india/products/scm/industry-4-0/what-is-industry-4-0.html>
7. <https://www.iiot-world.com/industrial-iot/connected-industry/the-role-of-iiot-in-smart-grid-technology-and-appli>

COURSE NAME : INTERNET OF THINGS
COURSE CODE : EEH504
COURSE ABBREVIATION : HIOT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	2	2
	Tutorial Learning	-	
	Laboratory Learning	2	
SLH-Self Learning	-		
NLH-Notional Learning	4		

B. ASSESSMENT SCHEME:-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	25
-	-	-	-	-	25	10	-	-	-	-	

C. ABBREVIATIONS: -

CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# on Line Examination, @\$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities

D. i) RATIONALE: -

IoT is responsible for the super-fast evolution of industry 4.0, where the operations are mostly automated thus eliminating the need for much human intervention. The Internet of Things (IoT) describes the network of physical objects- “things” that are embedded with sensors , software’s and other technologies. IoT edge devices gather data from sensors and send it to a cloud-based infrastructure where the IoT applications can be monitored and managed. IoT enables the creation of innovative solutions to real world challenges.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop and implement creative solutions for real time problems that can enhance efficiency, safety and convenience across various domains.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

EEH504-1: Understand the fundamental concepts of IoT.

EEH504-2: Analyze IoT gateways and microcontrollers.

EEH504-3: Apply sensors and communication protocols to design efficient IoT systems.

EEH504-4: Understand the software stack required for developing and managing IoT applications

EEH504-5: Integrate IoT services with cloud computing for scalable data storage, processing, and real-time analytics.

EEH504-6: Understand the fundamentals of 3D printing technology and its applications.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analyses	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems
EEH504-1	2	1	2	2	1	2	1	-	-
EEH504-2	1	2	2	3	2	2	2	-	-
EEH504-3	1	2	2	3	2	2	2	1	-
EEH504-4	1	2	2	3	2	2	2	1	-
EEH504-5	2	2	3	3	2	2	2	1	-
EEH504-6	2	1	2	2	1	2	1	1	-

F. CONTENT:

V) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Internet of Things* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. No	Laboratory experiences	No. of Hours	CO
1	Circuit Design for IoT System — Door Automation Solution	2	EEH504-1
2	Build the IOT Home Security Solution using IR, Camera and Buzzer	2	EEH504-1,2,3
3	Block Based IoT programming for Home security solution(Digital Block)	2	EEH504-1
4	Build the Energy Saving Solution with Smart Lighting	2	EEH504-1,2,3,4,5
5	Demonstrate a timer based Smart Irrigation Solution	2	EEH504 - 1,2,3
6	Build the IoT based water quality testing solution.	2	EEH504 - 1,2,3,4,5
7	Demonstrate IOT in Healthcare - Smart, Pulse Rate and Oxygen Monitoring Solution	2	EEH504 - 1,2,3,4,5
8	Demonstrate IOT in Healthcare -Smart saline monitoring solution.	2	EEH504 - 1,2,3,4,5
9	Construct IOT application in Weather Forecasting - Wind Speed, Temperature and Humidity Monitoring	2	EEH504 - 1,2,3,4,5
10	Build IOT in Agriculture - Smart Scalable Irrigation Solution using LoRa Protocol	2	EEH504 - 1,2,3,4,5
11	Create a smart energy monitoring solution(pf,voltage, current,energy consumption)	2	EEH504 - 1,2,3,4,5
12	Build a Home Security Solution - Digital Lock with Camera	2	EEH504 - 1,2,3,4,5
13	Build IoT solution for rain sensing automatic roof	2	EEH504 - 1,2,3,4,5
14	Create IoT solution for vehicle overload detection & warning	2	EEH504 - 1,2,3,4,5
15	Develop a home and building fire safety solution.	2	EEH504 - 1,2,3,4,5
16	Build a transportation and safety solution.	2	EEH504 - 1,2,3,4,5
17	Create a public safety smart crowd management system.	2	EEH504 - 1,2,3,4,5
18	Build a smart LPG monitoring solution.	2	EEH504 - 1,2,3,4,5
19	Build smart city waste management solution.	2	EEH504 - 1,2,3,4,5
20	Create IoT application for air quality monitoring.	2	EEH504 - 1,2,3,4,5
21	Develop a smart city smart parking management system.	2	EEH504 - 1,2,3,4,5
22	Create a smart stress monitoring solution using GSR sensor.	2	EEH504 - 1,2,3,4,5
23	Create your own IoT solution.	2	EEH504 - 1,2,3,4,5
24	Calibration of 3D printer-bed level, temperature calibration, filament flow rate calibration	2	EEH504 -6
25	Printing and assembling multiple parts to create a functional object.	2	EEH504 -6

III) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)
EEH504-1: Understand the fundamental concepts of IoT.		
1	Fundamental Building Blocks of IOT 1.1 Why Learn IoT 1.2 Impact of IoT on Work d and Job Opportunities 1.3 Fundamental Building Blocks of IoT Application. 1.4 Demonstrate example use case highlighting the following: <ul style="list-style-type: none"> - 5 steps of application building - Fundamental building blocks of the use case - Circuit Designer - Block Programmer 	10
EEH504-2: Analyze IoT gateways and microcontrollers.		
2	IoT Gateway and Microcontroller & Microprocessor 2.1 Know your IoT Gateway 2.2 Microcontrollers — Arduino / ESP32 2.3 Microprocessor — Raspberry Pi 4B	4
EEH504-3 : Apply sensors and communication protocols to design efficient IoT systems.		
3	Sensors and Communication Protocols in IoT 3.1 Working Principles of Sensors 3.2 Sensor Calibration 3.3 IoT Communication Protocols - Bluetooth, WiFi, SPI, USB, UART, I2C	4

Section –II

Sr. no.	Topics/Subtopics	
EEH504-4 : Understand the software stack required for developing and managing IoT applications		
4	Software Stack for IoT Application 4.1 Circuit Designer Overview 4.2 Block Programming 4.3 Python Direct IDE 4.4 Introduction to Python 4.5 Learn Python using Blocks	4
EEH504-5 : Integrate IoT services wEEH504 cloud computing for scalable data storage, processing, and real-time analytics.		

5	IoT Services and Cloud Computing 5.1 Unlocking power of IoT 5.2 Mobile browser to IoT Gateway Communication 5.3 Cloud Connectivity for IoT Application 5.4 How to open AWS account 5.5 AWS Cost Management	4
EEH504-6 : Understand the fundamentals of 3D printing technology and its applications.		
6	Introduction to 3D printing 6.1 Basic principle of 3D printing, steps in 3D printing process 6.2 3D printer components and its calibration 6.3 Common basic slicer settings (layer height, fill density, supports, platform adhesion — skirt, brim, raft, shell thickness) 6.4 Post-processing techniques, need of post-processing, steps in post processing	4

**** No questions will be asked on IKS learning subtopics in any question papers.**

G. List of Assignments under SLA (Assignments Marked in * are compulsory)

Complete any one course related to “Internet of Things” freely available on Infosys Springboard/NPTEL/Spoken Tutorial.

Micro project

- Construct a Timer Based Automatic Bell/Buzzer
- Design an Alcohol Sensing & Alert System for vehicle drivers.
- Automate a fan based on room temperature monitoring.
- Electronic Smart Blind Stick- If someone is in front of blind person, LED and Buzzer should on otherwise LED and Buzzer will remains off
- Electronic Notice Board- Any Message send from mobile application should get displayed on LCD. When new message sends, previous message gets automatically erased and replaced wEEH504 new message.

Assignment

- Solve Assignment covering all COs given by Course Teacher.

Note:

Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.

H. Specification table for setting question paper for semester end theory examination

NA

I. Assessment Criteria

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

J. Instructional Methods:

7. Lectures cum Demonstrations.
8. Class room practices.
9. Use of projector and soft material for demonstration
10. Laboratory experiences and laboratory interactive sessions
11. Regular Home Assignments

K. Teaching and Learning resources:

Chalk board, LCD presentations, Self-Learning Online Tutorials, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetti	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	Cisco Press ISBN. 978-1-58714-456- 1 599
2.	Sinlen Monk	Raspberry Pi Cookbook	Publisher(s). O'Reilly Media, Inc. ISBN.' 9781098130923
3.	N. Ida	Sensors, Actuators and Their Interfaces	SciTech Publishers 2014
4.	Daniel Minoli	Building the Internet of Things wEEH504 IPv6 and MIPv6 . The Evolving World of M2M Communications	Willy Publications 2016, ISBN: 978-1-118-47347-4
5.	Dernd Scholz-Reiter, Florian Michahelles	Architecting the Internet of Things	Springer 2016, ISBN.' 978- 3-642-19157- 2

M. Learning Website & Software

1. <https://gEEH504ub.com/microsoft/IoT-For-Beginners>
2. <https://javatpoint.com/difference-between-sensors-and-actuators>

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COURSE NAME : PLC AND SCADA
COURSE CODE : EEH505
COURSE ABBREVIATION : HPLC

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME :

Paper duration in Hrs.	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: 02 Hrs.)

- C.** Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
 Legends: @ Internal Assessment, # External Assessment, *# On-Line Examination, @\$ Internal Online Examination

Note:

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

Programmable Logic Controllers (PLCs) and Supervisory Control and Data Acquisition (SCADA) systems are integral to modern industrial automation. These technologies are widely used in manufacturing, energy management, water treatment, and numerous other industries that require real-time monitoring and control. Industries such as oil and gas, pharmaceuticals, power generation, and automotive manufacturing rely on these technologies to enhance efficiency, reliability, and safety. Understanding PLC programming and SCADA system integration is crucial for engineers and technicians

working in these fields. The proposed course on PLC & SCADA aims to equip students with the necessary theoretical knowledge and practical skills to design, implement, and troubleshoot automation systems effectively.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME:

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Troubleshoot common issues in PLC and SCADA systems, ensuring minimal downtime in industrial processes.

E. COURSE LEVEL LEARNING OUTCOMES (COs):

EEH505-1. Explore PLC’s common industrial applications in manufacturing, energy, water treatment, and other sectors.

EEH505-2. Identify and connect PLC hardware components for automation and communication.

EEH505-3. Write, implement, debug and troubleshoot PLC programs to ensure proper functionality and efficiency.

EEH505-4. Explore SCADA system’s role in industrial automation.

EEH505-5. Describe commonly used SCADA communication protocols.

EEH505-6. Select appropriate hardware and software components for a SCADA setup.

Competency, Course Outcomes (CO) and Programme Outcomes (POs) / Programme Specific Outcomes (PSOs):

(CP-CO-PO/PSO) Matrix:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0”]

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipment	PSO2 Maintain various sections of electrical power systems	
EEH505-1. Explore PLC’s common industrial applications in manufacturing, energy, water treatment, and other sectors.	3	3	1	2	1	1	3	1		
EEH505-2. Identify and connect PLC hardware components for automation and communication.	3	3	1	2		1	3	1	1	
EEH505-3. Write, implement, debug and troubleshoot PLC programs to ensure proper functionality and efficiency.	2	3	1	2		1				
EEH505-4. Explore SCADA system’s role in industrial automation.	3	2	1	1	1	1	3	1		
EEH505-5. Describe commonly used SCADA communication protocols.	3	2		1			2			
EEH505-6. Select appropriate hardware and software components for a SCADA setup.	2	3	2	2	1	1	3	1	1	

F. CONTENT:

I) Practical exercises:

The following practical exercises shall be conducted in the *Centre of Excellence in Robotics and Automation* developed by the Institute in practical sessions of batches of about 20-25 students:

Sr. no.	Laboratory experiences	CO
1	Introduction to PLC Hardware and Software	EEH505-1
2	Basic Input and Output Operations in PLC	EEH505-1
3	Timer and Counter Programming	EEH505-2
4	PLC Communication and Data Exchange	EEH505-2
5	Sequential Control Using PLC	EEH505-3
6	SCADA Integration with PLC	EEH505-3
7	Introduction to SCADA System and Components	EEH505-4
8	Real-Time Data Acquisition in SCADA	EEH505-4
9	Configuring SCADA Communication with Industrial Protocols	EEH505-5
10	SCADA Cybersecurity Implementation	EEH505-5
11	Designing a SCADA HMI for Process Visualization	EEH505-6
12	Alarm Management and Historical Data Logging in SCADA	EEH505-6

II) Theory:

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	CL evaluation Marks
CO: EEH505-1: Explore PLC's common industrial applications in manufacturing, energy, water treatment, and other sectors.			
1	Introduction to PLCs 1.1 Overview of Industrial Automation <ul style="list-style-type: none"> Importance of automation in industries Evolution of control systems (IKS) Role of PLCs in automation 1.2 Basics of PLCs <ul style="list-style-type: none"> Definition and purpose of PLCs Key components: CPU, input/output modules, power supply, memory Advantages of PLCs over traditional control systems (IKS) 1.3 Types and Applications of PLCs <ul style="list-style-type: none"> Classification based on size and functionality Common applications in manufacturing, energy, water treatment, etc. Emerging trends in PLC technology 	08	08
CO: EEH505-2: Identify and connect PLC hardware components for automation and communication.			

Sr. No.	Topics/Subtopics	Learning (Hours)	CL evaluation Marks
2	<p>PLC Hardware and Architecture</p> <p>2.1 PLC System Components</p> <ul style="list-style-type: none"> • Power supply and its role • Input/output modules and types • Central processing unit (CPU) and memory structure <p>2.2 Working of a PLC</p> <ul style="list-style-type: none"> • Scanning cycle: input scan, program execution, output scan • Ladder logic execution and real-time operation • Role of timers, counters, and internal memory <p>2.3 Communication Interfaces and Networking</p> <ul style="list-style-type: none"> • Common industrial communication protocols (Modbus, Profibus, Ethernet/IP) • PLC connectivity with other automation systems • Introduction to Industry 4.0 and smart PLCs <p>2.4 PLC Troubleshooting</p> <ul style="list-style-type: none"> • Steps for Troubleshooting, Troubleshooting methods, faults & safety, PLC Maintenance, Electrical connections 	10	12
CO: EEH505-3: Write, implement, debug and troubleshoot PLC programs to ensure proper functionality and efficiency.			
3	<p>PLC Programming and Logic Development</p> <p>3.1 Introduction to PLC Programming</p> <ul style="list-style-type: none"> • Programming languages: Ladder Logic, Structured Text, Function Block Diagram • PLC software and simulation tools • Programming best practices <p>3.2 Developing PLC Programs</p> <ul style="list-style-type: none"> • Creating basic logic programs (ON/OFF control, timers, counters) • Implementing complex control logic • Debugging and troubleshooting PLC programs <p>3.3 Advanced PLC Applications</p> <ul style="list-style-type: none"> • Sequential function charts and state machines • Integration with SCADA and HMI systems • Case studies on real-world PLC applications 	12	14

Section –II

Sr. No.	Topics/Subtopics	Learning (Hours)	CL evaluation Marks
CO: EEH505-4: Explore SCADA system's role in industrial automation.			
4	<p>Introduction to SCADA Systems</p> <p>4.1 Fundamentals of SCADA</p> <ul style="list-style-type: none"> • Definition and purpose of SCADA systems • Key components: RTUs, PLCs, HMIs, and 	08	08

	<ul style="list-style-type: none"> communication networks • SCADA vs. traditional monitoring systems <p>4.2 SCADA System Architecture</p> <ul style="list-style-type: none"> • Centralized vs. distributed SCADA architectures • Overview of data acquisition, processing, and control functions • Role of SCADA servers, workstations, and field devices <p>4.3 Applications and Benefits of SCADA</p> <ul style="list-style-type: none"> • Industrial sectors utilizing SCADA (energy, water, manufacturing, etc.) • Advantages of SCADA in process control and decision-making • Emerging trends: cloud-based SCADA and remote monitoring 		
CO: EEH505-5. Describe commonly used SCADA communication protocols.			
5	<p>SCADA Communication and Networking</p> <p>5.1 Communication Protocols in SCADA</p> <ul style="list-style-type: none"> • Overview of SCADA communication protocols (Modbus, DNP3, IEC 60870, OPC) • Role of industrial Ethernet and fieldbus networks in SCADA • Data transmission methods: wired and wireless systems <p>5.2 SCADA System Integration</p> <ul style="list-style-type: none"> • Interfacing SCADA with PLCs, sensors, and industrial equipment • Connectivity with enterprise-level systems (ERP, MES) • Cyber-physical integration and IoT-enabled SCADA <p>5.3 Cybersecurity in SCADA Networks</p> <ul style="list-style-type: none"> • Security risks and vulnerabilities in SCADA systems • Best practices for securing SCADA networks and communication • Case studies on SCADA cybersecurity breaches and mitigation strategies 	10	12
CO: EEH505-6. Select appropriate hardware and software components for a SCADA setup.			
6	<p>SCADA System Development and Implementation</p> <p>6.1 Designing a SCADA System</p> <ul style="list-style-type: none"> • Key considerations in SCADA system design • Selection of hardware and software components • SCADA system scalability and expansion planning <p>6.2 SCADA Software and HMI Development</p> <ul style="list-style-type: none"> • Configuration of SCADA software platforms • Designing Human-Machine Interface (HMI) for process visualization • Alarm management and real-time data logging <p>6.3 SCADA System Maintenance and Troubleshooting</p> <ul style="list-style-type: none"> • Common challenges in SCADA implementation 	12	16

	<ul style="list-style-type: none"> System diagnostics and performance optimization Preventive maintenance strategies for long-term reliability 		
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**** No questions will be asked on IKS learning subtopics in any question papers.**

G. List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hrs. Allotted
1	Assignment on Topic 1: Introduction to PLCs	05
2	Assignment on Topic 2: PLC Hardware and Architecture	05
3	Assignment on Topic 3: PLC Programming and Logic Development	05
4	Assignment on Topic 4: Introduction to SCADA	05
5	Assignment on Topic 5: SCADA Communication and Networking	05
6	Assignment on Topic 6: SCADA System Design and Implementation	05

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to PLCs	4	2	2	08	EEH505-1
I / 2	PLC Hardware and Architecture	2	4	6	12	EEH505-2
I / 3	PLC Programming and Logic Development	4	4	6	14	EEH505-3
II / 4	Introduction to SCADA	4	2	2	08	EEH505-4
II / 5	SCADA Communication and Networking	2	4	6	12	EEH505-5
II / 6	SCADA System Design and Implementation	6	4	6	16	EEH505-6
Total Marks					70	

I. Assessment Criteria

i) Formative Assessment of Practical:

Every laboratory assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

At the time of Practical Examination, the practical assignment shall be assessed for 25 marks as per following criteria:

Sr.No.	Criteria	Marks allotted
1	Knowledge about the course	05

2	Preparedness for practical / Oral	05
3	Neat & complete Diagram /write up	05
4	Observations / Handling of instrument / Communication / Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods:

1. Lectures cum Discussions
2. Class room practices
3. Presentations and demonstrations

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Introduction to PLC	Gary Dunning	Thompson Publication
2	Programmable logic controllers; principles and applications	John W. Webb, Ronald A. Reis.	Eastern Economy edition
3	PLCs & SCADA: Theory and Practice	Rajesh Mehra Vikrant Vij	Laxmi Publications Pvt. Ltd.
4	Introduction to PLC	V. R. Jadhav	Khanna Publications
5	Programmable logic controllers: programming methods and applications	John R. Hackworth, Frederick D. Hackworth Jr.	Pearson Publications
6	SCADA: Supervisory Control and Data Acquisition	Stuart A. Boyer	ISA-The Instrumentation, Systems, and Automation Society
7	Power System SCADA and Smart Grids	Mini S. Thomas, John Douglas McDonald	CRC Press

M. Learning Website & Software:

1. <https://www.electrical4u.com/scada-system/>
2. <https://www.electrical4u.com/programmable-logic-controllers/>
3. <https://www.unitronicsplc.com/what-is-plc-programmable-logic-controller/>
4. <https://www.c3controls.com/white-paper/back-to-plc-basics-guide-programmable-logic-controller/>

Course Name : Industrial Automation and Control
Course Code : EEH506
Course Abbreviation : HIAC

TEACHING AND EVALUATION SCHEME:

A. Teaching/Learning Scheme:

Scheme component	Hours / week	Credits
Theory	4	4
Practical	2	
Tutorial	-	
Self Learning	2	
Notional Learning Hours	8	

B. EVALUATION SCHEME:

PAPER DURAT ION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTA L
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
03	MAX	MAX	MAX	MI N	MAX	MI N	MAX	MI N	MAX	MIN	175
	30	--	70	--	25	10	25#	10	25	10	

(Total IKS Hrs for Sem. : 02 Hrs)

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
 Note : (TNR 11 font)

- 1.FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- 2.If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- 3.If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- 4.Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
 1(one) credit is equivalent to 30 Notional hrs.
 * Self learning hours shall not be reflected in the Time Table.
 * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i. RATIONALE

A technician engineer has to look after the day to day the automation such as motor control circuits, typical input/output devices, programmable Logic Controller (PLC), Distributed Control System (DCS), supervisory Control and Data Acquisition (SCADA) and Human Machine Interface (HMI). He should be conversant with the various technical aspects of control pilot devices, control relays & contactors such as principle,

construction, working and performance. The course is therefore intended to cater to the needs and requirements of using controllers as per the needs

ii. INDUSTRY/EMPLOYER EXPECTED OUTCOME

1. Ability to operate and program PLC, HMI, and SCADA systems.
2. Skill in designing and troubleshooting control panels and ladder logic.
3. Knowledge of sensors, actuators, drives, and control devices used in industry.
4. Ability to read and create electrical and automation wiring diagrams.
5. Capability to implement motor control (VFD, DOL, Star-Delta) using automation.
6. Skill to diagnose and solve real-time industrial automation faults.
7. Awareness of industrial safety standards and practices.

E. COURSE OUTCOMES

EEG506 -1Use architecture of industrial automation systems

EEG506-2 Connect and use various industrial control components

EEG506-3.Implement the industrial control actions

EEG506- 4. Handle the PLC.

EEG506-5 Implement simple industrial controls.

EEG506-6 Implement simple industrial automation systems

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX :

[**Note : Correlation levels** :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-” : no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Competency: Maintain simple industrial automation systems	02	02	01	02	03	02	01	02	02
EEG506 -1Use architecture of industrial automation systems	01	02	01	01	03	01	--	02	02
EEG506-2 Connect and use various industrial control components	01	03	02	01	02	01	01	01	03
EEG506-3. Implement the industrial control actions	02	02	01	01	02	02	01	02	01
EEG506-4. Handle the PLC	01	03	03	02	02	01	02	02	03
EEG506-5 Implement simple industrial controls	01	02	01	01	01	01	02	02	01
EEG506-6 Implement simple industrial automation systems	02	02	02	01	02	01	01	01	03

F.CONTENT

i. Suggested Practical/ Exercise

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted and assess the student for attainment of the competency

Sr.No	Laboratory experiences	Course outcome
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1	Identify various automation systems available in different appliances/ devices/ machines in day to day use	EEH506-2
2	Identification of automation components.	EEH506-2
3	Operation of different switches in automation	EEH506-2
4	Identify symbols in industrial control diagram	EEH506-2
5	Develop and connect interlocking circuits for Contactors	EEH506-2
6	Identify and connect the modules	EEH506-4
7	Prepare ladder diagram and implement it for DOL and star-delta starters	EEH506-4
8	Operate any one type of electric drive (such as VFD, VVVF drives etc.) used in automation	EEH506-3
9	Identify various parts of the given PLC and front panel status indicators	EEH506-4
10	Use PLC to control the following devices like lamp, motor, push button switches, proximity sensor	EEH506-4
11	Develop / test ladder program for rotating stepper motor in forward and reverse direction at constant speed.	EEG506-5
12	Use PLC to test the START STOP logic using two inputs and one output.	EEG506-5

ii. THEORY

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
EEH506-1 Use architecture of industrial automation systems.			
1	General Idea of Automation Industrial Automation need and benefit Types of automation system: Fixed, Programmable, Flexible Industrial Automation and Control Architecture of Industrial Automation Systems	08	10
EEH506-2 Connect and use various industrial control components			
2.	Industrial Control Components Input devices (Basic working and schematic diagrams with functions) Definition of control devices such as Push buttons, Selector switches. Proximity sensors Solenoid valves, Limit switches and its types Pressure, temperature, flow, float actuated switches Reed switches, photoelectric, hall effect, inductive, capacitive proximity Switches Two wire and three wire control. Output devices (Basic working and schematic diagrams with function) ,NO/NC contacts Electromagnetic Relays, contactors and their ratings, solenoid valves , Solid state Relays:	12	14

	<p>Latching Relays, Bimetallic Thermal Over-load Relay, Time Delay Relays (Timers): Electronic Overload Relay Pneumatic cylinders</p> <p>Power and control wiring diagrams, main and auxiliary contacts</p> <p>Interlocking of contactor circuits using push buttons, NC contacts and limit switches.</p> <p>Schematic of symbols used in industrial control circuits</p>		
EEH506-3 Implement the industrial control actions			
3	<p>Implement the industrial control actions</p> <p>Industrial Control Actions</p> <p>Process control actions (block diagrams with very brief functioning descriptions)</p> <p>Proportional Controllers, Integral Controllers, Proportional-Integral Controllers, Derivative Controllers,</p> <p>Proportional-Integral-Derivative Controllers</p>	10	10

Section II

EEH506-4 Handle the PLC.			
4	<p>Programmable Logic Controller Block diagram and working of PLC,</p> <p>Functions of different parts of PLC, proximity sensors /switches; inductive and capacitive types: description with simple block diagrams; areas of applications, Opto-isolators, optical sensors.</p> <p>PLC modules: digital I/O modules and their ratings, analog I/O modules and their ratings, timer/counter Modules.</p> <p>Memories: ROM: types (Mask ROM, PROM, EPROM, EEPROM) and RAM, functions.</p> <p>PLC power supplies block diagram and function of each block,</p> <p>PLC advantages and disadvantages</p>	12	12
EEH506-5 Implement simple industrial controls.			

5	Basic Components of PLC. Ladder diagrams Typical PLC inputs. Typical PLC Outputs. One contact, one coil circuit Standard start-stop-seal circuit Ladder diagrams for simple logic operations(NOT, AND, OR, EXOR) On delay timer, off delay timer Ladder diagrams for DOL, Star-delta (automatic starter)	10	12
EEH506-6 Implement simple industrial automation systems.			
6	Implementation of automation: Electric Drives: Energy saving with adjustable speed Drives, production control systems. Introduction to CNC Machines	08	12
TOTAL		60	70

G. List of Assignments under SLA

Sr.No	List of Assignment (under SLA)	Hrs Allotted
1	Present seminar on various topic form course content	04
2	Make a survey of commercially available PLCs in the market.	04
3	Make a survey of industrial control components based on their ratings.	04
4	Write the report on the use of DCS in oil and gas refineries	04
5	Enlist International manufacturers of PLC/SCADA/DCS/HMI	04
6	Report on PLC-based Speed Control of Electric Vehicle	02
7	Visit any manufacturing / process plant having SCADA and / or DCS	04
8	Visit any manufacturing / process plant having PLC automation	04
Total Hours		30

OR

The following suggested list given below for Micro project, concerned faculty can add similar micro projects

1. Display temperature and humidity at the entrance of the institute and institute campus. Compare the reading and submit a report
2. Prepare a project of Automatic bottle filling plant on conveyor belt using SCADA software
3. Prepare a project indicating historical/real-time trend for an event using SCADA software
4. Design a small automation model for automatic ON/OFF control of a light in a room according to occupancy in the room
5. Automatic railway gate controlling system
6. Demonstration of five axes rotation of Robotic Arm
7. Control of servo-motor and stepper motor by using Raspberry Pi 4.0
8. Operate Robot-Based Welding Automation

H .Specification table for setting question paper for semester end theory examination

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Total Marks	Course Outcome
		Remember	Understand	Application		
I/1	General Idea of Automation	04	04	02	10	EEH506-1
I/2	Industrial Control Components	02	06	06	14	EEH506-2
I/3	Implement the industrial control actions	02	04	04	10	EEH506-3
II/4	Programmable Logic Controller	04	02	06	12	EEH506-4
II/5	Implement simple industrial controls	04	02	06	12	EEH506-5
II/6	Implement simple industrial automation systems	02	02	06	12	EEH506-6

I. Assessment Criteria

i. Formative Assessment of Practical:

Every laboratory assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

ii. Summative Assessment of Practical:

At the time of Practical Examination, the practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical / Oral	05
3	Neat & complete Diagram /write up	05
4	Observations / Handling of instrument / Communication / Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional strategies:

- Lectures cum Demonstrations,
- Class room practices.
- Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publisher
1.	Eshwar U. S.	Handbook of Electric Motor Controls	Tata McGraw Hill
2.	Bhattacharya & Singh	Control of Electrical Machines	New Age International Publishers
3	Webb & Reis	Programmable Logic Controllers principles and applications	Prentice Hall India
4	Biswanath Paul	Industrial electronics and control (including Programmable Logic Controller) [3rd edition only, not earlier one	Prentice Hall India
5.	Bryan & Bryan	Programmable Controllers Theory and Implementation	An Industrial Text Company Publication
6	John R. Hackworth & Frederick Hackworth (Jr)	Programmable Logic Controllers	Pearson

M. Websites

1. www.nptel.iitm.ac.in
2. www.futurlec.com
3. www.bis.org.in

Course Name : Instrumentation and Signal Conditioning
Course Code : EEH507
Course Abbreviation : HINS

TEACHING AND EVALUATION SCHEME:

A. Teaching/Learning Scheme:

Scheme component	Hours / week	Credits
Theory	4	4
Practical	2	
Tutorial	0	
Self Learning	2	
Notional Learning	8	

B. Evaluation Scheme:

PAPER DURAT ION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTA L
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
03	MAX	MAX	MAX	MI N	MAX	MI N	MAX	MI N	MAX	MIN	175
	30	--	70	--	25	10	25#	10	25	10	

(Total IKS Hrs for Sem. : 02 Hrs)

C: Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
 Note : (TNR 11 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
 1(one) credit is equivalent to 30 Notional hrs.
 * Self learning hours shall not be reflected in the Time Table.
 * Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i. RATIONALE

To introduce the basics of instrumentation and signal conditioning. To elucidate sensors and signal conditioning circuits. To familiarize with different sensors and transducers. To explain signal conditioning circuits.

ii. INDUSTRY/EMPLOYER EXPECTED OUTCOME

The student should be able to measure real-world physical parameters, condition and process the signals accurately, interface them with control/DAQ systems, diagnose faults, and maintain reliable industrial instrumentation systems.

E. COURSE OUTCOMES

- EEH 507-** 1. Select relevant transducers/sensors used for measuring electrical and non-electrical quantities for various applications.
- EEH 507-** 2 Use relevant instruments for measuring non-electrical quantities.
- EEH 507-** 3. Check the signal conditioning and telemetry system for their proper functioning.
- EEH 507-** 4. Use data acquisition systems in various applications.
- EEH 507-** 5. Undertake condition monitoring for diagnostic analysis of electrical equipment.
- EEH 507 - 6** Identify PLC components and modes of operations.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX :

[**Note : Correlation levels :** 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “-” : no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems
Competency: Use instrumented equipment for condition monitoring and control.	1	2	2	1	2	1	3	2	2
EEH507-1. Select relevant transducers/sensors used for measuring electrical and non-electrical quantities for various applications.	2	3	1	-	1	1	2	1	1
EEH507-2. Use relevant instruments for measuring non-electrical quantities.	2	1	1	2	2	2	2	2	2
EEH507-3. Check the signal conditioning and telemetry system for their proper functioning.	2	2	1	2	2	1	2	1	1
EEH507-4. Use data acquisition systems in various applications.	3	1	1	1	1	1	2	1	2
EEH507-5. Undertake condition monitoring for diagnostic analysis of electrical equipment.	-	2	3	1	-	1	2	2	
EEH507-6. Identify PLC components and modes of operations	3	2	3	1	-	1	2	1	1

F. CONTENT

A.Suggested Practical/ Exercise

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted and assess the student for attainment of the competency

Sr No.	Title of Practical Exercise	Course Outcome
1.	Measure linear displacement by L.V.D.T.	EEH507-1,2
2.	Measure the strain with the help of strain gauge	EEH507-1,2
3.	Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.	EEH507-3
4.	Use Thermocouple to control the temperature of a furnace/machine	EEH507-3
5.	Measure pressure using a pressure sensor kit.	EEH507-4
6.	Measure angular speed using a stroboscope and tachometer.	EEH507-4
7.	Measure the flow using a flow meter.	EEH507-4
8.	Use an op-amp as an inverter, non-inverting mode, adder, differentiator and integrator.	EEH507-5
9.	Convert analog data into digital data by using analog to digital converters and analog data into digital data by digital to analog converter.	EEH507-5
10	Study of PLC hardware components	EEH507-6

B. THEORY

Ch. No.	Topics / Subtopics	Lectures (Hours)	Theory Evaluation (Marks)
	CO: EEH507-1. Select relevant transducers/sensors used for measuring electrical and non-electrical quantities for various applications.		

1.	<p>1. Transducers Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices pry. And sec. Transducers. Advantages of electric transducers. Required characteristics of transducers. Factors affecting the choice of transducers. Construction and principle of resistive transducer, Potentiometer –variac and strain gauges, Gauge factor, Types of strain gauges like unbonded, bonded and semiconductor. Construction and principle of working of Inductive transducers-L.V.D.T. and R.V.D.T, their applications. Construction, principle and applications of transducers – Piezo-Electric transducer, photoconductive cells, photovoltaic cells.</p>	10	12
2.	CO: EEH507-2. Use relevant instruments for measuring non-electrical quantities.		
	<p>2. Measurement of Non-Electrical Quantities Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple, radiation pyrometer, technical specifications and ranges. Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit. Construction and Working of Speed Measurement by contact type and non-Contact type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pickup and Stroboscope. Construction and Working of Vibration measurement by accelerometer-LVDT accelerometer, Piezo electric type. Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter. Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods. Construction and Working of Thickness measurement by resistive, inductive, capacitive, ultrasonic and Nuclear methods.</p>	12	12

CO: EEH507-3. Check the signal conditioning and telemetry system for their proper functioning.

3	<p>3. Signal Conditioning Basic</p> <p>Concept of signal conditioning System.</p> <p>Draw pin configuration of IC 741. Define Ideal OP-AMP and Electrical Characteristics of OP-AMP. Different Parameters of op-amp:-Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain bandwidth. Output short circuit current.</p> <p>Use of op-amp as inverting, non- inverting mode, adder, subtractor, and Working of Differential amplifier and instrumentation amplifier.</p> <p>Filters: Types of RC filters and frequency response -no derivation. Sample and hold circuits - operation and its application.</p>	8	10
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SECTION II

	CO: EEH507-4. Use data acquisition systems in various applications.		
4	<p>4. Data Acquisition System Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplexer, converter and recorder.</p> <p>Draw Single Channel and Multi-channel DAS- Block diagram. Difference between Signal Channel and Multi- Channel DAS. Data conversion- Construction and Working of Analog to digital conversion- successive approximation method, ramp type method.</p> <p>Digital to Analog conversion- Construction and Working of binary weighted resistance method. Concept and methods of data transmission of electrical and electronic transmission. Construction and principle of telemetry system and its type - Electrical telemetering system.</p> <p>Digital display device- operation and its application of seven segment display, dot matrix display and concept of 3½, 4½ digits, LED and LCD applications.</p>	12	14
5	CO: EEH507-5. Undertake condition monitoring for diagnostic analysis of electrical equipment		
	<p>5. Condition Monitoring and Diagnostic Analysis</p> <p>Definition of condition monitoring. application in instrumentation, Charge amplifier, Carrier amplifier. Introduction to active filters, Classification, Butterworth, Chebyshev, Courir filters, First order, Second order and higher order filters.</p> <p>Voltage to frequency and frequency to voltage converters.</p>	10	12
	EEH507-6. Identify PLC components and modes of operations		
6	<p>6. PLC</p> <p>Block diagram of PLC, elements of PLC, Operation of PLC, common terms in PLC, Advantages & Disadvantages of PLC.</p> <p>PLC Processors:</p> <p>Processor operating cycle, Processor operating modes, Processor operating systems and processor status indicators.</p> <p>PLC Memory</p>	08	10

	System memory, Application memory, Memory requirement.		
	TOTAL	60	70

G. List of Assignments under SLA

Sr.No	List of Assignment (under SLA)	Hrs Allotted
1	Present seminar on various topic form course content	04
2	Prepare report on the different electrical & Electronic measurement instruments	04
3	Seminar on latest Signal conditioning equipments.	04
4	Have group discussion on various topic on course content and get updated with latest trends in Signal conditioning system	04
5	Co-relating the importance of content of this course with other courses and practical applications	04
6	Collect the sample overhead cable, supports and line insulator	02
7	Present seminar on various topic form course content	04
8	Make report on Data Acquisition system	04
	Total Hours	30

OR

The following suggested list given below for Micro project, concerned faculty can add similar micro projects

1. Temperature Measurement using LM35 with Signal Conditioning
2. RTD (PT-100) Temperature Measurement using Wheatstone Bridge
3. Thermocouple Temperature Measurement with Cold-Junction Compensation
4. Strain Gauge Weight Measurement System
5. LVDT Based Displacement Measurement
6. Pressure Measurement using Pressure Transducer
7. Signal Filtering (LPF, HPF, BPF) using Op-Amp
8. Instrumentation Amplifier Design for Low Level Signals
9. Light Intensity Measurement using LDR with Signal Conditioning
10. Noise Reduction in Sensor Signals (Filtering & Shielding)

H .Specification table for setting question paper for semester end theory examination

Section /Topic No	Name Of Topic	Distribution of Marks (level wise)			Course outcome	Total Marks
		Remember	Understand	Application		
I / 1.	Transducers	4	6	2	EEH507- 1	12
I / 2	Measurement of Non-Electrical Quantities	2	6	4	EEH507- 2	12
I / 3	Signal Conditioning Basic	2	6	2	EEH507- 3	10
II /4	Data Acquisition System Generalized DAS	4	6	4	EEH507- 4	14

II / 5	Condition Monitoring and Diagnostic Analysis	4	4	4	EEH507- 5	12
II / 6	PLC	2	6	2	EEH507- 6	10

I. Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given in *Laboratory Manual*

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

J. Instructional strategies

- Lectures cum Demonstrations
- Class room practices.
- Use of projector and soft material for demonstration

K. Teaching and Learning resources

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE MATERIAL

a) Books

Sr . No.	Title of Book	Author	Publication
1	Electric and Electronic Measurement and instrumentation	Sawhney, A.K.	Dhanpat Rai and Co. Nineteenth revised edition 2011 reprint, 2014, ISBN:10: 8177001000
2	Instrumentation devices and system	Rangan, C.S. G.R.Sharma. and V.S.V. Mani	Pen and ram International Publishing India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3	Electronics and instrumentation	Mehta, V.K.	Third edition-S.Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3
4	Industrial instrumentation and control	Singh, S.K.	Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.
5	Op-amp and Linear	Ramakant Gayakwad	PHI Pearson Education.
6	Electronic Measurement and Instrumentation,	J.G. Joshi	Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

7	Integrated Circuits ,Process Control Instrumentation Technology	C. D. Johnson	PHI Pearson Education.
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M. Websites

1. www.nptel.iitm.ac.in
2. www.futurlec.com
3. www.bis.org.in
4. www.electrical4u.com

Course Name : **ELECTRIC VEHICLE**
Course Code : **EEH508**
Course Abbreviation : **HELV**

A. LEARNING SCHEME

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME

Paper duration in Hrs.	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA-PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: 02 Hrs.)

C. Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On-Line Examination, @\$ Internal Online Examination

Note:

- 1.FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- 2.If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
- 3.If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- 4.Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
1(one) credit is equivalent to 30 Notional hrs.
* Self learning hours shall not be reflected in the Time Table.
* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE

The global movement towards sustainable energy has positioned electric vehicle (EV) technology as a crucial field for electrical engineers. This course is designed to provide students with the essential knowledge and skills to understand, test, and work with EV systems. Through a blend of theoretical instruction and hands-on laboratory

experiments, students will develop a thorough understanding of EV technology, equipping them for careers in the rapidly expanding electric vehicle industry.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

Test and use different components of EV systems and compliance of policies & preparing for careers in the electric vehicle industry.

E. INDUSTRY / EMPLOYER EXPECTED OUTCOME

EEH508 -1 Identify components and subsystems used in electric vehicles.

EEH508-2 . Select electrical drives for particular EV application.

EEH508-3 . Test the performance of EV batteries.

EEH508-4 . Apply the concept of converters and charging system in EV.

EEH508-5 . Implement Indian and state EV policies for EV applications.

COURSE LEVEL LEARNING OUTCOMES (COs):

Note : Correlation levels : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), “0” : no correlation

Competency and Cos	Programme Outcomes POs and PSOs									
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Maintain various types of electrical equipments	PSO2 Maintain various sections of electrical power systems	
Competency:	3	1	3	1	1	–	1	3	3	
EEH508-1: Identify components and subsystems used in electric vehicles.	3	2	3	1	1	–	1	3	3	
EEH508-2- Select electrical drives for particular EV application.	3	2	3	2	1		1	3	3	
EEH508-3- Test the performance of EV batteries.	3	2	3	2	1	–	1	3	3	
EEH508-4- Apply the concept of converters and charging system in EV.	3	2	3	1	1	–	1	3	3	
EEH508-5 - Implement Indian and state EV policies for EV applications.	3	2	3	1	1	–	1	3	3	

F. CONTENT

A. SUGGESTED PRACTICAL'S/ EXERCISE

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as practical's and assess the student for attainment of the competency.

Sr No.	Title of Practical Exercise	Course Outcome
1	Identification of terminals of motors used in EVs.	EEH508-2
2	Determine and compare the characteristics of given EV motors	EEH508-2
3	Testing of EV batteries.	EEH508-3
4	Perform Active Lithium-Ion Cell balancing using Plastic Platform Scale.	EEH508-3
5	Design battery pack for specified capacity of EV.	EEH508-3
6	Report on a Charging station of EV battery.	EEH508-4
7	Report on EV policy.	EEH508-4
8	Calculate the charging time for different battery capacities using given formulas	EEH508-4

B. Theory

SECTION I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	<i>EEH508-1</i> - Identify components and subsystems used in electric vehicles.		
1.	Unit - I Basics of Electric Vehicles 1.1 History and evolution of electric vehicles (EV), need of EV, 1.2 Electric vehicles and internal combustion engine vehicles: Comparison on the basis of environmental impact, power source, maintenance, gear change, noise level, vibrations level, capital cost, and running cost. 1.3 Electric vehicle architecture, Types of EV: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), Fuel Cell Electric Vehicle (FCEV). 1.4 Comparison of different electric vehicle types on the basis of Driving Component, Energy Source used, Features, Problems and models available in market.	16	20

	1.5 Block diagram of EV subsystems: energy source subsystem, propulsion subsystem and auxiliary subsystem.		
2	<p>EEH508-2 Select electrical drives for particular EV application.</p> <p>Unit - II Electric Vehicle Drives</p> <p>2.1 Classification of electric drives used in EV: DC Motor drives, AC Motor drives.</p> <p>2.2 Revision of Brushed DC Motor, Brushless DC Motor (BLDC), Permanent Magnet Synchronous Motor (PMSM), Induction Motor (IM)</p> <p>2.3 Synchronous Reluctance Motor (Syn RM), PM Assisted Synchronous Reluctance Motor, Axial Flux Ironless Permanent Magnet Motor: Salient features, characteristics, advantages, limitations, and usage of different motor types in EV models.</p> <p>2.4 Comparison of EV motors based on power-weight ratio, torque- speed characteristic, cost of controllers required and cost of motors.</p> <p>2.5 Physical location of motor in EV, Rating of motors, Connections (Mechanical and Electrical), and Selection criteria of various types of EV motors.</p>	14	14
Section II			
3.	<p>EEH508-3 Test the performance of EV batteries.</p> <p>Unit - III Batteries</p> <p>3.1 Energy storage technology: EV Batteries, Supercapacitors, flywheel energy storage.</p> <p>3.2 Battery Parameters: Cell and Battery Voltages, Charge (or Amp-hour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amp-hour (or Charge) Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs, Battery Life and Number of Deep Cycles.</p> <p>3.3 Batteries: Lead-acid, NiMH (Nickel-Metal Hydride), Li-Ion (Lithium-Ion), Ni-Zn (Nickel-Zinc), Ni-Cd (Nickel-Cadmium), Aluminium-Ion batteries (Al-Ion batteries), Aluminium-air batteries (Al-air batteries)- their basic construction components,</p> <p>3.4 Comparison of various batteries.</p> <p>3.5 Factors influencing the operation of battery, and selection of battery.</p> <p>3.6 Series and Parallel connection of Batteries, Calculation of battery capacity.</p>	12	14
4.	EEH508-4 Apply the concept of converters and charging system in EV.	12	14

	<p>Unit - IV Converters and EV Chargers</p> <p>4.1 Block diagram of typical EV: Description and Functions of DC to DC Converter, DC to AC Converter, AC to DC Converter (Rectifier) and filters.</p> <p>4.2 Charging methods: Home charging, Trickle charging, Household AC charging, Public charging (DC Fast charging).(Simple block diagrams)</p> <p>4.3 Charging System: Classification (No detailed required)</p> <p>4.4 Charging Stations: Types of charging station, Public charging station: Selection and sizing, components and, single line diagram.</p> <p>4.5 Calculation of charging time and concept of battery swapping.</p> <p>4.6 Precautions observed while charging.</p>		
5.	<p>EEH508-5 Implement Indian and state EV policies for EV applications.</p> <p>Unit - V Electric Vehicle (EV) Policies</p> <p>5.1 Goal of EV30@30 campaign. Goals of electric vehicles initiative in India. National Electric Mobility 5.2 Mission Plan 2020 (NEMMP): Objectives, Steps taken by Indian Government for faster adoption of electric vehicles, Barriers to adoption of electric mobility, E-mobility strategy, NEMMP 2020 Implementation structure.</p> <p>5.3 Maharashtra Electric Vehicle Policy, 2021: Objectives, Basic demand incentives for electric vehicles, Vehicle segment-wise scrappage incentives, Incentives for charging infrastructure.</p>	06	08

G. List of SLA:

Microproject related to electric vehicle

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basics of Electric Vehicles	6	6	8	20	EEH508-1
I / 2	Electric Vehicle Drives	4	6	4	14	EEH508-2
I / 3	Batteries and Energy Storage Systems	4	6	4	14	EEH508-3
II / 4	Converters and EV Chargers	4	6	4	14	EEH508-4
II / 5	Electric Vehicle (EV) Policies	4	2	2	08	EEH508-5
Total Marks					70	

I. Assessment Criteria

Formative Assessment of Practical:

Every laboratory assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		25

Summative Assessment of Practical

At the time of Practical Examination, the practical assignment shall be assessed for 25 marks as per following criteria:

Sr.No.	Criteria	Marks allotted
1	Knowledge about the course	05
2	Preparedness for practical / Oral	05
3	Neat & complete Diagram /write up	05
4	Observations / Handling of instrument / Communication / Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		25

J. Instructional Methods

Lectures cum Discussions
Class room practices
Presentations and demonstrations

K. Teaching and Learning resources

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books

Books / Journals / IS Codes

Sr.No.	Author-Publication	Title
1.	Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz Ebrahimi.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles.
2.	James Larminie, John Lowry.	Electric Vehicle Technology Explained.
3.	Dr. Nitesh Tiwari, Dr. Shekhar Yadav.	Electric Vehicle (Green and Sustainable Transportation).
4.	Ali Emadi, Mehrdad Ehsani, John M. Miller.	Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles.
5.	Sunil R. Pawar.	Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology.

M. Websites

- i. www.nptel.iitm.ac.in.
- ii. www.learningaboutelectricalcircuits.com.
- iii. www.futurlec.com iv . www.bis.org.in.