GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document: All Semesters

CURRICULUM: MPECS 2023
(NEP 2020 Compliant & Outcome Based Curriculum)
For

DIPLOMA IN ELECTRONICS & TELECOMMUNICATION

Secretary   **Chairman**

Programme wise Board of Studies (PBOS)
Electronics & Telecommunication 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 Semester of knowledge and skills. An emphasis and an attempt have 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 PBOSs and feedback 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
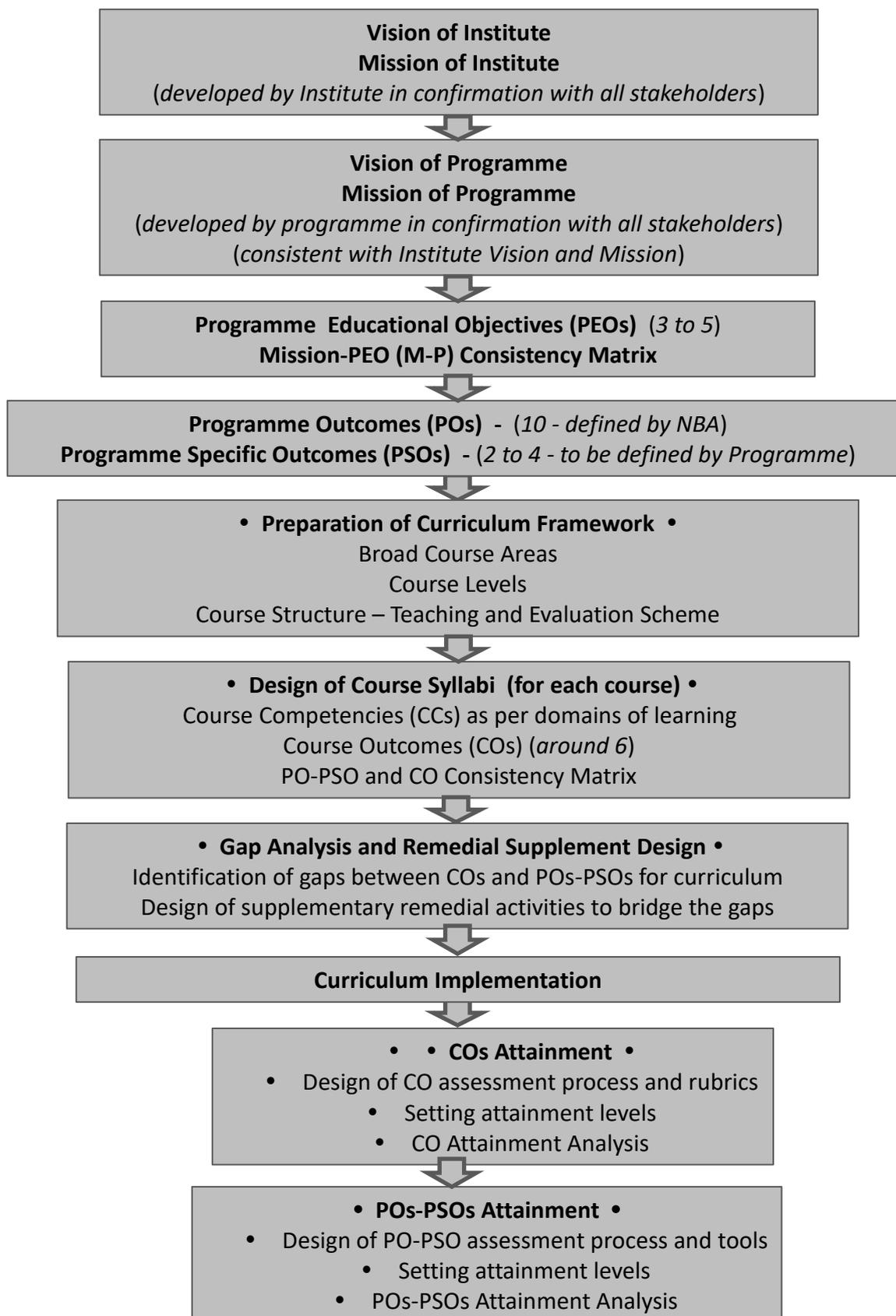- To accept systematic planning methods

- 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

Vision of Institute
Mission of Institute
(*developed by Institute in confirmation with all stakeholders*)

Vision of Programme
Mission of Programme
(*developed by programme in confirmation with all stakeholders*)
(*consistent with Institute Vision and Mission*)

Programme Educational Objectives (PEOs) (*3 to 5*)
Mission-PEO (M-P) Consistency Matrix

Programme Outcomes (POs) - (*10 - defined by NBA*)
Programme Specific Outcomes (PSOs) - (*2 to 4 - to be defined by Programme*)

• **Preparation of Curriculum Framework** •
Broad Course Areas
Course Levels
Course Structure – Teaching and Evaluation Scheme

• **Design of Course Syllabi (for each course)** •
Course Competencies (CCs) as per domains of learning
Course Outcomes (COs) (*around 6*)
PO-PSO and CO Consistency Matrix

• **Gap Analysis and Remedial Supplement Design** •
Identification of gaps between COs and POs-PSOs for curriculum
Design of supplementary remedial activities to bridge the gaps

Curriculum Implementation

• • **COs Attainment** •
• Design of CO assessment process and rubrics
• Setting attainment levels
• CO Attainment Analysis

• **POs-PSOs Attainment** •
• Design of PO-PSO assessment process and tools
• Setting attainment levels
• POs-PSOs Attainment Analysis

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 Semester.

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

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 ten 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-Semester 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-Semester 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-Semester 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 Semesters 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.
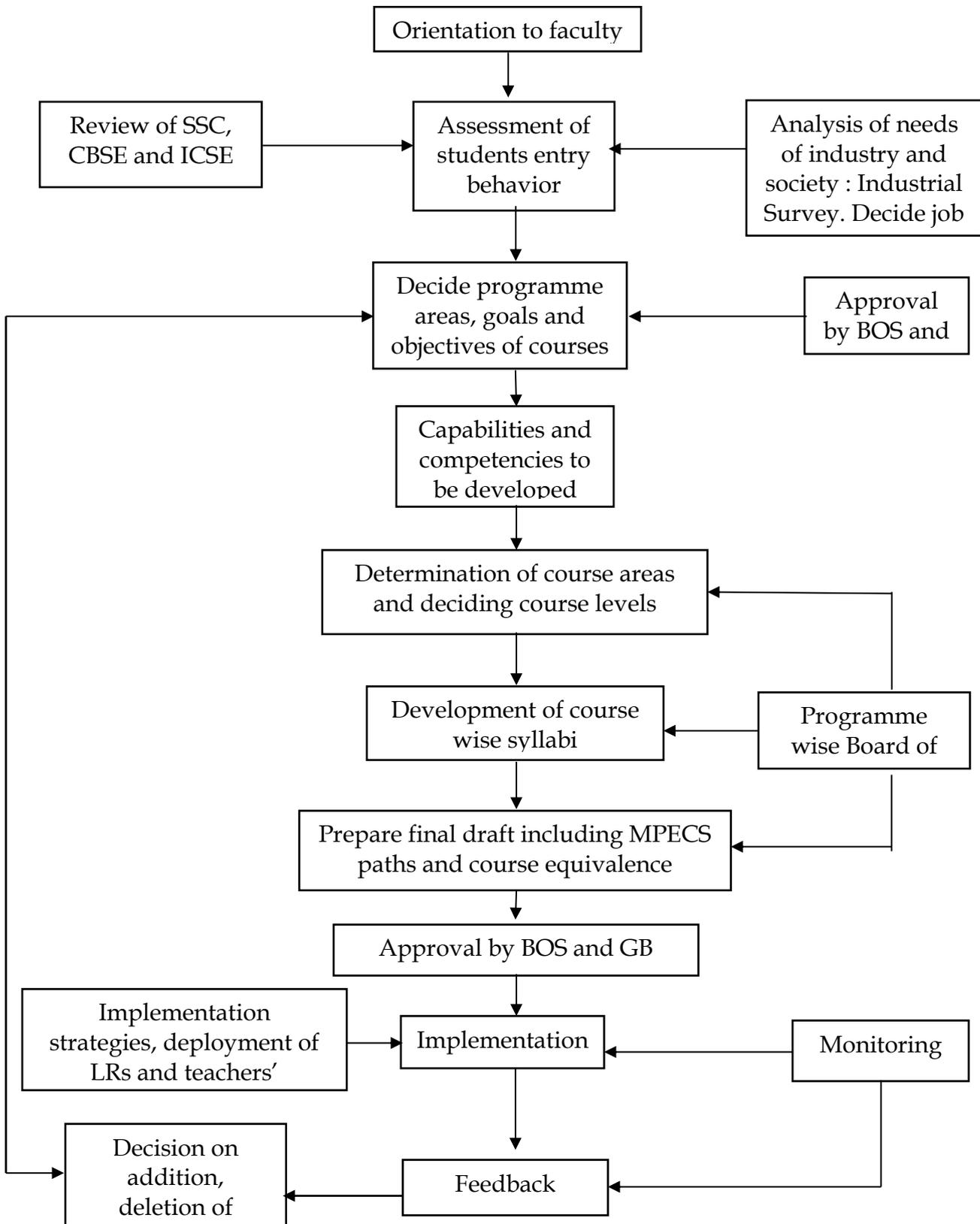
Programme Dean – He/she is the Head of Department of a Programme Department

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
  Government Polytechnic, Kolhapur is the first Government Polytechnic in Maharashtra to have been awarded academic autonomy
- Year of award of MPECS and Flexibility : 1994
- 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:

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                        ┌─────────────────────┐
                        │ Orientation to faculty│
                        └─────────────────────┘
                                  │
                                  ▼
┌──────────────┐        ┌─────────────────┐        ┌─────────────────┐
│ Review of SSC,│──────▶│   Assessment of  │◀───────│ Analysis of needs│
│ CBSE and ICSE │        │  students entry  │        │  of industry and │
└──────────────┘        │     behavior     │        │ society : Industrial│
                        └─────────────────┘        │  Survey. Decide job│
                                  │                  └─────────────────┘
                                  ▼
                        ┌─────────────────┐        ┌─────────────┐
                        │ Decide programme │◀───────│  Approval   │
                        │ areas, goals and │        │ by BOS and  │
                        │objectives of courses│      └─────────────┘
                        └─────────────────┘
                                  │
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                        ┌─────────────────┐
                        │  Capabilities and│
                        │  competencies to │
                        │   be developed   │
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                        ┌──────────────────────┐
                        │Determination of course│◀─────┐
                        │areas and deciding      │      │
                        │course levels           │      │
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                        ┌─────────────────┐    ┌─────────────┐
                        │ Development of course│◀──│ Programme   │
                        │   wise syllabi   │    │ wise Board of│
                        └─────────────────┘    └─────────────┘
                                  │                    │
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                        ┌──────────────────────┐      │
                        │Prepare final draft including│◀┘
                        │MPECS paths and course equivalence│
                        └──────────────────────┘
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                        │ Approval by BOS and GB│
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┌──────────────────┐    ┌─────────────────┐    ┌─────────────┐
│ Implementation    │───▶│  Implementation  │◀───│  Monitoring │
│ strategies,       │    └─────────────────┘    └─────────────┘
│ deployment of     │            │
│ LRs and teachers' │            ▼
└──────────────────┘    ┌─────────────────┐
┌──────────────┐         │    Feedback     │◀────────
│ Decision on   │◀───────└─────────────────┘
│ addition,     │
│ deletion of   │
└──────────────┘
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2. VISION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES (PEOs), PROGRAMME OUTCOMES (POs) AND PROGRAMME-SPECIFIC OUTCOMES (PSOs)

Vision of Institute:

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

Mission of Institute:

- To educate and train in multi-disciplinary multi-Semester 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 Semester
- To provide quality management system with focus on effective student-centric education and high recognition

Vision of Programme:

Programme of high recognition and flexibility for the development of competent technical manpower in the profession of Electronics and Telecommunication .

Mission of Programme:

- **M1**: To provide technical education of high recognition to the aspiring learners.
- **M2**: To empower student's competency to fulfill nation's project of Digital India
- **M3**: To adapt student centric approach in teaching-learning process to mould students for skill oriented professional, social and ethical practices
- **M4**: To utilize flexibility in curriculum development to incorporate recent and emerging advancements in the field of Electronics & Telecommunication

Programme Educational Objectives (PEOs):

Diploma graduates will,

PEO 1: Apply fundamental knowledge of Basic Sciences, Mathematics and Industrial Electronics engineering in problem solving.

PEO 2: Operate, demonstrate and debug the systems in the field of Industrial Electronics engineering and to resolve real life problems.

PEO 3: Attain technical knowledge, skills and attitude to acquire further advancement in technology for lifelong learning.

PEO 4: Work as a responsible team member of an organization to achieve its goal or can be an individual entrepreneur.

Programme Outcomes (POs)

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 analyse 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 analyse individual needs and engage in updating in the context of technological changes.

Programme Specific Outcomes (PSOs)

PSO 1: Operate and Maintain: Competency to apply the concepts of Electronics & Telecommunication engineering in the operation and maintenance of engineering application systems.

PSO 2: Supervision and providing solution: Ability to supervise work and reach appropriate solution to simple practical problems in Electronics and Telecommunication engineering industry.

1. Overview And Salient Features Of Curriculum: MPECS 2023

1.1 Overview of Curriculum MPECS 2023

Total Number of Credits		**120**
Number of courses offered	Total	**41**
	Theory	**24**
Maximum number courses in a semester		**07**
Total Maximum Marks		**5100**
Courses in **Semester** V **Semester** VI	Number	**11**
	Credits	**40**
	Marks	**1700**
Courses in **Semester** I	Number	**07**
	Credits	**20**
	Marks	**825**
Courses in **Semester** II	Number	**07**
	Credits	**20**
	Marks	**850**
Courses in **Semester** III	Number	**07**
	Credits	**20**
	Marks	**900**
Courses in **Semester** IV	Number	**07**
	Credits	**20**
	Marks	**825**
Courses in **Semester** V	Number	**07**
	Credits	**20**
	Marks	**850**
Ratio of TH:PR in %	Credit-wise	**63:37**
	Marks-wise	**46:54**
No. of Allied Courses		**05**
Elective Courses	No. of Elective courses	**03**
	Options per Elective Course	**02/03**
Number of Practical Exams	External	**11**
	Internal	**16**

Diploma shall be awarded on the basis of marks obtained in Semester V and Semester VI courses

1.2 Salient Features of Curriculum MPECS 2023

Addition and deletion of Courses as compared to previous MPECSs with justification:

After discussions with the industry persons and PBOS members we found it necessary to add and delete some courses as compared to previous MPECS

➢ **Following courses are newly added:-**

1. Yoga & Meditation (1 Credits, Non-Exam Course)
2. Internship (16 weeks) (10 Credits)
3. Entrepreneurship & Start up (1 Credits)
1. Optical Fiber & Satellite Communication(4 Credits)
2. PLC AND SCADA (4 Credits)
3. Introduction To AI (2 Credits)
4. Data Analytics(2 Credits)
5. Microwave Engg & Radar System (3 Credits)
6. Industrial IOT(2 Credits)

➢ **Following courses are deleted:**

1. Environmental Science (Non-credit, Non-Exam - Audit course)
2. Essence of Indian Traditional Knowledge. (Non-credit, Non-Exam - Audit course)
3. Internship 1 (4 weeks) (3 Credits)
4. Internship 2 (3 weeks) (2 Credits)
5. Instrumentation (Elective) (5 Credits)
6. Optical Fiber communication (4 Credits)
7. Applied Maths (Elective) (4 Credits)
8. Principle of control System(4 Credits)
9. Electronic Circuit Design (4 Credits)
10. Advance Microcontroller (4 Credits)

➢ **Major modifications in Course Contents with justification:**

1. To adapt OBE for the courses under term end examination scheme –
    a. Term work assessment is removed for all the courses
    b. For all courses FA-PR,SA-PR,SLA is adopted.

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER I

Programme Code	: ET	With Effect From Academic Year	: AY 2023-2024
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: First	Scheme	: H

Sr. No.	Name of Course	Course Abbrevia-tion	Course Type	Course Code	Semester	IKS Hrs per Semester	CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week	Credits	Paper Duration (Hrs)	FA-TH Max	SA-TH Max	Total Max	Total Min	FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	SLA Max	SLA Min	Total Marks
1	ENGINEERING PHYSICS	HPHA	DSC	CCH101	1	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
2	BASIC MATHEMATICS	HBMT	AEC	CCH105	1	4	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125
3	ENGINEERING GRAPHICS	HGRC	AEC	CCH109	1	2	2	-	2	0	4	2	-					50	20	50@	20			100
4	BASIC ELECTRONICS	HBTX	DSC	ETH101	1	2	3	-	4	1	8	4	3	30	70	100	40	50	20	25@	10	25	10	200
5	ELECTRONICS WORKSHOP PRACTICE	HWET	SEC	ETH102	1	2	2	-	4	0	6	3	-	-	-	-	-	50	20	50@	20	-	-	100
6	FUNDAMENTALS OF ICT	HICT	SEC	CCH202	2	0	1	-	2	1	4	2	-	-	-	-	-	25	10	25@	10	25	10	75
7	YOGA AND MEDITATION	HYAM	VEC	CCH203	2	1	-	-	1	1	2	1	-	-	-	-	-	25	10	-	-	25	10	50
	Total:					15	16	2	15	7	40	20	-	90	210	300		250		175		125		825

Government Polytechnic Kolhapur

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER II

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2023-2024
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: Second	Scheme	: H

Sr. No.	Name of Course	Course Abbrevia-tion	Course Type	Course Code	Semester	IKS Hrs per Semester	Learning Scheme					Credits	Paper Duration (Hrs)	Assessment Scheme									Based on Self Learning		Total Marks
							CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week			Theory				Based on LL & TL				SLA		
														FA-TH	SA-TH	Total		FA-PR		SA-PR				
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	APPLIED MATHEMATICS	HAMT	AEC	CCH301	3	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100
2	ENGINEERING CHEMISTRY	HCHA	DSC	CCH103	1	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	COMMUNICATION SKILLS	HCMS	AEC	CCH201	2	0	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
4	APPLIED ELECTRONICS	HATX	DSC	ETH103	1	0	4	-	2	-	6	3	3	30	70	100	40	25	10	25@	10	-	-	150
5	ELECTRICAL ENGINEERING	HEEG	DSC	ETH104	1	0	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
6	C PROGRAMMING	HCPR	SEC	ETH105	1	-	2	-	2	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50
7	SOCIAL & LIFE SKILLS	HSLS	VEC	CCH204	2	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
	Total:					6	21	2	10	7	40	20		150	350	500		125		100		125		850

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER III

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2024-2025
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: Third	Scheme	: H

Sr. No.	Name of Course	Course Abbreviation	Course Type	Course Code	Semester	IKS Hrs per Semester	Learning Scheme					Credits	Paper Duration (Hrs)	Assessment Scheme											Total Marks
							CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week			Theory				Based on LL & TL				Based on Self Learning		
														FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	CIRCUITS & NETWORKS	HCKN	DSC	ETH301	3	0	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
2	LINEAR INTEGRATED CIRCUITS	HLIC	DSC	ETH302	3	0	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	DIGITAL TECHNIQUES & APPLICATIONS	HDTA	DSC	ETH303	3	0	3	-	4	1	8	4	1.5	30*#	70*#	100	40	25	10	25#	10	25	10	175
4	ANALOG COMMUNICATION	HACM	DSC	ETH304	3	0	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
5	ELECTRONICS MEASUREMENTS & INSTRUMENTATION	HEMI	DSC	ETH305	3	0	3	-	2	1	6	3	-	-	-	-	-	50	20	25@	10	25	10	100
6	BASIC PYTHON PROGRAMMING	HBPP	AEC	ETH306	3	0	2	-	2	-	4	2		-	-	-	-	25	10	25@	10	-	-	50
7	ESSENCE OF INDIAN CONSTITUTION	HEIC	VEC	CCH205	3	0	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
	Total:					0	18	-	16	6	40	20	-	120	280	400	-	175	-	150	-	175	-	900

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER IV

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2024-2025
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: Four	Scheme	: H

Sr. No.	Name of Course	Course Abbreviation	Course Type	Course Code	Semester	IKS Hrs per Semester	Learning Scheme					Credits	Paper Duration (Hrs)	Assessment Scheme											Total Marks
							CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week			Theory				Based on LL & TL				Based on Self Learning		
														FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	MICROCONTROLLERS	HMCS	DSC	ETH307	3	0	4	-	4	-	8	4	3	30	70	100	40	25	10	25#	10	-	-	150
2	DIGITAL COMMUNICATION	HDCM	DSC	ETH308	3	0	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175
3	POWER ELECTRONICS	HPTX	DSC	ETH309	3	0	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
4	SIMULATION SOFTWARE	HSMS	DSC	ETH401	4	0	-	-	4	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50
5	SIGNALS & SYSTEMS	HSYS	DSC	ETH402	4	0	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
6	CONSUMER ELELCTRONICS	HCEX	DSC	ETH501	5	0	3	-	2	1	6	3	-	-	-	-	-	25	10	-	-	25	10	50
7	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	HEES	VEC	CCH206	2	2	2	-	-	2	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125
	Total:					2	19		16	5	40	20	-	150	350	500	-	150	-	75	-	100	-	825

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER V

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2025-2026
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: FIFTH	Scheme	: H

Sr. No.	Name of Course	Course Abbreviation	Course Type	Course Code	Semester	IKS Hrs per Semester	Learning Scheme			Self Learning (TW & Assignment)	Notional Learning Hrs / Week	Credits	Paper Duration (Hrs)	Assessment Scheme									Based on Self Learning		Total Marks
							CL	TL	LL					Theory				Based on LL & TL				SLA		
														FA-TH	SA-TH	Total		FA-PR		SA-PR				
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	ENTREPRENEURSHIP & STARTUP	HESU	AEC	CCH501	5	1	2	-	-	1	3	1	-	-	-	-	-	-	-	-	-	50	20	50
2	INTERNSHIP (16 WEEKS)	HINT	INP	CCH505	5	0	-	-	-	-	-	10	-	-	-	-	-	100	40	100#	40	-	-	200
3	DATA COMMUNICATION & NETWORKING	HDCN	DSC	ETH404	4	0	7	-	4	-	11	2	3	30	70	100	40	25	10	25#	10	-	-	150
4	EMBEDDED SYSTEM	HEMS	DSC	ETH405	4	0	7	-	4	-	11	2	3	30	70	100	40	25	10	25#	10	-	-	150
5	ELECTIVE 1		GE		5	0	5	-	-	1	6	2	1	15*#	35*#	50	20	-	-	-	-	50	20	100
6	INTERNET OF THINGS	HIOT	DSC	ETH502	5	0	3	-	4	-	7	1	-	-	-	-	-	50	20	50@	20	-	-	100
7	PROJECT	HPRJ	INP	ETH503	5	-	-	-	4	2	6	2	-	-	-	-	-	-	-	50#	20	50	20	100
	Total:					1	24	-	16	4	45	20		75	175	250	-	200		250	-	150	-	850

IOM, ESU & Project will be conducted online for 4 weeks (Prior to the Offline schedule), followed by 6 weeks of offline session

CURRICULUM STRUCTURE: TEACHING AND EXAMINATION SCHEME OF SEMSTER VI

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2025-2026
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: SIXTH	Scheme	: H

Sr. No.	Name of Course	Course Abbrevia-tion	Course Type	Course Code	Semester	IKS Hrs per Semester	CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week	Credits	Paper Duration (Hrs)	FA-TH Max	SA-TH Max	Total Max	Total Min	FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	SLA Max	SLA Min	Total Marks
1	OPTICAL FIBRE & SATELLITE COMMUNICATION	HOSC	DSC	ETH406	4	0	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
2	PLC AND SCADA	HPCS	DSC	ETH407	4	0	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	MOBILE & WIRELESS COMMUNICATION	HMCM	DSC	ETH408	4	0	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
4	ELECTIVE 2		DSE		5	0	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
5	ROBOTICS	HROB	DSC	ETH504	5	0	3	-	2	1	6	3	-	-	-	-	-	25	10	50#	20	25	10	100
6	ELECTIVE 3		DSE		5	0	2	-	2	-	4	2	-	-	-	-	-	50	20	50#	20	-	-	100
	Total:					0	20	0	12	8	40	20		120	280	400		175		150		125		850

ELECTIVES & OPTIONS

Programme Code	: Electronics & Telecommunication	With Effect From Academic Year	: AY 2025-2026
Duration of Programme	: 6 Semesters	Duration	: 16 Weeks
Semester	: FIFTH & SIXTH	Scheme	: H

Sr. No.	Name of Course	Course Abbrevia-tion	Course Type	Course Code	Semester	IKS Hrs per Semester	Learning Scheme					Credits	Paper Duration (Hrs)	Assessment Scheme										Based on Self Learning		Total Marks
							CL	TL	LL	Self Learning (TW & Assignment)	Notional Learning Hrs / Week			Theory				Based on LL & TL						SLA		
														FA-TH	SA-TH	Total		FA-PR		SA-PR						
														Max	Max	Max	Min	Max	Min	Max	Min			Max	Min	
	ELELCTIVE 1																									
1	INDUSTRIAL ORGANIZATION AND MANAGEMENT	HIOM	AEC	CCH502	5	0	5	-	-	1	6	2	1	15*#	35*#	50@$	20	-	-	-	-			50	20	100
2	MARKETING MANAGEMENT	HMKM	AEC	CCH503	5	0	5	-	-	1	6	2	1	15*#	35*#	50@$	20	-	-	-	-			50	20	100
3	PROJECT MANAGEMENT	HPRM	AEC	CCH504	5	0	5	-	-	1	6	2	1	15*#	35*#	50@$	20	-	-	-	-			50	20	100
	ELECTIVE 2																									
1	MICROWAVE ENGG & RADAR SYSTEM	HMWR	DSC	ETH505	5	0	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-			25	10	150
2	INDUSTRIAL IOT	HINI	AEC	ETH506	5	0	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-			25	10	150
3	VLSI APPLICATION	HVLA	DSC	ETH507	5	0	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-			25	10	150
	ELECTIVE 3																									
1	INTRODUCTION TO AI	HIAI	DSE	ETH508	5	0	2	-	2	-	4	2	-	-	-	-	-	50	20	50#	20			-	-	100
2	DATA ANALYTICS	HDAL	DSE	ETH509	5	0	2	-	2	-	4	2	-	-	-	-	-	50	20	50#	20			-	-	100
3	AUTOMOTIVE ELECTRONICS	HAEL	DSE	ETH510	5	0	2	-	2	-	4	2	-	-	-	-	-	50	20	50#	20			-	-	100

ABBREVIATIONS :

CL- CLASSROOM LEARNING , TL- TUTORIAL LEARNING, LL-LABORATORY LEARNING, FA - FORMATIVE ASSESSMENT, SA -SUMMATIVE ASSESSMENT, IKS - INDIAN KNOWLEDGE SYSTEM

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.

   - SELF LEARNING HOURS SHALL NOT BE REflECTED IN THE TIME TABLE.

COURSE CATEGORIES :

A. DISCIPLINE SPECIFIC COURSE CORE (DSC)
B. DISCIPLINE SPECIfiC ELECTIVE (DSE)
C. VALUE EDUCATION COURSE (VEC),
D. INTERN./APPRENTI./PROJECT./COMMUNITY (INP)
E. BILITY ENHANCEMENT COURSE (AEC)
F. SKILL ENHANCEMENT COURSE (SEC)
G. GENERIC ELECTIVE (GE)

Government Polytechnic Kolhapur (MPECS 2023)														
PROFORMA -I														
Formative Assessment of Practical's /Tutorial /Self LearningAssessment														
													Total Mark s 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
Used for Summative Assessment Practical /Oral Examination

SR.NO	ROLL NO	Knowledgee 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								

	MPECS-2023					
	PROFORMA III					
	FORMAT FOR SLA MARKS OF PROJECT					
SR.NO	Enrollement No.	Marks out of 25(Qtr-1)	Marks out of 25(Qtr-1)	Marks out of 25(Qtr-1)	Marks out of 25(Qtr-1)	Total out of 100	Converted Marks As Per L/A scheme
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

PROFORMA IV

SR.NO	Enrollement No.	Marks of Internal Examiner(25)	Marks of External Examiner(25)	Marks Out of (50)
FORMAT FOR EXTERNAL EXAMINATION OF PROJECT				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Sign.of Internal Examiner   Sign of External Examiner
Institute Name   Instirtute Name
Code   Code

Course Equivalence For Previous MPECSs

SN	MPECS-2010	MPECS-2013	MPECS-2016	MPECS-2020	MPECS-2023
1	**X101**-Generic Skill	**CCE201**-Gen. Skills	**CCF201**-Gen. Skills	--	--
2	**X102**-Basic Physics	**CCE102**-Engineering Physics	**CCF102**-Engineering Physics	**CCG102**-Engineering Physics	**CCH101**-Engineering Physics
3	**X103**-Applied Chemistry	**CCE104**-Engineering Chemistry	**CCF104**-Chemistry of Engineering materials	**CCG104**-Engineering Chemistry	**CCH103**-Engineering Chemistry
4	**X104**-Basic Mathematics	**CCE105**-Basic Mathematics	**CCF105**-Basic Mathematics	**CCG105**-Basic Mathematics	**CCH105**-Basic Mathematics
5	**IX/EJ 105**-Engineering Drawing	-----	-----	-----	-----
6	**X106**-Comm.Skills	**CCE202**-Com.Skills	**CCF202**-Com.Skills	**CCG203**-Communication Skills	**CCH201**-Communication Skills
7	**IX/EJ107**-Basic workshop practice	**CCF114**-Workshop Practice	**CCF114**-Workshop Practice	**CCG114**-Workshop Practice	---
8	**X108** -Engg. Science	----	----	----	----
9	**IX/EJ 109**-Electronic Components and Applications	**IEE/ETE103**-Electronic Components and Applications	**EIF 101**-Electronics Components &Application	**EIG101**-Electronics Components &Application	----
10	**X110**-Engineering Mathematics	**CCE106**-Engineering Mathematics	**CCF 106**-Engineering Mathematics	**CCG118**-Engineering Mathematics	**CCH301**- Applied Mathematics
11	----	**IEE/ETE108**-Computer Fundamental & Application	**EIF 108**-Computer Fundamental & Application	**CCG201**-Introduction to IT System	**CCH202**-Fundamental of ICT.
12	**IX/EJ111** Basic Electronics	**IEE/ETE103**-Basic Electronics	**EIF 103**-Basic Electronics	**EIG103**-Basic Electronics	**EIH101**-Basic Electronics
13	-----	**EIF107**- Basic Electrical Engg	**EIF 107**- Basic Electrical Engg	**EIG107**- Basic Electrical Engg	**ETH104**- Electrical Engg
14	-----	**CCE 109**-Engineering Graphics	**CCF 109**-Engineering Graphics	**CCG109**-Engineering Graphics	**CCH109**-Engineering Graphics

15	**IX/EJ112** Circuit & Network	**IEE/ETE308** Circuit & Network	**EIF 308**- Circuit & Network	**EIG308**- Circuit & Network	**EIH301**- Circuit & Network
16	----	**CCE203**-Professional Practices	**CCF203**-Professional Practices	----	
17	----	**CCE204**-Environmental Studies	----	**CCG204**-Environmental Science	**CCH206**-Environmental Education and Sustainability
19	**ET201**- Applied Mathematics	**IEE/ETE301**-Applied Mathematics	**EIF 301**- Applied Mathematics	**EIG301**- Applied Mathematics	**CCH301**- Applied Mathematics
20	**ET202**- Applied Electronics	**IEE/ETE302**-Applied Electronics	**EIF 302**- Applied Electronics	**EIG302**-Applied Electronics	**ETH103**-Applied Electronics
22	**IX/EJ203**-Electronics Measuring Instruments	**IEE/ETE303**-Electronics Measuring Instruments	**EIF 303**-Electronics Measuring Instruments	**EIG303**-Electronics Measuring Instruments	**ETH305**-Electronics Measuring Instruments
23	**IX/EJ204** C Programming	**IEE/ETE304**- C Programming	**EIF 304**-C Programming	**EIG304**-C Programming	**ETH105**-C Programming
25	**IX/EJ205**-Analog Communication	**IEE/ETE305**-Analog Communication	**EIF 305**-Analog Communication	**EIG305**-Analog Communication	**ETH304**-Analog Communication
26	**IX/EJ206**-Linear Integrated Circuits	**IEE/ETE307**-Linear Integrated Circuits	**EIF 307**- Linear Integrated Circuits	**EIG307**- Linear Integrated Circuits	**ETH302**- Linear Integrated Circuits
27	**IX/EJ207**-Digital Techniques	**IEE/ETE306**-Digital Techniques & Application	**EIF 306**-Digital Techniques &Application	**EIG306**-Digital Techniques &Application	**ETH303**-Digital Techniques &Application
28	**IX/EJ208**-Digital Communication	**ETE310**-Digital Communication	**ETF310**-Digital Communication	**ETG310**-Digital Communication	**ETH308**-Digital Communication
29	**IX/EJ209**-Microprocessor & Interfacing	**IEE/ETE309**-Microprocessor & Interfacing	----	----	----
30	---	**IEE/ETE503**-Project-1	**EIF 503**-Project-1	**EIF404**-Project-1	**ETH503**-Project
33	---	**IEE/ETE311**-Non Conventional Energy Sources	**EIF 311**-Non Conventional Energy Sources	----	----
34	**IX/EJ210**-Higher Engineering Maths	**IEE/ETE312**-Higher Mathematics	**EIF 312**-Higher Mathematics	----	----

35	**IX/EJ211-**Industrial Electronics	**IEE/ETE401-**Power Electronics-1	**EIF 401-**Power Electronics-1	----	----
36	**EJ301-**Advance Communication System	---	---	---	---
37	**EJ302-**8051 Microcontroller	**IEE/ETE402-**8051 Microcontroller	**EIF 309-**8051 Microcontroller	**EIG309-**Microcontrollers	**ETH307-**Microcontrollers
38	**EJ303-**Feedback Control System	**IEE/ETE404-**Principles of Control System	**EIF 404-**Principles Of control System	**EIG406-**Principles Of control System	---
39	**EJ304-**Instrumentation	---	IEF403 - Instrumentation	**EIG508-**Instrumentation	---
40	**EJ 305-**Optoelectronics	---	---	---	---
41	**EJ306-**Medical Electronics	---	---	---	---
42	**EJ307-**Optical Fiber Communication	**ETE502-**Optical Fiber Communication	**ETF502-**Optical Fiber Communication	**ETG504-**Optical Fiber Communication	----
43	**EJ308-**Electronics Circuit Design	**IEE/ETE406-**Electronics Circuit Design	**EIF 406-**Electronics Circuit Design	**EIG403-**Electronics Circuit Design	---
44	**EJ309-** Signals & Systems	**ETE507-** Signals & Systems	**ETF 407-**Signals & Systems	**ETG407-** Signals & Systems	**ETH402-** Signals & Systems
45	**EJ401-** Mobile Communication	**ETE501-** Mobile Communication	**ETF501-**Mobile Communication	**ETG505-** Mobile and Wireless Communication	**ETH408-** Mobile and Wireless Communication
47	**EJ402-**Introduction To Matlab & OrCAD	**IEE/ETE405-**Simulation Software	**EIF 405-**Simulation Software	**EIG401-**Simulation Software	**ETH401-**Simulation Software
48	**EJ403-**Project	**IEE/ETE504-**Project II	**EIF 504-**Project II	**EIG506-**Project II	**ETH503-**Project
49	**EJ404-** Industrial Organization & Management	**IEE/ETE508-**Industrial Organization & Management	**CCF 501 -** Industrial Organization & Management	**EIG509 -** Industrial Organization & Management	**CCH 502 -** Industrial Organization & Management
50	**EJ405-**Marketing Management	**IEE/ETE509-**Marketing Management	**EIF 509-**Marketing Management	**EIG 510-**Marketing Management	**CCH 503-**Marketing Management
52	**EJ406-**Entrepreneurship Development	**IEE/ETE510-**Entrepreneurship Development	**EIF 510-**Entrepreneurship Development	**CCG501-**Entrepreneurship Development	**CCH501-**Entrepreneurship & **Startup.**
53	**EJ407-** VLSI Design	**IEE/ETE 407-**VLSI	**EIF 513-**VLSI	----	**ETH 507-**VLSI Application.

54	**EJ408-** Embedded System	----	**EIF 402-** Embedded Systems	**EIG402-** Embedded Systems	**EIH405-**Embedded Systems
55	**EJ409-** Data Communication & Networks	**ETE403-**Data Communication & Networks	**ETF403-**Data Communication & Networks	**ETG405-**Data Communication & Networks	**ETH404-**Data Communication & Networks
56	**EJ410-**Audio Video Engineering	**ETE 506-**Audio Video Engineering	**ETF506-**Audio Video Engineering	**EIG507** Consumer Electronics	**ETH501** Consumer Electronics
57	**EJ411-** Microwave Engineering	----	----	----	----
58	**EJ412-** DSP	**ETE513-** Fundamental of DSP	----	----	----
59	**EJ413-** Mobile Phone Servicing	----	----	----	----
60	**EJ414-** Computer Networking	----	----	----	----
61	**EJ415-**VB & MS ACCESS	----	----	----	----
62	----	**ETE505-**Radar & Navigation	**ETF505-**Radar & Navigation	----	----
63	----	**ETE408-** Satellite Communication	**ETF408-** Satellite Communication	**ETG408-**Satellite Communication	----
65	----	**ETE 512-**PIC Microcontroller	**EIF 512-**PIC Microcontroller	**ETG512-** Advance Microcontrollers	----
66	----	----	**EIF 507-**Energy Conservation	----	----
67	----	----	----	**EIG510-** Accounting	----
68	----	----	----	**EIG513-** Automotive Electronics	----
69	----	----	----	**CCG117-** Sports and Yoga	**CCH203-** YOGA & MEDITATION
70	----	----	----	**CCG205-** Essence of Indian Traditional Knowledge	----
71	----	----	----	**CCG206-**Indian Constitution	**CCH205 -** ESSENCE OF INDIAN CONSTITUTION

72	----	----	----	**CCG502**- Internship – 1 (4 weeks after 4th Semester)	**CCH505 -** INTERNSHIP (16 WEEKS)
73	----	----	----	**CCG503**- Internship – 2 (3 weeks after 5th Semester)	----
74	-----	ETE511 PLC and Drives	ETF511 PLC and Drives	**ETG511** Programmable Logic Controllers	**ETH 407:** Programmable Logic Controllers and SCADA.
75	----	----	----	**ETG514**- Introduction to Internet of Things	---
76	----	----	----	**ETG311**- Basics of Power Electronics	---

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SEMESTER I COURSES

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COURSE ID :

COURSE NAME   : ENGINEERING PHYSICS (EE/ET/IT)

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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30*#	70*#	100	40	25	10	25@	10	25	10	175

(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.

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*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 SEMESTER 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/pso) matrix

[Note : Correlation Semesters : 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 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	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		

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F. CONTENT :

I)   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
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**	**08**	**08**
	2.1 SEMICONDUCTORS 2.1.1 Conductors, insulators and semiconductors 2.1.2 Energy bands 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**	(06)	(06)
	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**	**12**	**14**

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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**	(06)	(10)
	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 **No numericals on above topic**	(06)	(04)

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**	**10**	**12**
	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**	(06)	(08)

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	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**	(04)	(04)

CO: CCH101-5 Apply principles of optics to solve engineering problems

5	**OPTICS**	**14**	**18**
	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**	(06)	(08)
	5.2 LASER 5.2.1 Introduction of LASER 5.2.2 Properties of laser 5.2.3 Spontaneous and stimulated emission 5.2.4 Population inversion and optical pumping 5.2.5 Applications of LASER **No numericals on above topic**	(04)	(06)
	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)

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.

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G : List of Microprojects/ 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 magnets.	02
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

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

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

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

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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

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10	The Surya Siddhanta	Aryabhatta	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

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COURSE ID:

Course Name	: BASIC MATHEMATICS
Course Code	: CCH105
Course Abbreviation	: HBMT
Course Type	: AEC
Course Semester	: 1

A. LEARNING & ASSESSMENT SCHEME:

IKS Hrs per Semester	Learning Scheme					Credits	Paper Duration (Hrs)	Assessment Scheme										Total Marks
								Theory				Based on LL & TL				Based on Self Learning		
	C L	T L	L L	Self Learning (TW &	Notional Learning Hrs /			FA TH	SA TH	Total		FA-PR		SA-PR		SLA		
								Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
4	4	2	-	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150

<u>CO,S</u>

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.

Section I

Unit No.	Topics / Sub-topics	Lectures (Hours)	SA-TH (Marks)
Unit 1 Algebra	**1.1 LOGARITHMS** 1.1.1 Concept and laws of logarithm 1.1.2 Simple examples based on laws of Logarithms **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 **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	12	14
Unit 2 Statistics	**MEASURES OF DISPERSION** 2.1 Range,coefficient of Range for Discrete & Grouped Data 2.2 Mean deviation and Standered 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	10	12
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	06	08
Total		28	34

Section II

Unit No.	Topics / Sub-topics	Lectures (Hours)	SA-TH (Marks)
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
Unit 5 Differential Calculus	5.1 **Functions**:Concept of Functions and simple examples 5.2 Limits:Concept of Limits without examples 5.3 **Derivatives:** 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)	14	16
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 6.4 Radius of curvature	4	6
	Total	32	36

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LIST OF TUTORIALS

Sr. no	Tutorial Title	No.of Hrs	Relevant CO
1	Solve Simple problems of Logarithms based on given application	2	CO1
2	Solve elementary problems on Algebra of Matrices	2	CO1
3	Solve simultaneous equations using Matrix inversion method	2	CO1
4	Resolve into Partial Fractions using linear non repeated, repeated and irreducible quadratic factors	2	CO1
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	2	CO3
6	Solve problems on finding range, coefficient of range and mean deviation	2	CO2
7	Solve problems on Standard deviation, coefficient of variation and comparison of two sets	2	CO2
8	Solve problems on Allied & Compound angles	2	CO4
9	Solve problems on Multiple & submultiple angles	2	CO4
10	Solve problems on factorization & De- factorization formulae	2	CO4
11	Solve problems on Inverse Trigonometric Functions	2	CO4
12	Solve examples on functions & rules of derivatives	2	CO5
13	Solve examples on Derivative of composite function ,inverse & parametric functions,	2	CO5
14	Solve examples on Derivative of exponential,implicit and logarithmic functions	2	CO5
15	Solve examples on Application of Derivatives	2	CO5

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COURSE ID	: ET
COURSE NAME	: **ENGINEERING GRAPHICS**
COURSE CODE	: **CCH109**
COURSE ABBREVIATION	: **HGRC**

C. LEARNING SCHEME:

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

D. 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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	100
-	-	-	-	-	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 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)

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D. i) RATIONALE:-

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. This course is useful in developing drafting and sketching skills in the student. It covers the knowledge & use of drawing instruments & also familiarizes the learner about Bureau of Indian standards related to engineering drawing.

The curriculum aims at developing the ability to draw and read various engineering curves, projections and dimensioning styles. The subject mainly focuses on use of drawing instruments, developing imagination and translating ideas into sketches. This course also helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints.

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. Prepare engineering drawing using prevailing drawing instruments.

E. COURSE SEMESTER LEARNING OUTCOMES (COS)

CCH109-1 Draw lines, letters and numbers using standard geometrical dimensions.

CCH109-2 Demonstrate the ability to draw conic sections using different methods and concepts.

CCH109-3 Apply orthographic projections to effectively convert diverse surface features.

CCH109-4 Apply basic CAD commands for drawing different entities.

CCH109-5 Draw free hand sketches of given engineering elements.

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

[Note: Correlation Semesters: 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 Work in manufacturing and service sector	PSO2 Start entrepreneurial activity
Competency: Prepare engineering drawing using prevailing drawing instruments.	-	-	-	-	-	-	-	-	-
CCH109-1 CO-1 Draw lines, letters and numbers using standard geometrical dimensions.	3	-	-	2	-	2	-	-	-
CCH109-2 CO-2 Demonstrate the ability to draw conic sections using different methods and concepts.	3	-	-	2	-	2	-	-	-
CCH109-3 CO-3 Apply orthographic projections to effectively convert diverse surface features.	3	-	-	2	-	2	-	-	-
CCH109-4 CO-4 Use Apply basic CAD commands for drawing different entities.	3	-	-	2	-	2	-	1	1
CCH109-4 CO-5 Draw free hand sketches of given engineering elements.	3	-	-	2	-	2	-	2	-

PSO 1: Operate and Maintain: Competency to apply the concepts of Electronics & Telecommunication engineering in the operation and maintenance of engineering application systems.

PSO 2: Supervision and providing solution: Ability to supervise work and reach appropriate solution to simple practical problems in Electronics & Telecommunication engineering industry.

F. CONTENT:

I) Practical exercises

Sr No	Laboratory Practical Exercise	Skills / Competencies to be Developed	RelevantCOs
1	Draw horizontal, vertical, 30-degree, 45 degrees, 60- & 75-degrees lines using Tee and Set squares/ drafter. (SketchBook).	To develop drawing skill	CO1
2	Draw different types of lines, dimensioning styles (SketchBook)	To develop drawing skills of line and dimensions	CO1
3	Draw one figure showing dimensioning techniques, twoproblems on redraw the figures and one problem on lociof points - slider crank mechanism. (Sketch Book)	To develop drawing skill of various loci points	CO1
4	Draw one figure showing dimensioning techniques, twoproblems on redraw the figures (01 Sheet)	To develop drawing ability in dimensioning technique	CO1
5	Draw any four Engineering Curves (Sketchbook)	To develop drawing skill for various Engineering curves	CO1
6	Draw any four Engineering Curves – (01 Sheet)	To develop drawing ability in Engineering drawing.	CO1
7	Draw two problems on orthographic projections usingfirst angle method of projection having plain surfaces,slanting surfaces and slots etc.- (Sketchbook)	To develop drawing ability to draw Orthographic projection	CO2 CO4
8	Draw two problems on orthographic projections usingfirst angle method of projection having plain surfaces,slanting surfaces and slots etc.	To develop drawing skill	CO2 CO4
9	Draw two problems on orthographic projections usingfirst angle method of projection having cylindrical surfaces, ribs etc. (Sketchbook)	To develop drawing skill	CO2 CO4
10	Draw two problems on orthographic projections usingfirst angle method of projection having cylindrical surfaces, ribs etc.- (01 Sheet)	To develop drawing ability to draw Orthographic projection	CO2 CO4
11	Draw basic 2D entities like rectangle, rhombus, polygon, arcs, circles using CAD. Commands.	To develop ability to draw using CAD software	CO3
12	Draw basic 2D entities using rectangular and circulararrays.	To develop ability to draw using CAD software	CO3
13	Draw basic branch specific components using CADcommands	To develop ability to draw using CAD software	CO3 CO4

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14	Draw complex branch specific components using CADcommands.	To develop ability to draw using CAD software	CO3 CO4
15	Problem Based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views (sketch book).	To develop drawing ability to draw Orthographic projection and sectional orthographic projection	CO2 CO4
16	Draw freehand Sketches of 12 different standard components (Sketch book)	To develop drawing skill in free hand sketches	CO5
17	Draw freehand Sketches of 12 different standard components (1 Sheet)	To develop drawing skill in free hand sketches	CO5
18	Correlate ancient Indian sculptures, Indian temples,Monuments, etc. with Engineering Graphics	To develop drawing skill in free hand sketches	CO1CO2CO3 CO4CO5

II)   Theory

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH109-1 Draw lines, letters and numbers using standard geometrical dimensions.			
1	**Basic Elements of Drawing** 1.1 Drawing Instruments and supporting material: method to use them with applications. 1.2 Standard sizes of drawing sheets (ISO-A series) 1.3 I.S. codes for planning and layout. 1.4 Letters and numbers (single stroke vertical) 1.5 Convention of lines and their applications. 1.6 Dimensioning techniques as per SP-46 (Latest edition) – types and applications of chain, parallel and coordinate dimensioning Geometrical constructions. 1.7 Mandala Art: It's known for its intricate and symmetric design, often used in meditation and spiritual practices.	6	
CO: CCH109-2 Demonstrate the ability to draw conic sections using different methods and concepts.			
2	**Engineering curves & Loci of Points.** 2.1 Concept and understanding of focus, directrix, vertex and eccentricity. Conic sections. 2.2 Methods to draw an ellipse by Arcs of circle method & concentric circles method. 2.3 Methods to draw a parabola by Directrix-Focus	6	

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	method & Rectangle method 2.4 Methods to draw a hyperbola by Directrix-Focus method. 2.5 Methods to draw involutes: circle & pentagon, Point Starter and Solid state starter 2.6 Warli Art: uses basic geometric shapes to depict scenes from tribal life also uses of circles, triangles, and squares.		
CO	CO: CCH109-3 Apply orthographic projections to effectively convert diverse surface features.		
3	**Orthographic projections** 3.1 Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. Orthographic projection: First angle and Third angle method, their symbols. Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces.	8	
	CO: CCH109-4 Apply basic CAD commands for drawing different entities.		
4	**Computer Aided Drafting** 4.1 Basic entities: line, circle, arc, polygon, ellipse, rectangle, multiline, polyline. 4.2 Commands: trim, delete, copy, offset, array, block, layers. 4.3 Dimensioning: linear, horizontal, vertical, aligned, rotated, baseline, continuous, diameter, radius, angular dimensions. 4.4 Text: Single line, multiline. Standard sizes of sheet, selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.	4	
	CO: CCH109-5 Draw free hand sketches of given engineering elements.		
5	**Free Hand Sketches of EngineeringElements** 5.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching) Cave Paintings and Rock Art: 5.2 India has ancient rock art and cave paintings found in places like Bhimbetka, depicting scenes from prehistoric times using graphic representations.	6	

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

G. List of Assignments under SLA

**At least complete six assignments must be completed.

Sr.No	List of Assignment (under SLA)	Hrs Allotted
01	List the applications of engineering curves in different fields of engineering and submit a report on it.	02
02	Prepare a list of industrial and household components in which conic curves are used and justify the utility of these curves.	02
03	Produce 2D technical drawings using industry-standard conventions and symbols	02
04	identify and use geometric dimensioning and tolerance (GD&T) symbols correctly	02
05	Proficiently use Computer-Aided Design (CAD) software to create and edit engineering drawings?	02
06	List various industry and international standards (e.g., ASME Y14.5) in your engineering graphics work	04
07	Developed a systematic approach to quality assurance in your engineering graphics projects	02
08	List various ethical considerations in engineering graphics, such as intellectual property and honesty in design	02

H. Assessment Criteria

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	10
	Application	10
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and Punctuality	10
Total		**50**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 50 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Attendance at regular practical	10
2	Preparedness for practical	10
3	Neat & complete Diagram.	10
4	Observations & handling of instrument.	10

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5	Oral Based on Lab work and completion of task	10
	TOTAL	**50**

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.

LI)   Reference Books:

S.N.	Name of Book	Author	Publication
1	Bureau of Indian Standards.	Engineering Drawing Practice forSchools and Colleges IS: SP-46	Third Reprint, October 1998 ISBN No. 81-7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2010 ISBN No.978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2010 ISBN No.978-93-80358-11-6
4	Jolhe, D.A.	Engineering Drawing	Tata McGraw Hill Edu. New Delhi, 2010,ISBN No. 978-0-07-064837-1
5	Dhawan, R. K.	Engineering Drawing	S. Chand and Company New Delhi, ISBN No.81-219-1431-0
6	Pradhan, S.K Jain,K.K	Engineering Graphics	Khanna Book Publishing CO(P) LTD, NewDelhi, ISBN No. 978-93-91505-50-9
7	Jeyapoovan T	Engineering Drawing and Graphicsusing AutoCAD	Vikas Publishing House Pvt. Ltd., First Reprint 2013, ISBN NO.978-81259-4000-5

M)   Learning Website & Software

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=dmt6_n7Sgcg	Free Hand Sketches
2	https://www.youtube.com/watch?v=dmt6_n7Sgcg	Orthographic Projection
3	https://www.youtube.com/watch?v=3WXPanCq9LI	Basics of Projection
4	https://www.youtube.com/watch?v=fvjk7PlxAuo	Introduction to Engineering Graphics
5	https://www.youtube.com/watch?v=cmR9cfWJRUU	Basics of AutoCAD

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COURSE ID :

COURSE NAME   : **BASIC ELECTRONICS**

COURSE CODE   : **ETH101**

COURSE ABBREVIATION   : **HBTX**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	04
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	01	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	50	20	25@	10	25	10	200

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 basic electronics course is essential for building foundational knowledge, developing practical skills, preparing for various careers, and fostering technological literacy. It also promotes critical thinking, innovation and interdisciplinary applications, while supporting broader educational and personal development goals. Section I covers Semiconductor Diodes, Rectifiers and Filters and Regulators and Power supply. In section II Bipolar Junction Transistor, Biasing of transistor, BJT amplifiers and Field Effect Transistors (FET) are covered. So this course is the base of all electronic courses offered in forthcoming semesters.

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. Maintain and operate semiconductor diode in rectifiers and regulator power supply.

2. Maintain and operate the transistor in basic electronics circuits..

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH101-1 Describe construction, working and characteristics of diodes.
ETH101-2 Use rectifiers and filters in electronics circuit
ETH101-3 Maintain DC regulated power supply.
ETH101-4 Use BJT in electronics circuits
ETH101-5 Examine and use various types of biasing circuits of BJT
ETH101-6 Use FET and MOSFET in electronics circuits

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH101-1 Describe construction, working and characteristics of diodes	3	2	-	3	-	-	--	2	--
ETH101-2 Use rectifiers and filters in electronics circuit	3	2	-	2	--	--	--	3	2
ETH101-3 Maintain DC regulated power supply	3	2	2	2	-	--	--	3	3
ETH101-4 Use BJT in electronics circuits	3	1	1	2	--	--	--	3	--

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 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH101-5 Examine and use various types of biasing circuits of BJT	3	2	2	2	-	--	--	3	1
ETH101-6 Use FET and MOSFET in electronics circuits	3	2	--	1	--	--	--	3	--

F. CONTENT:

I) Practical exercises

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

Sr. No.	Laboratory experiences	CO
1.	Identification and operation of CRO and Function Generator for voltage and frequency measurement in basic electronics laboratory	ETH 101-1
2.	Identification and operation of Regulated Power Supply for amplitude measurement in basic electronics laboratory	ETH 101-1
3.	Plot V-I characteristics of PN junction diode.	ETH 101-1
4.	Plot V-I characteristics of Zener diode.	ETH 101-1
5.	Plot V-I characteristics of LED.	ETH 101-1
6.	Plot V-I characteristics of Photodiode.	ETH 101-1
7.	Test the performance of half wave rectifier.	ETH 101-2
8.	Test the performance of full wave center tapped rectifier.	ETH 101-2
9.	Test the performance of full wave bridge rectifier.	ETH 101-2
10.	Test the performance of full wave rectifier with capacitor filter.	ETH 101-2
11.	Test the performance of full wave rectifier with LC filter.	ETH 101-2
12.	Test the performance of full wave rectifier with CLC filter.	ETH 101-2
13.	Build and test the performance of regulated power supply using IC 78XX	ETH 101-3
14.	Build and test the performance of regulated power supply using IC 79XX	ETH 101-3
15.	Build and test the performance of regulated power supply using ICLM317	ETH 101-3
16.	Verify performance of zener diode as voltage regulator: Line regulation	ETH 101-3
17.	Verify performance of zener diode as voltage regulator: Load regulation	ETH 101-3
18.	Identify and select transistors using datasheets	ETH 101-4

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19.	Build, Test and Plot input and output characteristics of CE configuration	ETH 101-4
20.	Build, Test and Plot input and output characteristics of CB configuration	ETH 101-4
21.	Build and Test the BJT Fixed bias circuit for given input.	ETH 101-5
22.	Build and Test the BJT voltage divider bias circuit for given input.	ETH 101-5
23.	Construct and Test the performance parameters of BJT as Switch.	ETH 101-5
24.	Test the performance of JFET drain characteristics	ETH 101-6
25.	Test the performance of JFET transfer characteristics and calculate transconductance.	ETH 101-6
26.	Build complete circuit diagram of regulated power supply using IC 78XX/79XX on general purpose PCB	ETH 101-3
27.	Build the circuit of BJT as Switch on general purpose PCB	ETH 101-5

II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH101-1 Describe construction, working and characteristics of diodes.		
1	**Semiconductor Diodes** 1.1 Construction, Symbol of P-N junction diode 1.2 P-N Junction with Unbias, forward Bias and reverse Bias. 1.3 Working principle of P-N junction diode 1.4 V-I characteristics of P-N junction diode. 1.5 Ideal diode and practical diode model. 1.6 Important specifications of P-N junction diode: PIV rating, Static forward and reverse resistance, dynamic forward and reverse resistance, Steady state forward current, Static forward voltage drop, Continuous power dissipation 1.7 Breakdown mechanism: Avalanche and zener breakdown 1.8 Zener diode: Construction Symbol, V-I characteristics and applications. 1.9 Specifications of zener diode: Zener voltage, Break over current (I_{ZK}), Zener test current (I_{ZT}) Dynamic Impedance (Z_Z), Power dissipation. 1.10 Construction, symbol and V-I characteristics of LED, photodiode, varactor diode and tunnel diode.	10	14
	ETH101-2 Use rectifiers and filters in electronics circuit		
2	**Rectifiers and Filters** 2.1 Definition, need and classification of rectifier. 2.2 Half wave and full wave rectifier: Circuit diagram, operation and waveforms. 2.3 Parameters of rectifier: Average DC value of current and voltage ripple factor ripple frequency, PIV of diode, TUF,	6	10

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	efficiency of rectifier of HWR and Full wave Center tapped and Bridge rectifier. (No derivation) 2.4 Definition and need of filter, types of filters: shunt capacitor filter, series inductor filter, LC filter and CLC filter. 2.5 Operation of each filter w.r.t. full wave bridge rectifier. 2.6 Comparison of filters		
	ETH 101-3 Maintain DC regulated power supply.		
3	**Regulators and Power supply** 3.1 Need of Regulated power supply. Basic block diagram of DC regulated power supply and function of each block 3.2 Load and Line regulation. 3.3 Zener diode voltage regulator: load and line regulation 3.4 Fixed voltage IC Regulator: Three terminal Pin diagram, working and specifications of 78XX and 79XX series. 3.5 Complete Circuit diagram of DC regulated power supply. 3.6 Variable voltage IC Regulator : LM 317 pin diagram Simple numerical on IC LM317	6	10
	Sub-total	**22**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH 101-4 Use BJT in electronics circuits		
4	**Bipolar Junction Transistor** 3.1 BJT-Types, symbols 3.2 Construction of BJT. 3.3 Operating principles of NPN & PNP Transistor 3.4 Transistor configurations: CB,CE,CC 3.5 Modes of operation: Active, Cut-off, Saturation 3.6 Current amplification factor (α,β,γ) and Relation between them 3.7 Transistor input & output characteristic for CE & CB configuration. Numerical based on transistor current and amplification factor.	7	12
	ETH101-5 Examine and use various types of biasing circuits of BJT		
5	**Biasing of transistor** 4.1 Load line: AC Load line, DC Load Line 4.2 Quiescent Point for DC Load Line 4.3. Bias Stability, stability factor, Factors affecting bias stability, Thermal runaway	8	12

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks

	4.4 Transistor Biasing Methods: Different transistor biasing circuits. Circuit equations, advantages & disadvantages of
	        4.4.1 Fixed Bias Circuit
	        4.4.2 Voltage Divider Bias Circuit		

	ETH101-6 Use FET and MOSFET in electronics circuits		
6	**Field Effect Transistor (FET)** 6.1 FET as voltage controlled device, Classification of FET **Junction Field Effect Transistor(JFET)** 6.2 Symbols of N-channel and P-channel JFET 6.3 Construction of N-channel and P-channel JFET 6.4 Working principle of N-channel JFET 6.5 Drain and transfer Characteristics of N- channel JFET 6.6 JFET parameters-A.C. drain resistance(rd), transconductance (gm), amplification factor(μ), relation between μ,rd & gm 6.7 Advantages, disadvantages, applications of JFET 6.8 Comparison between JFET and BJT **Metal Oxide Field Effect Transistor:-** 6.9 Types and symbol of MOSFET- Depletion type MOSFET and Enhancement type MOSFET 6.10 Working principle of N-channel depletion type and enhancement type MOSFET 6.11 Applications of MOSFET	8	12
	Sub-total	**23**	**36**

G. List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Write procedure to measure AC and DC amplitude, time period and frequency using CRO and function generator.	02
2.	Tabulate important characteristics of commonly available semiconductor diodes.	02
3.	Tabulate important characteristics of commonly available zener diodes.	02
4.	Tabulate important characteristics of commonly available LEDs.	02
5.	Write a procedure to test semiconductor diode using DMM	02
6.	Draw a chart showing circuit diagrams of half wave and full wave rectifiers with waveforms and equations.	02
7.	Study rectifier IC KBU 808	02
8.	Study of different types of regulator ICs other than mentioned in curriculum.	02
9.	Study Switch Mode Power Supply.	02
10.	Write procedure to identify terminals of BJT using digital multimeter	02

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11.	Select specific BJTs and study the datasheet.	02
12.	Study different types of transistor biasing circuits.	02
13.	Which type of transistor biasing method is widely used? Why?	02
14.	Study working of JFET as variable resistor	02
15.	Study working of MOSFET as variable capacitor	02

**Eight out of 12 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Semiconductor Diodes	4	2	8	14	ETH101-1
I / 2	Rectifiers and Filters	2	2	6	10	ETH101-2
I / 3	Regulators and Power supply	2	8	-	10	ETH101-3
II /4	Bipolar Junction Transistor	2	8	2	12	ETH101-4
II /5	Biasing of transistor	-	4	8	12	ETH101-5
II / 6	Field Effect Transistor	-	4	8	12	ETH101-6
	Total Marks	10	28	32	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**

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:

4.   Lectures cum Demonstrations
5.   Class room practices
6.   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	Principles of Electronics	Mehta, V.K. Mehta, RohitMehta	S.Chand New Delhi, edition-2008ISBN-13: 978-8121927833
2	Electronics Circuit and Circuit theory	Robert L.Boylestead	Pearson Education India, ISBN-13978-9332542600
3	A Text book of Applied Electronics	Sedha, R.S.	S.Chand (G/L) & Company Ltd;ISBN-13 978-8121904209
4	Basic Electronics (solid State)	B.L.Theraja	S Chand;ISBN-13 978-8121925556
5	Electronic Principles	Albert P. Malvino, David J.Bates	McGraw Hill; ISBN-13 978-9354602399
6	Basic Electronics and Linear Circuits	by N.N. Bhargava (Author), D.C. Kulshreshtha (Author), S.C. Gupta (Author)	NITTTR Chandigarh 2nd Edition

M. Learning Website & Software

a.   www.circuitstoday.com/
b.   www.circuitlab.com/
c.   www.vlab.com
d.   www.tinkercad.com

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COURSE ID :

COURSE NAME : ELECTRONICS WORKSHOP PRACTICE

COURSE CODE : ETH102

COURSE ABBREVIATION : HWET

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	03
	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
					Practical						100
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
--	--	--	--	--	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 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)

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D. i) RATIONALE:-

Engineering diploma holders specializing in electronics are expected to handle various mechanical, electrical and electronics tools in the workshop in any industry in which they are employed. This course provides simulated industrial environment and enable students to perform a variety of operations in various shops using relevant electrical and electronic materials as well as use appropriate hand tools, equipment, tools and machinery. Through this course student will develop practical skills in identifying, testing, soldering, de-soldering, assembly, simulate, PCB design etc. of electronic components and circuits that will also be very useful for projects and other courses that he or she will undertake during the diploma programme as well as in the world of 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:
1. Build simple electronic circuits on PCB.

E. COURSE SEMESTER LEARNING OUTCOMES
ETH 102.1 Identify and measure the values of passive components.
ETH 102.2 Identify the different types of switches, relays and digital displays
ETH 102.3 Prepare the PCB using SMD component and ICs
ETH 102.4 Identify the different types of cables and connectors
ETH 102.5 Use digital meters and transducers in electronics circuits
ETH102-6 Identify and use oscilloscope and signal generator in electronics circuits.

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

[Note : Correlation Semesters : 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 Operate and Maintain:	PSO2 Supervision and providing solution:
Competency: Build simple electronic circuits on PCB	3	1	2	2	0	0	2	2	-
ETH 102.1 CO-1 Identify and measure the values of passive components.	3	2	0	2	0	0	2	2	-
ETH 102.2 CO-2 Identify the different types of switches, relays and digital displays	3	0	0	2	0	0	2	2	-
ETH 102.3 CO-3 Prepare the PCB using SMD component and ICs	3	0	2	2	0	2	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 Operate and Maintain:	PSO2 Supervision and providing solution:
ETH 102.4 CO-4 Identify the different types of cables and connectors	3	0	0	1	0	0	2	2	-
ETH 102.5 CO-5 Use digital meters and transducers in electronics circuits	3	1	0	1	0	0	2	2	-
ETH102-6 CO-6 Identify and use oscilloscope and signal generator in electronics circuits.	3	1	0	1	0	0	2	2	-

F. CONTENT:

I) Practical exercises

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

Sr. no	Laboratory experiences	CO
1	Safety symbols	ETH102-1
2	Fire extinguishers and accessories	ETH102-1
3	Identification and operation of DMM, Breadboard and Test different types of fixed resistors.	ETH102-1
4	Test different types of variable resistors.	ETH102-1
5	Test different types of fixed capacitors.	ETH 102.1
6	Test different types of variable capacitors.	ETH 102.1
7	Test different types of inductors.	ETH 102.1
8	Identification of windings of transformer	ETH 102.1
9	Test performance of relay	ETH 102.2
10	Test performance of Seven segment display	ETH 102.2
11	Test performance of LCD Displays	ETH 102.2
12	Test performance of Switches	ETH 102.2
13	Build simple circuits on a breadboard using resistors, diode, switch and LED.	ETH 102.2

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Sr. no	Laboratory experiences	CO
14	Design PCB(Demonstration using software tool or Video)	ETH 102.3
15	Design PCB using copper clad or zero PCB	ETH 102.3
16	Identification of SMDs and ICs	ETH 102.3
17	Identify the different types of cables	ETH 102.4
18	Identify the different types of connectors	ETH 102.4
19	Test the performance of RTD	ETH 102.5
20	Test the performance of LVDT	ETH 102.5
21	Use thermocouple to measure temperature of the given liquid	ETH 102.5
22	Test relation between Linear displacement and output voltage using LVDT	ETH 102.5
23	Identification and operation of Regulated Power Supply for amplitude measurement in basic electronics laboratory	ETH102-6
24	Identification and operation of CRO and Function Generator for amplitude measurement in basic electronics laboratory	ETH102-6
25	Identification and operation of CRO and Function Generator for frequency measurement in basic electronics laboratory	ETH102-6
26	Identification and operation of DSO to measure amplitude and frequency of given signal	ETH102-6
27	Visit the industry	All Cos

II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)
	CO: ETH 102.1 Identify and measure the values of passive components.	
1	**Resistors:** 1.1 Components-discrete, non-discrete, Active, passive components. 1.2 Concept of Resistors, Classification of resistors, Resistors general specification: - maximum voltage rating, power rating, temperature coefficient, tolerance, Ohmic range, operating temperature 1.3 Color Coding with three, four and five bands of resistors **Capacitors:** 1.4 Concept of Capacitor 1.5 Classification of capacitors 1.6 Coding of capacitors using numerals and color band system. **Inductors:** 1.7 Concept of Inductor, Classification of Inductor 1.8 Specifications:- self-inductance, mutual inductance, coefficient of coupling, Q factor, Inductive Reactance	06

Sr. no.	Topics/Subtopics	Learning (Hours)
	1.9 Color coding of Inductor. **Transformers:** 1.10 Definition of transformer. Types of transformer: Step up and Step down transformer	

CO: ETH 102.2 Identify the different types of switches, relays and digital displays

Sr. no.	Topics/Subtopics	Learning (Hours)
2	**Switches, Relays and Displays** **Switches:** 2.1 Types of Switches: SPST, SPDT, DPST, DPDT 2.2 Construction and application of Toggle, Rotary, push to on & push to off, Rocker switch, slide switch, limit switch, proximity switch, photo sensor switch. **Relays**: 2.3 Construction and working of electromechanical relay 2.4 Construction and working of solid state relay **Displays:** 2.5 Classifications of displays 2.6 Construction, operation & application of LED, Seven segment display-common cathode & common anode display, Dot matrix display, sixteen, fourteen segment display 2.7 Construction, operation & applications of Liquid crystal display (LCD)-Dynamic Scattering Display Different types of switches (IKS learning)	04
3	**Introduction to PCB, SMD and IC** **PCB:** 3.1 Concept of PCB ,Advantages & disadvantages of PCB, Types of PCB 3.2 Base & Conducting material, types of laminates, Flowchart for preparation of single sided PCB **SMD:** . 3.3 Introduction to SMT,SMD 3.4 Advantages & disadvantages of SMD. **Integrated Circuit:** 3.5 Concept of IC, Advantages & disadvantages of ICs 3.6 Classification of IC's, Linear and Digital IC's and its examples, Flowchart for preparation of IC	04

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Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: ETH 102.4 Identify the different types of cables and connectors			
4	**Cables and Connectors** **Cables:** 4.1 Types of cable 4.2 Construction, and applications of coaxial cable, telephone cable, FRC cable, Twin core cable(Twisted & Shielded type)cable used for CRO. **Connectors:** 4.3 Types of connectors 4.4 Construction and applications of BNC, TNC, Edge, FRC connectors, Phone Plug & Jacks	04	
CO: ETH 102.5 Use digital meters and transducers in electronics circuits			
5	**Digital meters and introduction to transducers.** 5.1 Concepts of ADC & DAC only 5.2 Advantages and Disadvantages of Digital Instruments , Comparison of digital and analog instruments 5.3 Resolution, Sensitivity and Accuracy of digital display. 5.4 Digital Multimeter: Measurement of electrical quantities. 5.5 Transducers: Definition, classification: Active, Passive, Primary, Secondary, Analog, Digital 5.6 Construction, Operation, Applications : LVDT, RTD.	06	
CO: ETH102-6 Identify and use oscilloscope and signal generator in electronics circuits.			
6	**Oscilloscope and Signal Generator** 6.1 CRO-Front panel control of CRO. 6.2 Digital storage oscilloscope: Function of DSO. 6.3 Uses of CRO & DSO- Amplitude, Frequency and Phase measurement 6.4 Signal / Function generator-AF and RF type- Block diagram and Operation only.	06	

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

G. Assessment Criteria

i) Formative Assessment of Practical:-

Every assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	10
	Application	10
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
TOTAL		**50**

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ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 50 marks as per following criteria

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	10
2	Preparedness for practical	10
3	Neat & complete Diagram.	10
4	Observations & handling of instrument.	10
5	Oral Based on Lab work and completion of task	10
	TOTAL	**50**

H. Instructional Methods:

7. Lectures cum Demonstrations,
8. Class room practices.
9. Use of projector and soft material for demonstration
4. Animation videos
5. Simulation software

I. Teaching and Learning resources:

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

J. Reference Books:

S.N.	Name of Book	Author	Publication
8	Raghuwanshi B.S.	A Course in Workshop Technology	Dhanpat Rai & Sons, New Delhi, 2017or latest edition
9	Sarathe A.K.	Engineering Workshop Practice	Khanna Book Publishing Co.(P) Ltd. ,New Delhi; 2021 or latest edition ISBN:978-9391505516
10	Gupta J.K., Khurmi R.S.	A Textbook of Manufacturing Process (Workshop Technology)	S. Chand and Co., New Delhi, 2021 or latest edition, ISBN: 978-8121908689
11	Jones, Thomas H.	Electronic Components Handbook	Reston Publishing, Virginia, US, latest edition, ISBN: 978-0879092221
12	Mehta V.K., Mehta Rohit	Principles of Electronics	S. Chand and Co., New Delhi-110 055,2014, ISBN: 978-8121924504
13	Glory Priyadarshini J. , Rani K.S.S., Maheswari M.P.,Gomathy S.	Engineering Workshop practice on Electrical & Electronics Engineering	Notion Press, Mumbai, 2021 or latest edition, ISBN: 978-1639203819

K. Learning Website & Software

Sr.No	Link / Portal	Description
1	http://fireextinguishertraining.com/	Fire extinguisher
2	www.youtube.com/watch?v=WE-SislzSMY	Fire extinguisher
3	https://www.youtube.com/watch?v=lUojO1HvC8c	Fire extinguisher
4	https://www.youtube.com/watch?v=0jbFC8dvTVY	Electrical tools
5	https://www.electroschematics.com/tools/	Electronic tools
6	https://www.youtube.com/watch?v=Fwj_d3uO5g8	Diodes
7	http://www.eleccircuit.com	Electronic circuit
8	https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf	Soldering
9	https://www.tinkercad.com/	3D modeling software
10	Multisim Live Online Circuit Simulator	Simulation software
11	EveryCircuit	Mobile Application

COURSE ID :

Course Name   : Fundamentals of ICT(CE/ME/EE/MT/ET/IT)

Course Code   : CCH202

Course Abbreviation : HICT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	01	02
	Tutorial Learning	00	
	Laboratory Learning	02	
	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			
-	-	-	-	-	25	10	25@	10	25	10	75

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.

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* 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:

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.

E. 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

F. 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 preadsheet

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

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G. 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 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
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 Semester									

H. 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 withfiles and folders	1.1 Identify various Input/output devices, connections and peripherals ofcomputer system 1.2 Work with Computer System, Input/output devices,	CCH202-1

2.	Work with document files: a) Create, editand save documentin Word Processing. b) Text, lines andparagraph Semester formatting	2.1 Create and manage word document. 2.2 Apply formatting featureson textat line, paragraph and page Semester.	CCH202-2
3.	Work with Images and Shapes in WordProcessing.	3.1 Insert and edit images, shapes in adocument file	CCH202-2
4.	Work with tables in Word Processing.	4.1 Insert table and apply various tableformatting 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 wordprocessing. 5.2 Print a document by applyingvarious 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 aworksheet. 6.2 Insert and delete cells, rows andcolumns 6.3 Apply alignment feature oncell	CCH202-3
7.	Formulas and functions in Worksheet.	7.1 Create formula and "If" conditionon cell data 7.2 Apply various functions and namedranges 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 VisualPresentation in Spreadsheet.	9.1 Create charts using various chartoptions in spreadsheet.	CCH202-3
10	Worksheet Printing.	10.1 Print the worksheet by applyingvarious print optionsfor worksheet	CCH202-3
11	Make Slide Show Presentation.	11.1 Apply design themes tothe givenpresentation 11.2 Insert pictures text/images/shapesin slide 11.3 Use pictures text/images/shapesediting options.	CCH202-4
12		12.1 Add tables and charts in theslides. 12.2 Run slide presentation in	CCH202-4

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		differentmodes	
	Use Tables and Charts in Slide	12.3 Print slide presentation as handouts/notes	
13	a) Insert Animation effects to Text and Slides. b) Insert Audio and Video files in presentation	13.1 Apply animation effects to thetext and slides 13.2 Add/set audio and video files inthe presentation.	CCH202-4
14	a) Internet connection configuration b)Use Internetand Web Services.	14.1 Configure internet connection ona computer system 14.2 Use different web services oninternet	CCH202-5
15	Working with Browsers.	15.1 Configure different browsersettings 15.2 Use browsers for the givenpurpose	CCH202-5
16	Prepare Web Forms for Survey.	16.1 Create web forms for surveyusing different options.	CCH202-6
17	Prepare Web Forms for Quiz	17.1 Create web forms for Quiz usingdifferent options	CCH202-6

I. 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 totranslate the given content from one langanother. 4) Use cloud based storage drive to store and share your files.

Assignment

Prepare journal of practical performed in the laboratory.

Micro project

The microproject has to be industry application based, internet-based, workshop- based, laboratory-based obased as suggested by Teacher. 1) Perform a survey on various input and output devices available in market a its report. 2) Prepare Time Table, Prepare Notes on Technical Topics, Reports, Biodata with covering letter (S teacher shall assign adocument to be prepared by each students) 3) Prepare slides with all Presentation featur as: classroom presentation, presentation about department, presentation of Technical Topics. (Subject teacher assign a presentation to be prepared by each student). 4) StudentMarksheet, 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 anyindustry ChatGPT/any other AI tool

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J. 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)

K. CONTENT:

Sr. No.	Topics / Sub-topics	Lectures (Hours)
	Course Outcome CCH202-1 - Use computer system and its peripherals for given purpose.	
1	**Unit - I Introduction to Computer System**	2
	1.1 Basics of Computer System: Overview of Hardwareand Software: block diagram of Computer System, Input/Output unit CPU, Control Unit, Arithmetic logic Unit (ALU), MemoryUnit	
	1.2 Internal components: processor, motherboards, randomaccessmemory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives)	
	1.3 External Devices: Types of input/output devices, typesof monitors, keyboards, mouse, printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD,Hard disk and pen drive	
	1.4 Application Software: word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editingsoftware, graphics manipulation software System Software compilers, linkers, devicedrivers, operating system	
	1.5 Network environments: network interface cards, hubs, switches, routers and modems, concept of LAN, MAN, WAN,WLAN, Wi-Fi and Bluetooth	
	1.6 Working with Operating Systems: Create and manage file andfolders, Copy a file, renaming and deleting of filesand folders, Searching files and folders, application installation, creating shortcut of application on the desktop.	
	Course Outcome CCH202-2 - Prepare Business document using Word Processing Tool.	
2	**Word Processing**	3
	2.1 Word Processing: Overview of Word processor Basicsof Fonttype, 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.	
	2.2 Editing a Document: Navigate through a document,Scroll through text, Insert and delete text, Select text, Undo and redocommands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting	
	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	
	2.4 Inserting Elements to Word Documents: Insert and delete apage break, Insert page numbers, Insert the dateand time, Insert	
Sr. No.	Topics / Sub-topics	Lectures (Hours)

	special characters (symbols), Insert a picture from a file, Resizeand reposition a picture 2.5 Working with Tables: Insert a table, Convert a table totext, Navigate and select text in a table, Resize table cells,Align text ina table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pageorking with Columned Layouts and Section Breaks:a Columns, Section breaks, Creating columns, Newsletterstyle columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Columnwidths, Adjust	

Course Outcome CCH202-3: Design files of word processors, spreadsheets, presentation software, and database application.

| 3 | **Spreadsheets**
3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, CopyWorksheet, Delete Worksheet, Close and openWorkbook.
3.2 Editing Worksheet: Insert and select data, adjust row heightand 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
3.3 Formatting Cells and sheet: Setting Cell Type, SettingFonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades,Sheet Options, Adjust Margins, Page Orientation, Headerand Footer, Insert PageBreaks, S
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 usingIF.
3.5 Working with Charts: Introduction to charts, overviewof different types of charts, Bar, Pie, Line charts, creatingand editingcharts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart ina separate sheet. Advanced Operations: Conditional Formatting, DataFiltering,

Data Sorting, Using Ranges, Data Validation, Adding Graphics,Printing Worksheets, print area, margins, header, footer and other page setup options. | 3 |

Course Outcome CCH202-4 - Prepare professional Slide Show presentations

| 4 | **Presentation Tool**
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 Prese
4.2 Inserting Media elements: Adding and Modifying GraphicalObjects to a Presentation - Insert Images into aPresentation, | 4 |

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Sr. No.	Topics / Sub-topics	Lectures (Hours)
	insert audio clips, video/animation, Add Shapes, Add VisualStyles to Text in a Presentation, Edit Graphical Objects on aSlide, Format 4.3 Working with Tables: Insert a Table in a Slide, FormatTables,and Import Tables from Other Office Applications. Working with Charts: Insert Charts in a Slide, Modify Chart, Import Charts from Other Office Applications.	

Course Outcome
CCH202-5 - Use different types of Web Browsers and Apps
CCH202-6 - Explain concept and applications of Emerging Technologies

Sr. No.	Topics / Sub-topics	Lectures (Hours)
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 effectivelyfor 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 otherApps	3

L. 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

M. 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

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7	Oral Based on Lab work and completion of task	04
	TOTAL	25

Assessment at semester end practical exam as per Proforma 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**

N. INSTRUCTIONAL TRATEGIES:

InstructionalMethods:

    a. Lectures cum Discussions
    b. Regular Home Assignments.
    c. Laboratory experiences and laboratory interactive sessions

Teaching and Learning Resources:

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

O. 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, Windows10	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Alvaro Felix	Linux: Easy Linux for Beginners	CreatevSpace Independent Publishing Platform- 2016, ISBN-13: 978-1533683731

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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

Sr.No	Link / Portal	Description
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
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
Sr.No	**Link / Portal**	**Description**
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

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COURSE ID:

Course Name   : **YOGA & MEDITATION**
Course Code   : **CCH203**
Course Abbreviation   : **HYAM**

TEACHING SCHEME:

Pre-requisite Course(s)   : *<nil >*

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	NIL	
Practical	01	

I. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	RelevantCOs
LLO 1.1 Practice warming up for Yoga.	1	Introduction :- 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.	3	CO1
LLO 2.1 Practice Sun salutaion	2	Lab Exp: 2. Perform all the postures of Sun salutation- one by one in a very slow pace, after warm up. 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	CO1 CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	RelevantCOs

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LLO 3.1 Practice basic Asanas	3	Lab Exp: 4 Perform Sarvangasna,Halasana,Kandharasaa (setubandhasana), uttanpadasan, pavan muktasan. Lab Exp: 5 Perform Bhujangasana,Naukasana,Mandukasan Lab Exp: 6 Perform Shalabhasan, Dhanurasan, Vakrasan, Gomukhasan, Paschimottasana, Ardhamachendrasan. Lab Exp: 7 Perform Veerasan Veerbhadrasana, Vrukshasana,Trikonasana. Follow up experiment 5 to 7 with shavasana for self relaxation	4	CO2
LLO 4.1 Practice basic pranayama	4	Lab Exp: 8 Perform Deep breathing, Anulom Vilom Pranayam Kriya Lab Exp: 9 Practice Kapalbhati Pranayam Kriya, Bhastrika Lab Exp:10 Practice Bhramary and sheetali Pranayam.	2	CO3
LLO 5.1 Practice meditation	5	Lab Exp: 11 Perform sitting in Dhyan Mudra and meditating.Start with five minute and slowly increasing to higher durations. Introduction to Vipasshana, Anapan and Chakras. (Trainer will explain the benefits of Meditation before practice)	2	CO3

Note :
Note:
1. Start and end of each session can be with appropriate Yoga prayers and chanting of Omkar. 2. Trainers can add similar asanas in practical sessions.
3. Students are to be instructed to practice the experiment performed at least twice a week as part of self learning practices.
4. Live demonstration by the trainer needs to be carried out during practical hours. Yogic Videos can

be used as well .

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SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

i. Maintain a diary indicating date wise practice done by the student with a photograph of self in yogic posture.

ii. Write up details any five asans illustrating steps to perform, posture image, benefits and precautions.

Assignment

Prepare Diet and nutrition chart for self

Self Learning and Practice

• Practice at least thrice a week.
• Read books on different methods to maintain health, wellness and to enhance mood
• Watch videos on Yoga Practices.

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SEMESTER II COURSES

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COURSE ID :

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	
	LaboratoryLearning	-	
	SLH-SelfLearning	00	
	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	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-ClassRoomLearning,TL-TutorialLearning,LL-LaboratoryLearning,SLH-SelfLearningHours,NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self LearningAssessment
Legends:@InternalAssessment,#ExternalAssessment,*#OnLine
    Examination,@$InternalOnlineExamination(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 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)

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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 SEMESTER LEARNING OUTCOMES (COS)(TNR 14)

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 Semesters : 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 DC machines and transformers.	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 degree by various methods	3	1	1	1	1	1	1		
CCH301-3-CO-3 : To find approximate solution of algebraic equations and simultaneous equations by various methods.	2	3	1	1	1	1	1		
CCH301-4-CO-4:- To solve problems on Probability distributions	2	2	2	2	2	1	2		
CCH301-5-CO-5:- Solve examples on Laplace Transform	2	1	1	1	1	1	1		

F. CONTENT:

III)   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
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

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

Unit 3 Differential equation	**Differential equation**
	4.1 Definition of differential equation
	4.2 Order & degree of Differential equations
	4.3 Methods of solving Differential equations of first order & first degree of following types:
	   4.3.1 Variable separable form
	   4.3.2 Exact Differential equations
	   4.3.3 Linear Differential Equations
		8	10

Section –II

Sr. no.	Topics/Subtopics	Learning Hours	Classroom learning evaluation Marks
CO: CCH301-3 :- 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	10	14

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	4.2.2 Gauss-Seidel method Bakhshali iterative method for finding approximate square root.(IKS)		
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 Tranceform**	**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

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

Section / Topic no.	Name of topic	Distribution of marks (Semester 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	

I. Assessment Criteria
i)   **Formative Assessment (Assessment for Learning)**
- **Tests**

ii)   **Summative Assessment (Assessment of Learning)**
- **End term exam**

J. Instructional Methods:
10. Lectures cum Demonstrations
11. Classroom practices

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12. Use of projector and soft material for demonstration
13. Use of softwares such as Geogebra

K. Teaching and Learning resources:

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

L. Reference Books:

S.N.	Name of Book	Author	Publication
14	Higher Engineering Mathematics	Grewal B.S.	Khanna publication New Delhi,2013 ISBN:8174091955
15	A textbook of Engineering Mathematics	Dutta.D.	New age publication New Delhi,2006 ISBN:978-81-224-1689-3
16	Advance Engineering Mathematics	Kreysizg,Ervin	Wiley publication New Delhi,2016 ISBN:978-81-265-5423-2
17	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi,2008 ISBN:978-81-219-0345-5
18	Introductory Methods of Numerical Analysis	S.S.Sastry	PHI Learning Private Limited,New Delhi.ISBN:978-81-203-4592-8
19	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
20	Calculus & Its Applications	Marvin L.Bittinger David J.Ellenbogen Scott A. Surgent	Addison-Wesley 10th Edition ISBN-13:978-0-321-69433-1
21	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)

M. Learning Website & Software

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

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COURSE ID :

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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1.5	30 *#	70*#	100	40	25	10	25 @	10	25	10	175

(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.(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 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)

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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 SEMESTER 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.

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

[Note : Correlation Semesters : 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	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	-	-

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F. CONTENT:

A. 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 $H_2C_2O_4.H_2O$)	CCH103-1
6	Titration of weak base , strong acid & strong base (Na_2CO_3 X H_2SO_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 volt meter.	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 multiplicity, Pauli's exclusion principle. 1.6 Lewis and Langmuir's concept of stable electronic configuration. 1.7 Electrovalency and Co-valency.	**07**	**08**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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.** 2.1Definitions- Cathode, Anode, Conductor, Electrolyte, Electrode, Ionisation, Electrolysis. 2.2 Arrhenius Theory Of Ionisation. 2.3 Degree of Ionisation & Factors affecting degree of ionisation. 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 CuSO4 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. 2.11Wet 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 composite materials.	**13**	**16**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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. 4.5 Disadvantages of hard water for domestic & Industrial purpose - Textile Industry, Sugar Industry, Paper Industry Dying Industry.	**09**	**12**

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	4.6 Sterilization of water - Chlorination –by Cl_2, bleaching powder, Chloramines with chemical reactions. 4.7 Ion Exchange method to remove total hardness of Water.			

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

5	**METALLIC CONDUCTORS AND SOLDERS** **5.1 METALLIC CONDUCTORS** 5. 1.1 Occurrence of metals 5.1.2 Distinction between mineral & ore 5.1.3 Definition of flux, Gangue & Slag 5.1.4 Steps involved in metallurgy-Flow chart Concentration of ores— A) Physical Methods 1. Gravity Separation Method 2. Electromagnetic separation 3. Froth floatation method B) Chemical Methods 1. Calcination 2. Roasting . 5.1.6 Important ores of copper Metallurgy of copper-Extraction of copper from copper pyrites by concentration, roasting, smelting, Bessemerisation, Electrorefining. 5.1.7 Physical properties & uses of Copper. **5.2 SOLDERS** 5.2.1 Definition of alloy, classification of alloys & purposes of making alloy. 5.2.2 Composition, properties & applications of Soft solder. A) Tinmann's solder, B) Brazing alloy , C) Plumber's solder D) Rose metal E) Woods metal	**14**	**16**	

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

6	**CELL AND BATTERIES** 5.1Definition of Electrochemical cell, Battery, Charge, Discharge, Closed Circuit Voltage, Electrochemical couple, Internal resistance, Open Circuit Voltage, Separator, E.M.F. 5.2 Classification of Batteries such as – Primary & Secondary Batteries 5.3 Construction, Working and Applications of a 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	**07**	**08**	

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

G. List of Assignments under SLA (25 marks)

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 & Electrorefining 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	Bessemerisation 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. Tinmann'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

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

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

Section / Topic no.	Name of topic	Distribution of marks (Semester 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

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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:

14. Lectures cum Demonstrations,
15. Class room practices.
16. 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/hisotry-famous-people/indian-sage-acharya-kanad-001399

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COURSE ID:

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	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)

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

E. COURSE SEMESTER 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 Semesters : 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 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
Industry/Employer Expected Outcome: Communicate in written and oral form of English effectively and informal scenario	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		
CCH201-4 Make effective use of body	2	-	-	-	-	2	2		

language & graphical communication.									
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

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I. 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

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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 (Semester 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

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	NA
2	Preparedness for practical	NA

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3	Neat & complete Diagram.	NA
4	Observations & handling of instrument.	NA
5	Oral Based on Lab work and completion of task	NA
TOTAL		

I. Instructional Methods:

17. Lecture cum Demonstration,
18. Class room practices.
19. 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
22	Communication Skills	Sanjay Kumar ad Pushp Lata	Oxford University Press
23	Personality Development and Soft Skills	Brun K. Mitra	Oxford University Press
24	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill
25	Human Communication	Burgoon Michael	SAGE Publication Inc.
26	101 Ways to Better Communication	Elizabeth Hiemey	Pustak Mahal
27	Technical Writing and Professional Communication	Thomas Huckin and Leslie	McGraw-Hill College Division

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

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COURSE ID :

COURSE NAME   : **APPLIED ELECTRONICS**

COURSE CODE   : **ETH103**

COURSE ABBREVIATION   : **HATX**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	00	
	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			
03	30	70	100	40	25	10	25@	10	-	-	150

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.**

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* 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 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 SEMESTER LEARNING OUTCOMES (COs)

ETH103-1 Use transistor as an amplifier.

ETH103-2 Use transistor as a power amplifier.

ETH103-3 Comprehend feedback amplifiers.

ETH103-4 Analyze BJT waveform generator

ETH103-5 Analyze BJT Switching Circuits.

ETH103-6 Demonstrate and analyze linear and nonlinear wave shaping circuits.

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

[Note: Correlation Semesters: 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 Manageme nt	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH103-1	2	-	-	1	-	-	2	1	1
ETH103-2	3	-	-	2	2	2	3	3	2
ETH103-3	3	-	-	2	-	1	2	2	2
ETH103-4	3	-	-	2	2	2	1	1	1
ETH103-5	3	-	-	1	-	2	2	1	1
ETH103-6	3	-	-	2	2	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)

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Sr. No.	Laboratory experiences	CO
1.	Build and test the performance of single stage low power common emitter amplifiers.	ETH103-1
2.	Build and test the performance of single stage common source FET amplifiers.	ETH103-1
3.	Build and test the performance of two stage direct coupled amplifier through any simulation software tool.	ETH103-1
4.	Build class A power amplifier with resistive load and check output of Circuit.	ETH103-2
5.	Build class B power amplifier in complementary symmetry configuration and check output of circuit.	ETH103-2
6.	Build single tuned voltage amplifier and check output and draw response on semilog graph paper.	ETH103-2
7.	Build and test the performance of voltage series feedback amplifier.	ETH103-3
8.	Build and test the performance of voltage shunt feedback amplifier.	ETH103-3
9.	Build and test the performance of Hartley Oscillator. Calculate the oscillator frequency and verify calculated frequency with actual observed frequency	ETH103-4
10.	Build and test the performance of Colpitts Oscillator. Calculate the oscillator frequency and verify calculated frequency with actual observed frequency	ETH103-4
11.	Build and test the performance of RC phase shift Oscillator. Calculate the oscillator frequency and verify calculated frequency with actual observed frequency	ETH103-4
12.	Build and Test the performance of Astable multivibrator using transistor: time measurement and calculations.	ETH103-5
13.	Build and test the performance of Monostable multivibrator using transistor: time measurement and calculations through any simulation software tool.	ETH103-5
14.	Build RC circuit as Integrator/ differentiator and Check applications of differentiator as wave shaping circuit (response of the circuit for square input)	ETH103-6
15.	Build Positive and negative clipper circuit and Observe Clipping waveform on CRO.	ETH103-6
16.	Build Positive and negative Clamper circuit and Observe Clamping waveform on CRO.	ETH103-6

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II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH103-1 Use transistor as an amplifier.		
1	**Amplifier** 1.1 Classification of amplifier, BJT as an amplifier. 1.2 Single stage CE amplifier, frequency response, gain, bandwidth. 1.3 Types of BJT coupling: Circuit diagram, Operation, frequency response and application of RC, transformer, and direct coupling. 1.4 Multistage amplifier: General Multistage amplifier BJT based. 1.5 FET Amplifier: Common Source amplifier, Working Principle, and application. 1.6 Tuned Amplifier: Need of tuned amplifier, basic tuned circuit, circuit diagram, Operating principle, and frequency response of Single tuned, Double tuned and stagger tuned amplifiers.	11	12
	ETH103-2 Use transistor as a power amplifier.		
2	**Power Amplifiers** 2.1 Power Amplifiers: Comparison between small signal amplifier and power amplifier, performance parameter of power amplifiers: bandwidth, gain, frequency band, efficiency. 2.2 Classification of Power Amplifier 2.3 Circuit Diagram, Working, Characteristics, Efficiency of following: 2.3.1 Class A Power Amplifier- Transformer coupled 2.3.2 Class B Power Amplifier and Crossover distortion, Class AB Power Amplifier 2.3.3 Class B Push pull amplifier 2.3.4 Complementary symmetry Class B Push Pull amplifier 2.4. Class C amplifier(only introduction)	11	12
	ETH 103-3 Comprehend feedback amplifiers.		
3	**Feedback Amplifier** 3.1 Principle of feedback amplifier 3.2 Types of feedback: Negative and positive feedback, Advantages of negative feedback and its effects 3.3 Types of negative feedback (block diagram, Circuit diagram, Operation and comparison) 3.3.1 Current series feedback 3.3.2 Voltage series feedback 3.3.3 Voltage shunt feedback 3.3.4 Current shunt feedback 3.3.5 Darlington pair, Darlington amplifier (only introduction)	8	10

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.4 Numericals problems based on feedback formula.		
	Sub-total	**30**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	***ETH103-4* Analyze BJT waveform generator**		
4	**Wave form Generators** 4.1 Oscillators: Need, Comparision of oscillator and amplifier. 4.2 Condition for oscillation (Barkhausen's Criteria), classification of oscillators 4.3 Circuit Diagram, Working, frequency formula of following oscillators: - 　　　4.3.1 Tuned circuit Oscillators 　　　4.3.2 Hartley Oscillator 　　　4.3.3 Colpitts oscillator 　　　4.3.4 RC phase-shift oscillator 　　　4.3.5 Wein Bridge oscillator 4.4 Frequency stability consideration 4.5 Sweep generator: Miller sweep, Bootstrap circuit, current time base generator. 4.6 Numericals based on above	9	12
	***ETH103-5 Analyze* BJT Switching Circuits**		
5	**BJT Switching Circuits** 5.1 Transistor as a switch, Transistor Switching Times 5.2 Transistorized Multivibrators and its types: - Circuit Diagram, Operation, timing equations & applications of following: - 　　　5.2.1 Astable multivibrator 　　　5.2.2 Monostable multivibrator 　　　5.2.3 Bistable Multivibrator 　　　5.2.4 Schmitt Trigger 5.3 Numericals based on timing equations of above circuits	9	10
	ETH103-6 Demonstrate and analyze linear and nonlinear wave shaping circuits.		
6	**Wave shaping Circuits** Circuit diagram, waveforms and operation of following:- 6.1 Linear wave shaping circuits. 　　　6.1.1 Differentiator - High pass RC circuits-	12	14

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks

	Response to triangular input & square wave
	6.1.2 Integrator- Low pass RC circuit –
	    Response to square input & rectangular input
	6.2 Nonlinear wave shaping
	  6.2.1 Clippers
	    6.2.1.1 Positive clipper
	    6.2.1.2 Negative clipper
	    6.2.1.3 Combinational clipper
	  6.2.2 Clampers
	    6.2.2.1 Positive clampers
	    6.2.2.2 Negative clampers
	    6.2.2.3 Voltage doublers and triplers.		

	Sub-total	**30**	**36**

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Low Power Amplifier	2	6	4	12	ETH103-1
I / 2	High Power Amplifier	2	6	4	12	ETH103-2
I / 3	Feedback amplifier	2	2	6	10	ETH103-3
II /4	Wave form Generators	2	6	4	12	ETH103-4
II /5	BJT Switching Circuits	-	4	6	10	ETH103-5
II / 6	Wave shaping Circuits	-	4	10	14	ETH103-6
	Total Marks	8	28	34	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**

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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	V. K. Mehta	Principles of Electronics	S.Chand
2	B. L. Theraja	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
7	Bell, Devid	Fundamental of Electronics Devices and circuits	Oxford University

L. Learning Website & Software

1) www.nptel.iitm.ac.in
2) www.learningaboutelectronics.com
3) www.electronics-tutorials.com
4) https://circuitdigest.com/electronic-circuits
5) https://www.tutorialspoint.com/basic_electronics/basic_electronics_transistors.htm
6) https://www.youtube.com/watch?v=O_pqCNPs6xw
7) https://www.youtube.com/watch?v=0nXEUkFBd8A

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COURSE ID:

COURSE NAME   : **Electrical Engineering (ET)**

COURSE CODE   : **ETH104**

COURSE ABBREVIATION   : **HEEG**

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	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 ExaminationNote : (TNR 11 font)

7. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
8. 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.
9. 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.
10. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
11. 1(one) credit is equivalent to 30 Notional hrs.
12. * 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)

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D. i) RATIONALE:-

The subject deals in understanding the basics of laws, working principle, construction, operation and applications of the various equipment, instruments and machines in electrical engineering.

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 basic principles of electrical engineering to solve engineering problems".**

E. COURSE SEMESTER LEARNING OUTCOMES (COS)

COURSE OUTCOMES:

ETH104-1. Apply basic laws and principles of electrical engineering to electrical applications.
ETH104-2. Use principles of magnetic circuits to calculate various parameters in magnetic circuits.
ETH104-3. Interpret basic principles of electromagnetic induction.
ETH104-4. Apply basic principles of AC circuits in electrical devices.
ETH104-5. Interpret circuit parameters in AC circuits.
ETH104-6. Apply basic laws of electromagnetic induction principles in transformer &electric machines.

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

[**Note : Correlation Semesters :** 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-" : no correlation]

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO2
ETH104-1	3	1	0	1	0	0	0	0	0
ETH104-2	3	1	0	1	0	0	0	0	0
ETH104-3	3	1	0	1	0	0	0	0	0
ETH104-4	3	1	0	1	0	0	0	0	0
ETH104-5	3	1	0	1	1	0	0	0	0
ETH104-6	3	1	0	1	1	0	1	1	0

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F. CONTENT:-

I)   Practical exercises

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

Sr.No.	Title of Experiment	Skills to be developed	Course outcome
1.	Calculate the resistance of DC circuit by measuring voltage and current and verify using multi-meter. (Verify Ohm's law)	1.Identify different components in electrical Laboratory 2.Use voltmeter and ammeter.	1
2.	To measure the voltages across resistances in the circuit and verify the readings using Kirchhoff's Voltage Law.	Implement Kirchhoff's voltage law to solve electrical circuits.	1
3.	To measure the currents across resistances in the circuit and verify the readings using Kirchoff's Current Law.	Implement Kirchhoff's current law to solve electrical circuits.	1
4.	Connect resistances in series and parallel connection and measure its resistances by using Ohm's law.	Connect electrical loads in series and parallel.	1
5.	Determine the permeability of magnetic material by plotting its B-H curve.	1.Measure magnetic flux density and electric field intensity. 2.Plot B-H curve of a material.	2
6.	Observe and identify the direction induced emf in the coil with the moving magnet and moving coil. (Verify Faraday's law of electromagnetic induction and Lenz law)	Identify direction of induced emf in givenenvironment.	3
7.	Measure frequency, amplitude, time period, peak to peak value of alternating quantity.	Use CRO to measure different parameters.	5
8.	Calculate R, L and power factor of series RL circuit by measuring voltages and currents in circuit.	Identify AC meters. Measure AC quantities.	5
9.	Calculate R, C and power factor of series RC circuit by measuring voltages and currents in circuit.	Identify AC meters. Measure AC quantities.	5
10.	Calculate R, L, C and power factor ofseries RLC circuit by measuring voltages and currents in circuit.	1.Identify AC meters. 2. Measure AC quantities.	5
11.	Use transformer as step up and step down of single phase transformer.	Measure primary and secondary side voltages of transformer.	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
ETH104-1: Apply basic laws and principles of electrical engineering to electrical applications.		

1	**BASIC LAWS AND PRINCIPLES**
	
	1. Basic terms:-electric current and potential difference. Concept of voltage drop and terminal voltage.
	2. Concept of resistance and conductance Laws of resistance (Simple Numerical)Concept of resistivity and conductivity.
	3. Classification of electric current:
	    Direct current (DC) & alternating current (AC)
	4. Concept of power and energy with simple numerical. (in DC circuit)
	5. Series and parallel connection of resistances. (Simple numerical)
	6. Theorems for DC circuits:
	    Ohm's Law (Simple Numerical)
	    Kirchhoff's Laws (Simple Numerical with maximum two equations)
		06	10

ETH104-2: Use principles of magnetic circuits to calculate various parameters in magneticcircuits.		

2	**MAGNETIC CIRCUITS**
	
	1. Magnetic Circuit - Ohm's law of magnetic circuit.
	2. Definitions concerning magnetic circuit:
	    Magneto-Motive-Force (MMF), Ampere Turns (AT), Reluctance, Permeance, Reluctivity.
	3. Comparison between electric and magnetic circuit.
	4. Calculations of ampere-turns for simple series magnetic circuit (SimpleNumerical)
	5. Concept of magnetization curve (B - H Curve)
	    Magnetization curve for magnetic and non-magnetic materials.
	6. Concepts of magnetic hysteresis, hysteresis loop.
	    Significance of areaof hysteresis loop, hysteresis loss. (No Derivation and No Numerical), Definition of eddy current loss and it formula.
	8. Concepts of permanent magnet and electromagnet.
		08	14

ETH104-3: Understand basic principles of electromagnetic induction.		

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| 3 | **ELECTROMAGNETIC INDUCTION**

1. Faraday's laws of electromagnetic induction. (Simple Numerical)
2. Induced E.M.F: Statically induced E.M.F., dynamically induced E.M.F.(Simple Numerical)
3. Direction of induced E.M.F. and currents. Fleming's right hand rule, Fleming's left hand rule. Lenz'slaw.
4. Basic concepts of self induction and mutual induction. (No numerical)
5. Basic principle of elementary alternator.
6. Energy stored in magnetic field (No Derivation and No Numerical)
7. Lorentz force principle (Simple numerical). | 7 | 10 |

Section II

ETH104-4: Apply basic principles of AC circuits in electrical devices.		
4	**AC FUNDAMENTALS** 1. Generation of alternating EMFs. 2. Some important terms.: cycle, time period, frequency, amplitude, average values, rms value. 3. Equations of alternating voltages and currents. 4. Concept of effective or root mean square (R.M.S.) value of sinusoidal currentor voltage. 5. Peak factor and form factor. 6. Phasor representation of alternating quantities. 7. Phase and phase difference, concept of lagging and leading 8. Addition and subtraction of sinusoidal alternating quantities. (SimpleNumerical) 9. 9. Multiplication and division of sinusoidal alternating quantities. (SimpleNumerical)	10	12
ETH104-5: Understand circuit parameters in AC circuit.		
5	**AC CIRCUITS (NO NUMERICAL)** 1. Polyphase Generation 2. Three phase power equation 3. Star and delta connections of resistive load. (No derivation) Comparison between star and delta connections of load. 4. A.C. circuits Purely resistive A.C. circuit. Purely inductive A.C. circuit.Purely capacitive A.C circuit. 5. Series A.C. circuits Circuit with resistance and inductance in series (Concept of power factor) Circuit with resistance and capacitance in series (Concept of power factor)Circuit with resistance inductance and capacitance in series (Concept of power factor)	08	10

	Active and reactive power in single phase series circuit.		
	ETH104-6: Apply basic laws of electromagnetic induction principles in electric machines.		
6	**TRANSFORMER & MACHINE (NO NUMERICAL)** 1. Basic principle of working of a single phase transformer. 2. Construction of a single phase transformer. 3. Types of transformer based on Construction of core of transformersNumber of phases Voltage Semester Functions of transformer (instrument, power, isolation) 4. Application of transformers in electronic circuit. 5. Basic principle of working of single phase induction motor. 6. Basic principle of working of DC motor. Compare shunt and series DC motors. 7. Stepper Motor- reluctance type stepper motor – working and application 8.Basic principle of earthing, necessity of earthing, types of earthing (pipe earthing and plate earthing)	06	14

G. List of Assignments under SLA(Microproject/activity)

Sr.No	List of Assignment (under SLA)
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	Simple problems on Addition, subtraction, multiplication and division of sinusoidal alternating quantities.
6	Survey the electrical appliances which represents different types of load.(resistive, inductive and capacitive)
7	Compare types of transformer as per voltage Semester, construction, number of phases, applications.
8	Survey different types of earthing.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basic Laws & Principles	4	4	2	10	ETH104-1
I / 2	Magnetic Circuits	4	4	6	14	ETH104-2
I / 3	Electromagnetic Induction	4	4	2	10	ETH104-3
II /4	AC Fundamentals	4	6	2	12	ETH104-4
II /5	AC Circuits	4	4	2	10	ETH104-5
II / 6	Transformer & Machine	4	6	4	14	ETH104-6
			Total Marks		70	

I. Assessment Criteria

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

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**

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:

3. Lectures cum Demonstrations,
4. Class room practices.
5. 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
11	Basic Electrical Engineering,	Mittle and Mittal	McGraw Education, New Delhi, 2015,ISBN :978-0-07-0088572-5
12	Electrical Technology Vol – I	Theraja, B. L	S. Chand Publications, New Delhi, 2015
13	Electrical Technology Vol – II,	Theraja, B. L	S. Chand Publications, New Delhi, 2015
14	Basic Electrical Engineering	V.K Mehta Author), Rohit Mehta	S. Chandpublications.

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

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COURSE ID:

COURSE NAME : C PROGRAMMING

COURSE CODE : ETH105

COURSE ABBREVIATION : HCPR

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 (Hrs)	Assessment Scheme								Based on Self Learning		Total Marks
	Theory				Based on LL & TL						
	FAT H	SA TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	25	10	25@	10	-	-	50

(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.

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* 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 designed to develop programming attitude and attract the interest of the students in the C Language. C is a very powerful, widely used, efficient and compact, which combines features of high-Semester language and low-Semester language. It is used in many scientific programming situations. It forms the core of the modern languages Java and C++. Almost every set up in software Engineering domain chooses C as a first priority programming language.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Development of programming skills to solve engineering problems in procedural way. Understanding and implementing concepts of procedural programming. Operating Computer system efficiently. Development of attitude of precision, accuracy, safety, punctuality and aesthetic presentation.

E. COURSE OUTCOMES:

ETH105-1 Identify C expressions with character set and operators.

ETH105-2 Apply decision making and branching and looping constructs in programming.

ETH105-3 Implement user defined functions and arrays.

ETH105-4 Implement library functions for string handling.

ETH105-5 Develop C programs using structures and pointers.

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

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

Competency and COs	PO								
	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 practice for society, sustainability and environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Design and development	PSO2 Database and Network management
Competency: Apply concepts of C Programming to solve engineering problems	3	3	3	2	2	2	1	3	-
ETH105-1	2	1	2	2	2	1	1	-	-
ETH105-2	2	3	3	3	2	1	1	2	-

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Competency and COs	PO								
	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 practice for society, sustainability and environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Design and development	PSO2 Database and Network management
ETH105-3	2	2	3	3	1	1	1	2	-
ETH105-4	2	2	3	3	1	1	1	2	-
ETH105-5	2	2	2	3	2	1	1	2	-

PSO 1: Operate and Maintain: Competency to apply the concepts of Industrial Electronics in the operation and maintenance of engineering application systems.

PSO 2: Supervision and providing solution: Ability to supervise work and reach appropriate solution to simple practical problems in Industrial Electronics engineering industry.

F. CONTENT:

I) SUGGESTED PRACTICAL'S/ EXERCISE

The following practical exercises shall be conducted as practical's and assess the student for attainment of the competency. (any 10 out of 13 experiments)

Sr. No.	Title of Experiment	Skills to be developed	Course Outcome
01	Study of Flowchart and Algorithm	• Understanding an Algorithm • Understanding the Flowchart • Study of various Flowchart Symbols • To draw Flowchart on any Practical routine	ETH105-1
02	Installation of C/C++ Compiler and study of its IDE	• Understanding Integrated development environment of any one C compiler • To create and save and compile a program file • To run the compiled program and see the output	
03	Usage of C character set, keywords, identifiers, variables, constants, and expressions	• Study of character set of C language • Study of identifiers, variables, constant, and Keyword	ETH105-1

		- Rules for valid variables, identifiers, constants. - Identify valid and invalid variables, - Study of expressions and different types	
04	Usage of Operators	- Classification of operators in C - Understanding use of C different types operators - Writing imple C programs illustrating use of all category of C operators	ETH105-1
05	To use input and output library functions	Writing simple programs to illustrate the use of- - Standard Input function- scanf() - Standard Output function-printf() - Character input and output functions getchar() ,putchar() - String input and output functions gets(), puts()	ETH105-1
06	Implementation of decision Making and branching using if, if-else, Nested if, ladder if-else structure	Writing simple programs to illustrate the use of- - If statement - If-else statement - Nested if..else - else..if ladder	ETH105-2
07	Implementation of multiple decision making using switch statement	Writing program to illustrate the use of- - switch statement - break statement - default statement	ETH105-2
08	Implementation of looping using for Statement	Writing a program to illustrate the use of- - for statement to implement loop - Nested for loop	ETH105-2

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09	Implementation of looping using while and do---while statement	• Exit control and Entry control loop • program based on while loop and do-while	ETH105-2
10	To create and use of one dimensional and multi-dimensional array	Writing a program to illustrate- • creating one and multi-dimensional array • Manipulation of elements of an array	ETH105-3
11	Program based on User Defined Functions	Writing a program to illustrate- • User defined function declaration or prototype • User defined function definition • Function call or reference • Passing parameters to a function- call by value and call by reference	ETH105-3
12	Strings and string manipulation functions	Writing a program to illustrate- • Ddeclaration and initialization of string variable • reading and writing a string from and to terminal. • String- handling Functions - strlen(),strcmp() strcpy(), strcat(), strupr(), strlwr(), strrev() etc.	ETH105-4
13	Study of Structure	Writing a program to illustrate- • Defining a structure • Declaring and iinitialization of structure variable • Accessing members of structure variable	ETH105-6
13	Implementation of Pointer	Writing a program to illustrate- • Ddeclaration of pointer • Initializing pointer variable	ETH105-6

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		• Accessing data using pointer variable	

II) THEORY :

SECTION I

Sr. No.	Topics / Sub-topics	Lectures (Hours)
Course Outcome ETH105 – 1 Identify C expressions with character set and operators.		
1	**C FUNDAMENTALS** 1.1 History of c 1.2 C character set 1.3 Identifiers & Keywords, 1.4 Data types 1.5 Variables 1.6 Declarations 1.7 Constants 1.8 Expressions 1.9 C Instructions 1.10 The first C program 1.11 Compilation & Execution	**05**

2	**OPERATORS& DATA INPUT AND OUTPUT FUNCTIONS**
	
	2.1 Operators
	
	    2.1.1 Arithmetic Operators
	
	    2.1.2 Assignment Operator
	
	    2.1.2 Unary operators
	
	    2.1.3 Relational & Logical Operators,
	
	    2.1.4 Conditional & Comma Operator
	
	2.2 Input and Output Library Functions
	
	    2.2.1 printf() 2.2.2 scanf()
	
	    2.2.3 getchar() 2.2.4 putchar()
	
	    2.2.5 gets() 2.2.6 puts()
		05

Course Outcome ETH105 -2 Apply decision making and branching and looping constructs in programming.		

3	**CONTROL STATEMENTS**
	
	3.1 Decision making and branching
	
	    3.1.1 if Statement(if, if-else, if-else ladder,
	
	        nested if-else)
		06

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	3.1.2 Switch, break, continue, goto statement	
	3.2 Decision making and looping	
	3.2.1 While, do – while, for Statements	
	3.2.2 Nested loops	

SECTION II

Sr. No.	Topics / Subtopics	Lectures (Hours)
Course Outcome ETH105 -3 Implement user defined functions and arrays.		
4.	**ARRAYS & FUNCTIONS**	06
	4.1 Defining an array,	
	4.2 One dimensional array ,Declaration and Initialization of Arrays,	
	4.3 Two Dimensional Arrays Declaration and Initialization of Arrays,	
	4.4 Defining a Function, Accessing a function,	
	4.5 Passing arguments to a Function(call by value and call by reference), Specifying argument data types	
	4.6 Scope and lifetime of variables	
	4.7 Function prototypes	
	4.8 Recursion	
Course Outcome ETH105 -4 Implement library functions for string handling.		
5.	**CHARACTERS & STRINGS**	05
	5.1 The char data type, using character variables, using string	
	5.2 Declaring and initializing string variables	
	5.3 Reading strings from terminal	
	5.4 Writing Strings to screen, putting strings together.	
	5.5 Comparison of two strings	
	5.6 String- handling Functions - strcmp(), strlen(), strcpy(), strcat(), strupr(), strlwr(), strrev()	
Course Outcome ETH105 -5 Develop C programs using structures and pointers.		
6.	**Structures and Pointers**	5
	6.1 Simple structures (Defining & declaring structures, accessing structure members)	
	6.2 Complex structures (structures that contain arrays)	
	6.3 Understanding pointers, declaring pointer variable, initialization of pointer variable, accessing address of a variable	

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G. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS AND PRACTICAL EXAMINATION

a) Formative Assessment of Practical:

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

Domain	Particulars	Marks out of 25
Cognitive	Technical preparedness for practical	05
Psychomotor	Operating skills/Algorithm/ flowchart	05
	Observation/Logic/ Program/Result	05
Affective	Discipline and punctuality	05
	Procedure/ Safety Measures/ Decency/ Presentation	05
TOTAL		**25**

b) Summative Assessment of Practical:

Every student has to perform one practical within 3 hours at semester end practical assessment which shall be assessed as per following criteria.

Sr. No	Criteria	Marks allotted
1	Neat & complete circuit Diagram / schematic Diagram/ Algorithm/ Flowchart/ Program	5
2	Procedure followed to achieve the result	5
3	Observations, Result, Output, Sample Calculations with relevant formulae	5
4	Proper Graphs, workmanship and Safety measures	5
5	Oral	5
	Total	**25**

H. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

1. Online/Offline Lectures cum Discussions
2. Regular home assignments
3. Laboratory work

Teaching and Learning Resources:

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1. Chalk and Board   2. Video Clips   3.PPTs   4. Question Bank 5. Charts

I. REFERENCE MATERIAL:

a) Books / Codes

Sr. No.	Author	Title	Publisher
1.	E.Balgurusamy	Programming in ANSI C	Tata McGraw Hill Education
2.	Yashwant Kanetkar	Let us C	BPB Publication
3	Bryon Gottfried	Programming with C	Schaum's Outlines Series
4	kerninghan& Ritchie	The C Programming language	Prentice Hall

b) Websites

1) https://www.w3schools.in/c-tutorial/
2) www.cprogramming.com
3) www.learn-c.org
4) www.tutorialspoint.com/cprogramming
5) https://www.tutorialspoint.com/compile_c_online.php

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COURSE ID	:
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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
00	**00**	**00**	**00**	**00**	**00**	**00**	**-**	**-**	**50**	**20**	**50**

(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)

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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 SEMESTER 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.

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COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:
[Note : Correlation Semesters : 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 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
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		

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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 localproblems TLO 1.3 Design a methodology for fieldwork TLO 1.4 Select the attributes of engineering and socialsystem for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected. Study the data collected from fieldwork and conclude the observations.	**Unit - I MODULE I : Activities UnderUnnat 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 available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc 1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuringequipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 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 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 Observations of field visits and datacollected.	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 from the bigger group. ii) Assign a few batches of the students for this course to all thefaculty members. 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. iv) The group of course teacherswill 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. v) The course will be

`			implemented in eight sessionsand fieldwork. a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - 1. Pilot Visit - Pilot of surveyinstrument Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Datagathering Summary Visit - Closure afteranalysis
2	TLO 2.1 Adoption of Village or Slum TLO 2.2 Survey and Problem IdentificationTLO 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 theNSS for their up-liftment (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 andKaruna)	**Unit - III MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna):	i) Lectures

`	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	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 andSensitivity	ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks byPractitioners Site/Industry Visit
4	TLO 4.1 Punctuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3 Responsibility TLO 4.4 Gratitude andAppreciations 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 andForget	**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 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, Topicsfor 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	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Chalk-Board

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		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 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 Importanceof	**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 ofInstructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board Collaborative learning

Insurance TLO 5.8 Literacy About the Dos and Don'ts in finances		

** 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 heritageamong 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 educatingpeople and making them aware of women's rights both constitutional and legal;

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(ii) creating consciousness among women that they too contributed to economic and social well-being of thecommunity;

(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided theyacquire 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 ofpatients 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 land 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

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mass media forinstruction 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,
castism, regionalism,untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and Legal-literacy, consumer awareness.

H. Specification Table for Setting Question Paper for Semester End Theory Examination: Not Applicable

I. Assessment Criteria
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:
20. Group Discussion, Flipped Classroom
21. Demonstration, Case Study, Role Play, Collaborative Learning, Cooperative Learning
22. Field Visit, Survey
23. 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
28	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
29	Central Public Healthand Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi

30	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
31	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
32	Local college students,UMA staffs	Sample Case Studies on UMA website	IITB-UMA team

M. Learning Website & Software

f. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resol utions/English/201601131501523808.pdf (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan)

g. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resol utions/English/201606151454073708.pdf (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines)

h. https://censusindia.gov.in/census.website/ (A Website of Census of India)

i. https://gsda.maharashtra.gov.in/english/ (A Website of Groundwater Survey and Development Agency, GoM)

j. https://mrsac.gov.in/MRSAC/map/map (A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.)

k. https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx (A Website of Jal Jivan Mission, Government of India)

l. https://cpcb.nic.in/ (A Website of Central Pollution Control Board, Government of India)

m. http://www.mahapwd.com/# (A Website of Public Works Department, GoM)

n. http://tutorial.communitygis.net/ (A Website for GIS data sets developed by Unnat Maharashtra Abhiyan)

o. https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U (A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society)

p. https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac (A keynote talk by Prof. Milind Sohoni,IIT Bombay, on Interdisciplinary Engineering: The Road Ahead)

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SEMESTER III COURSES

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COURSE ID :

COURSE NAME	:	**CIRCUITS AND NETWORKS**
COURSE CODE	:	**ETH301**
COURSE ABBREVIATION	:	**HCKN**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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			
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   .

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.

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* 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 engineers must deal with the electronic circuit while maintaining various electronic equipment/systems in the industry. This course will help the students to use principles of circuit and analyse to maintain the electric circuit/network.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain following industry identified competencies through various teaching learning experiences:

Build and analyze various electronic circuits and Networks

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH301-1 Apply basic laws of Circuit analysis to determine circuit parameters.
ETH301-2 Apply Nodal and Mesh analysis to determine circuit parameters.
ETH301-3 Apply various circuit theorems to calculate circuit parameters .
ETH301-4 Calculate the electrical parameters of single phase A.C. circuit
ETH301-5 Evaluate circuit parameters at series and parallel resonant frequency .
ETH301-6 Determine the circuit parameters of two port network.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	**PO 5** Engineering Practices for society, sustainability and Environment	**PO 6** Project Management	**PO 7** Life-long Learning	**PSO1** Operate and Maintain	**PSO2** Supervision and Providing Solution
ETH301-1	3	3	2	3	1	1	2	3	2
ETH301-2	3	3	2	3	1	1	2	3	1
ETH301-3	3	3	2	3	1	1	2	3	1
ETH301-4	3	1	3	2	1	1	1	3	2
ETH301-5	3	2	3	2	1	1	1	3	1
ETH301-6	3	2	3	2	1	1	1	3	1

F. CONTENT:
  I)   Practical Exercises

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

Sr. No.	Laboratory experiences	CO
1.	Verify equivalent resistance formulae in series connection and parallel connection of Resistors .	ETH 301-1
2.	Measure current flowing through a resistor and voltage across that resistor and verify it using OHM's law	ETH 301-1
3.	Measure the voltage across resistors in resistive circuit and verify it, using Kirchhoff's Voltage law (KVL).	ETH 301-1
4.	Measure current in various branches of the given circuit and verify it, using Kirchhoff's current law (KCL).	ETH 301-1
5.	Calculate power dissipated in a resistor using I^2R and V^2/R formula	ETH 301-1
6.	Measure voltage across rsistors in resistive circuit and Verify it using Voltage divider Rule	ETH 301-1
7.	Measure current in various branches of the resistive circuit and verify it using Current divider Rule	ETH 301 -1
8.	Measure voltage at particular node and current through branch of network and verify it by nodal analysis	ETH 301-2
9.	Measure current through and voltage across given branch of electric network and verify it by mesh analysis.	ETH 301-2
10.	Measure current through given branch of network and verify it applying Superposition theorem.	ETH 301-3
11.	Measure open circuit voltage and thevenin's resistance of the given circuit and verify it using Thevenin's theorem.	ETH 301-3
12.	Vary load resistance to transfer Maximum power in the given circuit using maximum power transfer theorem.	ETH 301-3
13.	Measure short circuit current and Norton's resistance of the given circuit and verify it using Norton's theorem.	ETH 301-3
14.	Verify equivalent capacitor formulae in series and parallel connected capacitors	ETH 301-4
15.	Measure initial and final voltage across the capacitor before and after switching input supply.	ETH 301-4
16.	Measure voltage and current in the given RLC series circuit and calculate resonance frequency and impedance at resonance using variable supply frequency.	ETH 301-5
17.	Measure current of given RLC parallel circuit and calculate resonance frequency and impedance at resonance by varying supply frequency.	ETH 301-5
18.	Develop RC low pass filter on breadboard and plot its frequency response.	ETH 301-6
19.	Develop RC high pass filter on breadboard and plot its frequency response.	ETH 301-6
20.	Develop RC band pass filter on breadboard and plot it's frequency response.	ETH 301-6

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Sr. No.	Laboratory experiences	CO
21.	Perform minimum 5 practicals from above list using MultiSIM software	ETH 301-1,2,3,4,5,6

II. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING /SKILLS DEVELOPMENT (SELF LEARNING)

Micro projects:

- Prepare a report on real life applications of resonance (e.g. musical instruments)
- Prepare power point presentation on source transformation, star- delta transformation, mesh and nodal analysis andgive presentation in the class.
- Build a circuit on breadboard with multiple resistors connected in series and measure voltage across each resistor. Verify using KVL.
- Prepare a chart for comparison of single phase series RLC and parallel RLC circuit and draw input and outputwaveforms also.
- Build a circuit on breadboard with multiple resistors connected in series and measure voltage across and current through each resistor . Verify using Ohms law .
- Build a circuit on breadboard with multiple resistors connected in parallel and measure current across each resistor. Verify using KCL.

Assignments:

- Find circuit parameters of Single Phase AC series (R-L, R-C, R-L-C) and parallel (R-L, R-C, R-L-C) circuit, also draw its phasor diagram.
- Find the resonance condition for the specified series and RLC circuit and calculate current, voltage, bandwidth,quality factor . Observe the behaviour of R, L and C with change in frequency for series circuit.
- Identify the number of loops and nodes in the given circuit and solve the circuit using Nodal analysis and Meshanalysis.
- Simplify complex circuit using Thevenin's theorem, Norton's theorem and draw equivalent circuit for givencircuit.

Activities For Specific Learning / Skills Development

- Verification of various network analysis and theorems in Virtual Laboratory (https://asnm-iitkgp.vlabs.ac.in/).
- Verification of various network analysis and theorems using Simulation Software (MATLAB, MultiSIM).
- Perform R-L-C circuit analysis in Virtual Laboratory (https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/).
- Experimental verification of frequency response of R-L-C series Circuit (https://asnm-iitkgp.vlabs.ac.in/exp/rlc-series-circuit/).
- Test the resonance in Series RLC circuit using Simulation Software (MATLAB, MultiSIM).

Note

➢ Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank ofmicroprojects, assignments, and activities in a similar way.

➢ The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student inacquiring the desired skills.

➢ If a microproject is assigned, it is expected to be completed 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.

III. Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Theory evaluation Marks
	ETH301-1 Apply basic laws of Circuit analysis to determine circuit parameters		
1	**BASIC THEORY** 1.1 Electric charge and current , voltage , Power and Energy 1.2 Voltage and current sources , Independent and Dependent sources . 1.3 Ohm's law and its limitations . 1.4 Definitions of Node, Branch, Loop, Mesh 1.5 Series circuits - Kirchhoff's voltage law, Voltage divider rule , Total resistance of Series connected resistors . 1.6 Parallel circuits - Kirchhoff's current law, Current divider rule , Total resistance of Parallel connected resistors . 1.7 Concept of Ground , Open circuit and short circuit **(Numericals based on above concepts)**	8	12
	ETH301-2 Apply Nodal and Mesh analysis to determine circuit ***parameters.***		
2	**Methods of Circuit analysis** 2.1 Conversion of voltage to current source and current to voltage source 2.2 Series and parallel connection of Sources 2.3 Nodal Analysis method 2.4 Super Node analysis 2.5 Mesh Analysis method 2.6 Super Mesh Analysis **(Numericals based on above concepts)**	6	10

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Sr. no.	Topics/Subtopics	Learning (Hours)	Theory evaluation Marks
	ETH 301-3 Apply various circuit theorems to calculate circuit parameters		
3	**Network Theorems** 3.1 Linearity property. 3.2 Superposition Theorem 3.3 Thevenin's theorem 3.4 Norton's theorem 3.5 Maximum power transfer theorem 3.6 Millman's theorem 3.7 Tellegen's theorem **(Numericals based on above concepts)**	**8**	**12**
	Sub-total	**22**	**34**

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Theory evaluation Marks
	ETH301-4 Calculate the electrical parameters of single phase A.C. circuit		
4	**Single phase AC circuits** 4.1 Current , Voltage and energy expressions in inductor and capacitor . 4.2 Series and parallel connection of inductor and capacitor 4.3 Phase relationship between current and voltage in an inductor and capacitor . 4.4 Representation of complex number in polar and rectangular form 4.5 Impedance and admittance calculations in AC circuits 4.6 Time constant in RL and RC circuit 4.7 Charging and discharging equations and curves in inductor and capacitor 4.8 Power in inductor and capacitor **(Numericals based on above concepts)**	**8**	**12**
	ETH301-5 *Evaluate circuit parameters at series and parallel resonant frequency*		
5	**Resonance in Series and Parallel circuits** 5.1 Resonance in series circuit: Impedance, phase angle, voltage, current, bandwidth, Quality factor (Q),	**8**	**12**

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Sr. no.	Topics/Subtopics	Learning (Hours)	Theory evaluation Marks
	magnification factor for series resonance circuit 5.2 Behaviour of RLC series circuit with change in input frequency 5.3 Resonance in Parallel Circuit: Impedance, phase angle, voltage, current, bandwidth, Quality factor (Q), magnification factor for parallel resonance circuit 5.4 Behaviour of RLC parallel circuit with change in input Frequency 5.5 Applications of resonant circuits (**Numericals based on above concepts**)		
	ETH301-6 Determine the circuit parameters of two port network.		

6	**Analysis of two port network**
	  6.1 Network Types: Active and Passive, Bilateral and Unilateral, Linear and Nonlinear, Symmetrical and Asymmetrical, Single port and Two port network
	  6.2 Attenuators: Definition, types-T and Pi, features, frequency response, applications, comparison
	  6.3 Passive Filters: Definition, types- Low pass filter(LPF), high pass filter (HPF), band pass filter(BPF) and band stop filter (BSF), features, frequency response, applications, comparison
	
	(**Numericals based on above concepts**)
		7	12

	Sub-total	**23**	**36**

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basic Theory	-	4	8	12	ETH301-1
I / 2	Methods of Circuit analysis	-	4	6	10	ETH301-2
I / 3	Network Theorems	-	4	8	12	ETH301-3
II /4	Single phase AC circuits	2	6	4	12	ETH301-4
II /5	Resonance in Series and parallel circuits	4	4	4	12	ETH301-5
II / 6	Analysis of Two Port Networks	4	4	4	12	ETH301-6

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Total Marks	14	26	30	70	

H. ASSESSMENT METHODOLOGIES/TOOLS-

I) Formative Assessment (Assessment for learning)

- Two offline unit tests of 30 marks and average of two-unit test marks will be considered for out of 30 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- For formative assessment of laboratory learning 25 marks

II) Summative Assessment (Assessment of Learning)

- End semester summative assessment is of 25 marks for laboratory learning
- End semester assessment is of 70 marks.

I. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Electric circuits	Alexander and Sadiku	McGraw Hill
2	Circuit Analysis	Hayt and Kemmerly	McGraw Hill
3	Electrical Networks	Ravish Singh	McGraw Hill
4	Circuit and network	Sudhakar and Shyammohan	McGraw Hill
5	Electric Circuit Analysis	P. Ramesh Babu	SciTech Publication (India) Pvt. Ltd

J. LEARNING WEBSITES & Portals

	Link / Portal	Description
1	www.scilab.org/scilab	Open-source simulator for simulation of theorems
2	www.ni.com/multisim	Open-source simulator for simulation of theorems and circuit analysis
3	https://www.nptelvideos.com/course.php?id=462	NPTEL Circuit Theory Video Lectures
4	https://asnm-iitkgp.vlabs.ac.in/	Virtual laboratory link for theorems, R-L-C circuit analysis and its frequency response
5	https://www.udemy.com/course/electrical-circuit-for-electrical-electronics-engineering/	Basics, circuit element, circuit solving, network theorems, transient analysis
6	https://everycircuit.com/app	Online and mobile app to design and simulate electronic circuits

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COURSE ID:

COURSE NAME   : **LINEAR INTEGRATED CIRCUITS**

COURSE CODE   : **ETH302**

COURSE ABBREVIATION   : **HLIC**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	04
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	01	
	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	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.

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)

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D. i) RATIONALE: -

The physical world is inherently analog. To process analog signals, in many electronic systems, Linear Integrated Circuits are used as basic building blocks. Operational amplifier (OPAMP) is most versatile linear integrated circuit used to develop various applications in electronic circuit and equipment. Hence this course is intended to develop the skills to build, test, diagnose and rectify OPAMP based electronic circuits. It also covers IC555 and its applications which plays major role in industry, consumer and domestic 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 electronics circuits consisting of linear integrated circuits.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH302-1 Select suitable OPAMP with appropriate parameters for any application.

ETH302-2 Construct various configurations of OPAMP for different applications.

ETH302-3 Make use of OPAMP for various non-linear applications.

ETH302-4 Maintain various waveform generator circuits.

ETH302-5 Design various active filters using OPAMP

ETH302-6 Use IC555 to develop various applications.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH302-1 Select suitable OPAMP with appropriate parameters for any application.	3	-	-	1	-	-	--	2	--
ETH302-2 Construct various configurations of OPAMP for different applications.	3	2	2	3	--	--	--	3	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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH302-3 Make use of OPAMP for various non-linear applications.	3	2	2	3	-	--	--	3	1
ETH302-4 Maintain various waveform generator circuits.	3	-	-	3	--	--	--	3	--
ETH302-5 Design various active filters using OPAMP	3	3	2	3	-	--	--	3	1
ETH302-6 Use IC555 to develop various applications.	3	-	2	3	--	--	--	3	--

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the laboratory in practical sessions of batches of about 20- 22 students. Any 20 experiments should be performed. All COs should be covered.

Sr. No.	Laboratory Experiments	CO
1.	Measure output voltage swing of IC741.	ETH302-1
2.	Build the circuit to measure input offset voltage and output offset voltage of IC741	ETH302-1
3.	Build the circuit of Inverting and non-inverting amplifier with feedback using IC741 and measure its gain.	ETH302-2
4.	Build and test the circuit of inverting adder using IC741.	ETH302-2
5.	Build and test the circuit of non-inverting adder using IC741.	ETH302-2
6.	Build and test the circuit of subtractor using IC741.	ETH302-2
7.	Build and test the circuit of integrator using IC741.	ETH302-2
8.	Build and test the circuit of differentiator using IC741.	ETH302-2
9.	Build V to I converter circuit using IC741 and measure output current.	ETH302-3
10.	Build the circuit of Zero crossing detector using IC741 and test the output.	ETH302-3
11.	Build and test performance of non-inverting comparator with positive and negative reference voltage.	ETH302-3

Sr. No.	Laboratory Experiments	CO
12.	Build and test performance of inverting comparator with positive and negative reference voltage.	ETH302-3
13.	Build the circuit of RC phase shift oscillator using IC741 and measure output frequency.	ETH302-4
14.	Build the circuit of Wein bridge oscillator using IC741 and measure output frequency.	ETH302-4
15.	Simulate the working of Quadrature oscillator using IC741 using Multisim or relevant software.	ETH302-4
16.	Build and test Astable multivibrator using IC741.	ETH302-4
17.	Simulate the circuit of Monostable multivibrator using IC741.	ETH302-4
18.	Build the circuit of first order low pass filter using IC741and and measure the bandwidth and cutoff frequency.	ETH302-5
19.	Simulate the circuit of first order high pass filter using IC741and measure the bandwidth and cutoff frequency.	ETH302-5
20.	Build notch filter using IC741 and measure cutoff frequency.	ETH302-5
21.	Build and test Astable multivibrator using IC555.	ETH302-6
22.	Simulate the circuit of Monostable multivibrator using IC555.	ETH302-6
23.	Build and test voltage-controlled oscillator using IC555.	ETH302-6
24.	Build and test Schmitt trigger using IC555.	ETH302-6

II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH302-1 Select suitable OPAMP with appropriate parameters for any application.		
1	**Basics of Operational Amplifier (OPAMP)** 1.1 Differential amplifier: circuit diagram and description of Dual input balanced output, Dual input unbalanced output, Single input balanced output, Single input unbalanced output differential amplifier. 1.2 Block diagram of OPAMP. 1.3 Symbol and equivalent circuit of OPAMP.	**04**	**08**

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.4 IC741 pin configuration and description 1.5 Ideal OPAMP electrical characteristics, ideal voltage transfer curve 1.6 Electrical parameters of OPAMP and its value for IC741: Input offset voltage, Input offset current, Input bias current, Differential input resistance, Input capacitance, Input voltage range, Common mode rejection ratio (CMRR), Supply voltage rejection ratio (SVRR), Large signal voltage gain, Output voltage swing, Output resistance, Slew rate, Supply current, Power consumption, Gain bandwidth product.		
	ETH302-2 Construct various configurations of OPAMP for different applications.		
2	**OPAMP configurations and feedback** 2.1 Open loop configurations of OPAMP: Inverting, Non inverting and Differential amplifier. 2.2 Virtual ground and virtual short concept of OPAMP 2.3 Block diagram representation of feedback configurations: Voltage series, voltage shunt, current series, current shunt 2.4 Closed loop configurations of OPAMP: Voltage series feedback amplifier (Non Inverting amplifier), Voltage shunt feedback amplifier (Inverting amplifier). (Circuit diagram and derivations for voltage gain, effect of feedback on gain, input resistance, output resistance and bandwidth.) 2.5 Voltage follower, Inverter (sign changer) 2.6 Differential amplifier with one OPAMP (subtractor) 2.7 Summing, Scaling, and averaging amplifier in inverting and non-inverting configuration 2.8 Basic and practical differentiator 2.9 Basic and practical integrator. Circuit diagram, working, input output waveforms, derivation for output voltage and simple numericals based on it for all above applications of OPAMP.	10	14
	ETH302-3 Make use of OPAMP for various non-linear applications.		
3	**OPAMP Applications** 3.1 Comparators: Inverting and non-inverting comparators with positive reference voltage, negative reference voltage, Zero crossing detector. 3.2 Window comparator (detector)	8	12

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.3 Schmitt trigger		
	3.4 Voltage to current (V to I) converter with floating load and grounded load, Current to voltage (I to V) converter.		
	3.5 Precision rectifier half wave and full wave.		
	3.6 Instrumentation amplifier using three OPAMP.		
	3.7 Sample and hold circuit		
	3.8 Peak detector		
	Circuit diagram, working, input output waveforms, derivation for output voltage and simple numericals based on it for all above applications of OPAMP.		
	Sub-total	**22**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH302-4 Maintain various waveform generator circuits.		
4	**Waveform Generator**	**10**	**14**
	4.1 Astable multivibrator using OPAMP.		
	4.2 Monostable multivibrator using OPAMP.		
	4.3 Bistable multivibrator using OPAMP.		
	4.4 Triangular wave generator using OPAMP.		
	4.5 Sawtooth wave generator using OPAMP.		
	4.6 RC phase shift oscillator using OPAMP.		
	4.7 Wein bridge oscillator using OPAMP.		
	4.8 Quadrature oscillator using OPAMP.		
	4.9 Voltage controlled Oscillator IC566, block diagram, pin diagram.		
	Circuit diagram, operation, waveforms, equations for time periods /frequency and simple numercials based on it.		
	ETH302-5 Design various active filters using OPAMP		
5	**Active Filters**	**7**	**12**
	5.1 Introduction to filters, classification of filters		
	5.2 Advantages of active filter over passive filter		

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	5.3 Ideal and practical frequency response curve of low pass, high pass, band pass and band reject filters 5.4 Terms related to filters: order of filter, cutoff frequency, center frequency, pass band, stop band, roll off rate, bandwidth and Q factor. 5.5 First order Butterworth low pass and high pass filter. 5.6 Second order Butterworth low pass and high pass filter. 5.7 Band pass filter (wide band pass and narrow band pass). 5.8 Band reject filter (wide band and narrow band or notch filter) 5.9 All pass filter Circuit diagram, operation, frequency response, equation for gain and cutoff frequency (no derivation). Simple numericals based on design of low pass and high pass.		
	ETH302-6 Use IC555 to develop various applications.		
6	**Timer IC 555** 6.1 Block diagram of IC555. 6.2 Pin diagram and specifications of IC555 6.3 Astable multivibrator using IC555 6.4 Monostable multivibrator using IC555 6.5 Bistable multivibrator using IC555 6.6 Schmitt trigger using IC555 6.7 Voltage control oscillator using IC555 6.8 Water Semester controller using IC555 Circuit diagram, operation, waveforms, equations for time periods /frequency and simple numercials based on it.	6	10
	Sub-total	**23**	**36**

G. List of Assignments under SLA

Sr. No.	Microprojects
16.	Develop clap switch using IC741
17.	Build automatic light operated switch using LDR and IC741
18.	Build automatic evening lamp using IC555
19.	Develop square wave generator using IC741

20.	Develop low pass filter for cutoff frequency 2KHz
21.	Build notch filter for frequency 5 KHz
22.	Develop water Semester controller using IC555
23.	Automatic street light using IC555
24.	Simple metal detector using IC555
25.	Light sensitive switch using IC741

Above is a suggestive list of microprojects. Faculty must prepare their own bank of microprojects, assignments and activities in a similar way. The faculty must allocate judicial 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 in a group of 2 or 3 students.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basics of Operational amplifier (OPAMP)	4	4		08	ETH302-1
I / 2	OPAMP configurations and feedback	4	4	6	14	ETH302-2
I / 3	OPAMP Applications		4	8	12	ETH302-3
II /4	Waveform Generator		6	8	14	ETH302-4
II /5	Active filters	2	4	6	12	ETH302-5
II / 6	Timer IC555		4	6	10	ETH302-6
Total Marks		10	26	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**

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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:

24. Lectures cum Demonstrations
25. Class room practices
26. 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	OPAMPs and Linear Integrated Circuits	Ramakant A Gayakwad	PHI New Delhi
2	Integrated Circuits	Botkar K R	Khanna Publisher
3	Linear Integrated Circuits	D Roy Choudhary	New Age International Publisher

M. Learning Website & Software

a. https://www.monolithicpower.com/en/operational-amplifiers

b. https://ae-iitr.vlabs.ac.in/List%20of%20experiments.html

c. https://how2electronics.com/op-amp-ic-lm741-basics-characteristics-pins-applications/#google_vignette

d. https://archive.nptel.ac.in/courses/108/108/108108114/

e. https://www.hackatronic.com/voltage-controlled-oscillator-circuit-using-566-ic/

f. https://www.electronics-tutorials.ws/filter/filter_5.html#

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COURSE ID:

COURSE NAME   : **DIGITAL TECHNIQUES & APPLICATIONS**
COURSE CODE   : **ETH303**
COURSE ABBREVIATION   : **HDTA**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	**03**	**04**
	Tutorial Learning	**00**	
	Laboratory Learning	**04**	
	SLH-Self Learning	**01**	
	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			
1.5	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   .

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.

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* 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: -

It is essential to know the basics of digital techniques for understanding the applications of digital systems. This course will help the student to comprehend logic and circuit design. Digital technique course provides a foundation for understanding embedded systems and microcontroller-based applications. By encouraging hands-on experimentation and project-based learning, the digital electronics course can inspire students to think creatively and apply their knowledge to develop innovative technologies and applications. This course ensures that diploma students are prepared to work with the latest digital technologies, such as microcontrollers, programmable logic devices, embedded systems, and digital communication systems.

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 digital systems by applying principles of digital techniques

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH303-1: Use number system and codes for interpreting working of digital system

ETH303-2: Use Boolean expressions to realize logic circuits

ETH303-3: Understand different Logic families

ETH303-4: Build combinational circuits, multiplexers, demultiplexers and decoders

ETH303-5: Build sequential circuits

ETH303-6: Test data converters in digital electronics systems

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH303-1 (Use number system and codes for interpreting working of digital system)	2	3	2	1	1	-	1	1	-
ETH303-2 (Use Boolean expressions to realize logic circuits)	2	3	3	1	1	-	1	3	2
ETH303-3 (Understand different Logic families)	2	1	-	1	1	-	1	3	1
ETH303-4	2	3	3	1	1	-	1	3	3

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 Operate and Maintain	PSO2 Supervision and Providing Solution
(Build combinational circuits, multiplexers, demultiplexers and decoders)									
ETH303-5 (Build sequential circuits)	2	3	3	1	1	-	1	3	3
ETH303-6 (Test data converters in digital electronics systems)	2	2	3	1	1	-	1	3	3

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Digital Techniques* in practical sessions of batches of about 20- 22 students.

Sr. No.	Laboratory experiences	COs
1	Test the functionality of NOT, AND, OR logic gates using breadboard. (IC 7404,7408,7432)	ETH303-2
2	Test the functionality of NAND & NOR logic gates using breadboard. (IC 7400 & IC 7402)	ETH303-2
3	Test the functionality of EX-OR & EX-NOR logic gates using breadboard.	ETH303-2
4	Construct AND, OR & NOT gates using Universal gates NAND & NOR and verify their truth tables.	ETH303-2
5	Build and test the logic circuit on breadboard to check De Morgan's theorems for 2 input variables.	ETH303-2
6	Design Half adder & Full adder using Boolean expressions	ETH303-4
7	Design Half subtractor & Full subtractor using logic gates	ETH303-4
8	Construct & test BCD to 7-segment decoder using IC 7447/7448	ETH303-4
9	Design and implementation of 4-bit binary adder/subtractor and BCD adder using IC 7483	ETH303-4
10	Build & test function of MUX using IC 74151/74150/any other equivalent IC	ETH303-4
11	Build & test function of DeMUX using IC 74138/74139/any other equivalent IC	ETH303-4
12	Design 8:1 MUX using 4:1 MUX using circuit simulator.	ETH303-4
13	Build & test function of decoder IC 74155/74154/any other IC	ETH303-4
14	To study and Implement 4-Bit Magnitude Comparator using IC-74LS85	ETH303-4
15	Build/ test function of RS flip flop using NAND gate	ETH303-5

16	Build & test function of JK flip flop using IC 7476	ETH303-5
17	Build and test the functionality of D flip flop	ETH303-5
18	Build and test the functionality of T flip flop	ETH303-5
19	Build 4-bit Right Shift Register using D flip flop IC 7474	ETH303-5
20	Implement 4-bit ripple counter using IC 7476	ETH303-5
21	Build and test MOD-10 counter using IC 7490	ETH303-5
22	Build and test UP/DOWN counter using IC 74193	ETH303-5
23	Build an R-2R ladder DAC circuit using precision resistors	ETH303-6
24	Build weighted resistor DAC circuit using resistors	ETH303-6
25	Construct a Dual slope ADC circuit and apply an analog input voltage	ETH303-6

II)   Theory

Section I

Sr. No.	Topics	Teaching hours	Marks
ETH303-1: *Use number system and codes for interpreting working of digital system.*			
1	**Number system & codes** 1.1 Introduction to number system: Binary, Octal, Decimal Hexadecimal, unsigned and signed numbers 1.2 Conversion from one number system to other number system 1.3 Binary arithmetic operations: rules of binary addition, binary subtraction, binary subtraction using 2's complement. 1.4 Computer codes: BCD, ASCII Code, Gray code and Excess-3 code 1.5 Code Conversion: Gray to binary and binary to gray conversion (up to 4 bits) 1.6 BCD Arithmetic: BCD addition, BCD subtraction using 9's and 10's complement. 1.7 Parity: even and odd parity	06	10
ETH303-2: *Use Boolean expressions to realize logic circuits.*			
2	**Boolean Algebras**: 2.1 Boolean algebra (rules, laws, Boolean expressions) 2.2 De Morgan's Theorem 2.3 Logic gates: Symbol, logical expression, truth table and ICs of basic logic gates (AND, OR, NOT) Universal gates (NAND and NOR) and Special purpose gates (EX- OR, EX-NOR), realization of basic gates using universal gates. 2.4 Standard Boolean representation: Sum of Product (SOP) and Product of Sum (POS), Min-term and Max-term, Conversion between SOP and POS forms 2.5 K map reduction technique: Minimization of Boolean functions up to 4 variables (SOP and POS form), realization using NAND/NOR gates, don't care condition	10	16

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Sr. No.	Topics	Teaching hours	Marks
ETH303-3: **Understand different Logic families**			

3	**Digital Logic Families**
	3.1 Characteristics of logic families: fan in, fan out, propagation delay, power dissipation, noise margin
	3.2 TTL family: Circuit diagram & working of TTL NAND gate
	3.3 CMOS family:
	   a) Circuit diagram & working of CMOS inverter
	   b) Circuit diagram & working of CMOS NAND & NOR gates(2 inputs)
	3.4 Comparison of logic families TTL & CMOS.
		06	08

	Sub total (Section I)	22	34

Section II

Sr. No.	Topics	Teaching hours	Marks
ETH303-4: Build combinational circuits, multiplexers, demultiplexers and decoders			
4.	**Combinational circuits** 4.1 Design of arithmetic circuits using K-map: Half and full Adder, half and full Subtractor 4.2 Adder and subtractor using IC7483, BCD adder / subtractor 4.3 BCD to 7 segment decoder/driver (IC 7447 /7448) 4.4 Binary to gray code converter and gray to binary code converter. 4.5 Comparator: 1 bit and 2 bit (design and realization using K map), 4 bit comparator using IC7485. 4.6 **Multiplexer:** Necessity, types of multiplexers 2:1, 4:1, 8:1, 16:1 (realization using gates and ICs 74150, 74151), Multiplexer tree 4.7 **Demultiplexer:** Necessity, types of demux 1:2, 1:4, 1:8, 1:16 (realization using gates), Demultiplexer tree 4.8 **Decoder:** concept of decoder, 2 line to 4 line, 3 line to 8 line, 4 line to 16 line decoder (realization using gates and ICs 74154, 74155)	10	16
ETH303-5: Build Sequential circuits			
5	**Sequential Logic Circuits** 5.1 **Basic memory cell:** RS-latch using NAND and NOR 5.2 **Triggering Methods:** Edge trigger and Semester trigger 5.3 **SR Flip Flops:** SR-flip flop, clocked SR flip flop with preset and clear 5.4 **JK Flip Flops:** Clocked JK Flip flop with preset and clear, race around condition in JK flip flop, Master slave JK flip flop. D flip flop and T type flip flop,	08	12

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	Block schematic and function table of IC-7474, IC-7475 5.5 **Shift Register** Logic diagram of 4- bit Shift registers: Serial Input Serial Output, Serial Input Parallel Output, Parallel Input Serial Output, Parallel Input Parallel Output, 4 Bit Universal Shift register 5.6 **Counters:** Asynchronous counter using T flipflop: 4-bit Ripple counter, 4 bit up/down Counter, modulus of counter, Block schematic of IC 7490, Decade counter, IC 7490 as MOD N Counter (using 4 bits)		
	ETG 306-6: Test data converters in digital electronics systems		
6.	**Data converters** 6.1 DAC Types – Weighted resistor method and R-2R method, specifications of DAC 6.2 Types of ADC, specifications of ADC, block diagram and working of Dual slope ADC and Successive approximation ADC 6.3 Numerals on DAC and ADC	**05**	**08**
	Sub total (Section II)	**23**	**36**

Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Convert the decimal number 156 to binary, octal, and hexadecimal.	02
2.	Convert the binary number 110101 to decimal, octal, and hexadecimal.	02
3.	Convert the octal number 245 to binary, decimal, and hexadecimal.	02
4.	Convert the hexadecimal number 3F2 to binary, decimal, and octal.	02
5.	Implement a 2-input AND gate using logic gates and create its truth table.	02
6.	Implement a 3-input OR gate using logic gates and create its truth table.	02
7.	Implement a 4-input XOR gate using logic gates and create its truth table.	02
8.	Design and implement an SR flip-flop using NAND gates.	02
9.	Design and implement a D flip-flop using NOR gates.	02
10.	Design and implement a 4-bit shift register using D flip-flops.	02
11.	Design a 4-to-1 multiplexer using logic gates and verify its functionality.	02
12.	Design a 3-bit binary counter using flip-flops and verify its counting sequence.	02

**Out of 12, eight assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

	Name of topic	Distribution of marks (Semester wise)	Total marks	CO

Section / Topic no.		Remember	Understand	Apply		
I / 1	Number system & codes	2	2	6	10	ETH101-1
I / 2	Boolean Algebra	2	6	8	16	ETH101-2
I / 3	Digital Logic Families	2	6	-	08	ETH101-3
II /4	Combinational Circuits, Multiplexers, demultiplexers and decoders	2	6	8	16	ETH101-4
II /5	Sequential Logic Circuits	2	4	6	12	ETH101-5
II / 6	Data converters	2	2	4	08	ETH101-6
Total Marks		12	26	32	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	05
2	Circuit building, handling of ICs	05
3	Observation & Conclusion	05
4	Oral based on performed practical	05
5	Analytical, Logical problem solving skills, Creativity skills, time management	05
TOTAL		25

I. Instructional Methods:

1. Classroom Learning
2. Active Learning

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3. Collaborative Learning
4. Experimental Learning
5. 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	Digital Design	M. Morris Mano	Pearson Education
2	Modern Digital Electronics	R.P. Jain	McGraw Hill
3	Fundamentals of Digital Circuits	Kumar Anand and Bhupendra Kumar Singh	PHI Learning Pvt. Ltd.

L. Learning Website & Software

1. Electronics Hub: electronicsforu.com

2. All About Circuits: allaboutcircuits.com

3. Virtual Lab: https://dec-iitkgp.vlabs.ac.in/

4. Digital Electronics Course by NPTEL: nptel.ac.in (NPTEL's official website)

5. Multisim by National Instruments: ni.com/Multisim

6. MATLAB and Simulink: mathworks.com/products/matlab.html

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COURSE ID

COURSE NAME   : **ANALOG COMMUNICATION**

COURSE CODE   : **ETH304**

COURSE ABBREVIATION   : **HACM**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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	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.

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)

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D. i) RATIONALE: -

Analog Communication is the subject that presents information about the basic processes, circuits and other building blocks of communication system. The study of basic operating and handling of various analog communication systems will help to troubleshoot and maintain analog communication systems used for various types of communication.

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:

3. Identify and measure electrical parameters of analog communication circuits.

4. Maintain and operate analog communication circuits.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH304-1: Choose relevant frequency ranges for different communication systems
ETH304-2: Match relevant modulation techniques for specific applications.
ETH304-3: Select Frequency modulation and Phase modulation for specific applications
ETH304-4: Maintain receiver circuits of Am and FM
ETH304-5: Identify relevant type Antenna for various applications.
ETH304-6: Use relevant media for transmission and reception of signals.

**Course outcomes and programme outcomes/ programme specific outcomes
(CO- PO/PSO) matrix**
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
Competency: Explain, operate and maintain different Analog communication systems.	2	1	2	1	-	-	-	1	1
ETH304-1	1	-	-	-	-	-	-	-	-
ETH304-2	2	-	2		-	-	-	-	1
ETH304-3	2	-	1	1	-	-	-	-	1
ETH304-4	1	2	2	-	-	-	-	1	1
ETH304-5	-	1	-	-	-	-	-	-	-
ETH304-6	-	1	-	-	-	-	-	-	-

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F. CONTENT:

I) Practical exercises

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

Sr. No.	Laboratory experiences	CO
1.	Generate Amplitude modulation Wave Trace the circuit identify carrier, Modulating signal and modulated signal.	ETH 304-2
2.	Observation & measurements of AM wave Observe AM waveform on CRO Calculate modulating index	ETH 304-2
3.	Study trapezoidal pattern Observe various trapezoidal patterns on CRO. Calculate modulating index using this pattern	ETH 304-2, 4
4.	Demodulation of FM using Diode detector Trace the circuit, Identify Modulated and demodulated signal and observe waveforms on CRO.	ETH 304-2,3
5.	Generation of Frequency modulated waveform Trace the circuit, identify carrier, modulating signal and modulated signal.	ETH 304-2, 3 6
6.	Observation and measurement of FM wave Observe FM waveforms on CRO Calculate modulating index	ETH 304-2,3
7.	Demodulation of FM signal Observe FM and FM demodulated waveforms on CRO. Observe similarities in modulated signal and demodulated signal.	ETH 304-2, 4
8.	Visit to AM Transmitter Understand AM transmitter and prepare a project report.	ETH 304-1, 3, 5
9.	Visit to FM Transmitter Understand FM transmitter and prepare a project report	ETH 304-1, 3, 5
10.	Study of super heterodyne radio receiver Identify different blocks & expected waveforms of superheterodyne radio receiver, Identify different controls and their functions and measure the voltages at different check points.	ETH 304-1-4
11.	Fault finding in Super heterodyne receiver Locate faults using voltage and waveform technique at different check points and correct them.	ETH 304-1-4
12.	To plot selectivity and fidelity curve for superheterodyne radio receiver Give input AM wave from signal generator to the circuit and observe output on CRO. Plot the selectivity & fidelity curve by varying carrier frequency.	ETH 304-4,
13.	Study of FM Receiver Identify different blocks & expected waveforms of slope or ratio detector. Identify different controls and their functions and measure the voltages at different check points	ETH 304-4, 5
14.	Study and design Of Yagi-Uda Antenna Draw diagram of yagi_uda antenna. Identify and describe parts of yagi_uda antenna.	ETH 304-6 ,5
15.	Study and design of Parabolic reflector (Dish Antenna) Draw diagram of Dish antenna. Identify and describe parts of Dish antenna for particular λ	ETH 304-6

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II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH304-1 Choose relevant frequency ranges for different communication systems.		
1	**Introduction to electronic communication system** 1.1 Elements of basic electronic communication system 1.2 Classification of electronic communication systems into Wired and Wireless, Uni-cast and Broadcast, simplex, half duplex and full duplex. 1.3 Types of transmission media(Wired transmission). 1.3 Noise Fundamentals, Types, Noise figure, Noise Temperature, numerical based on noise figure and noise Temperature. 1.4 Electromagnetic Frequency spectrum 1.5 Bandwidth and Information Capacity 1.6 Modulation and Demodulation (Definition, Need of Modulation)	6	08
	ETH304-2 Match relevant modulation techniques for specific applications.		

2	**Amplitude Modulation and SSB Techniques.**
	 2.1 Amplitude modulation theory.
	 2.2 Sidebands, Frequency domain representation and bandwidth of AM wave
	 2.3 Time domain representation of AM wave and Trapezoidal pattern.
	 2.4 Power relation in AM wave.
	 2.5 Amplitude modulator circuits.
	 2.6 AM Transmitters – Low Semester and High Semester
	 2.7 Single side band technique (SSB)
	     2.7. 1 Advantages and disadvantages of SSB
	     2.7.2 Suppression of carrier.
	     2.7.3 Suppression unwanted side band.
	 2.8 Concept of vestigial sideband & waveforms
	 2.9 Numerical problems based on AM & SSB theory.
		9	14

	ETH304-3 Select Frequency modulation and Phase modulation for specific applications		
3	**Angle Modulation and FM Transmitters** 3.1 Frequency modulation and Phase modulation theory. 3.2 Mathematical representation of FM and PM 3.3 FM and PM waveforms. 3.4 Difference between FM and PM 3.5 Modulation index, Deviation ratio, Bandwidth, Power Considerations. 3.6 Generation of FM – Direct and Indirect methods 3.7 FM transmitters - Direct and Indirect 3.8 Comparison between AM and Angle modulation 3.9 Numerical problems based on FM and PM theory.	7	12
	Sub-total	22	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH304-4 Maintain receiver circuits of Am and FM		

4	**Radio Receivers**
	 4.1 AM Receivers
	     4.1.1 TRF receivers, Super heterodyne receiver.
	     4.1.2 Receiver performance characteristics
	     4.1.3 RF section
	     4.1.4 Frequency mixer and down converters
	     4.1.5 Image frequency and its rejection
	     4.1.6 IF amplifiers
	     4.1.7 AM detector
	     4.1.8 AGC circuits.
	 4.2 FM receivers:
	 4.2.1 FM discriminators – slope detector, ratio detector, PLL detector (Basic working of PLL to be covered)
	 4.2.2 Pre-emphasis and De-emphasis
		10	14

	ETH304-5 Identify relevant type Antenna for various applications		
5	**Antennas** 5.1 Radiation Mechanism. 5.2 Radiation pattern 5.3 Antenna gain, resistance, polarization, beam width, bandwidth 5.4 Resonant and non-resonant antennas. 5.5 Half wave dipole 5.6 Loop antenna. 5.7 Helical antenna. 5.8 Yagi-Uda antenna. 5.9 Parabolic reflector antenna	5	10
	ETH304-6 Use relevant media for transmission and reception of signals		

6	**Electromagnetic Wave Propagation**
	 6.1 Electromagnetic waves and polarization
	 6.2 Reflection, refraction, diffraction of waves
	 6.3 Ground (surface) waves propagation.
	 6.4 Space wave propagation.
	 6.5 Sky wave propagation
	     6.5.1 Virtual height.
	     6.5.2 Critical frequency and critical angle
	     6.5.3 Skip distance.
	     6.5.4 Maximum usable frequency.
	 6.6 Fading
		8	12

	Sub-total	23	36

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III) List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Write procedure to measure AC and DC Amplitude, time period and frequency using CRO and function generator.	02
2.	Tabulate important characteristics of commonly available analog communication system	02
3.	Tabulate important characteristics of AM modulation..	02
4.	Tabulate important characteristics of , FM, PM modulation	02
5.	Write a procedure to generate amplitude modulated signal.	02
6.	Draw a chart showing waveform of AM, FM, PM modulation	02
7.	Study of SSB techniques	02
8.	Study of different types of Radio Receivers.	02
9.	Draw a chart of different types of antenna.	02
10.	Study different types of Electromagnetic Wave Propagation.	02
11.	Draw a chart different type of Radio Receivers.	02
12.	Study of modulation and demodulation concept.	02
13.	Study different types of antenna.	02
14.	Draw a radiation pattern of different types of antenna.	02
15.	Study working of Pre-emphasis and De-emphasis	02

**Out of 12 eight assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	**Introduction to electronic communication system**	4	4	=	8	ETH304--1
I / 2	**Amplitude Modulation and SSB Techniques**	4	4	6	14	ETH304--2
I / 3	**Angle Modulation and FM Transmitters**	2	6	4	12	ETH304--3
II /4	**Radio Receivers**	2	8	4	14	ETH304--4
II /5	**Antennas**	4	4	2	10	ETH304--5
II / 6	**Electromagnetic Wave Propagation**	4	6	2	12	ETH304--6
	Total Marks	20	32	18	70	

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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**

H. Instructional Methods:

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

I. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

J. Reference Books:

Sr. No	Name of Book	Author	Publication
1.	Electronic Communication Systems	Wayne Tomasi	Pearson Publication
2.	Communication Electronics	Louis Frenzel	TMH Publication
3.	Electronic Communication Systems	Kennedy.	TMH Publication
4.	Electronic Communication	Roddy Coolen	PHI Publication

K. Learning Website & Software

1) www.nptel.ac.in
2) www.antenna-theory.com
3) www.explainthatstuff.com/antennas.html
4) www.circuitstoday.com/single-chip-fm-radio-circuit

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COURSE ID :

COURSE NAME   : **ELECTRONICS MEASUREMENTS & INSTRUMENTATION**

COURSE CODE   : **ETH305**

COURSE ABBREVIATION: **HEMI**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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			
-	-	-	-	-	50	20	25@	10	25	10	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, *# 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 students must have the skill to demonstrate the various electronic measuring instruments while maintaining various electronic equipment/systems. This subject intends to provide the students practical information & technical background. It also provides the students with concepts, principles and procedures of Analog and Digital electronic measuring instruments and the measurement techniques for the measurement of various electronic quantities. Because of the scope of the subject, students are well exposed to a good and wide area of the various electronic measuring instruments as the subject comprises of those basic equipment and transducers of which students should have knowledge.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Demonstrate and maintain electronic measuring equipments while troubleshooting of electronic circuits.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH305-1 Describe various characteristics of measuring instruments.
ETH305-2 Determine the unknown values of components using bridges and demonstrate various digital meters.
ETH305-3 Explain & demonstrate the use of various test instruments.
ETH305-4 Interpret working of various types of sensors and transducers.
ETH305-5 Interpret working of various types of sensors and transducers.
ETH305-6 Maintain signal conditioning and data acquisition systems.

Course outcomes and programme outcomes/ programme specific outcomes(CO- PO/PSO) matrix
 [Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH305-1	3	-	-	2	-	-	--	1	1
ETH305-2	3	2	-	3	--	--	--	3	1
ETH305-3	3	2	-	3	-	--	--	3	1
ETH305-4	3	2	-	3	--	--	1	2	1
ETH305-5	3	2	-	3	-	--	1	3	1
ETH305-6	3	2	--	3	--	--	1	3	1

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F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for AC Machine developed* by the Institute in practical sessions of batches of about 20- 22 students:
(Any 10)

Sr. No.	Laboratory experiences	CO
1.	Demonstrate the use of analog and digital multimeter.	ETH 305-2
2.	Demonstrate the use of LCR--Q meter	ETH 305-2
3.	Demonstrate the use of CRO as component tester.	ETH 305-3
4.	Identify various types of transducers.	ETH 305-4
5.	Demonstrate the use CRO for measurement of AC/DC voltage & frequency.	ETH 305-3
6.	Test performance of inductive transducer LVDT.	ETH 305-5
7.	Demonstrate the use of CRO for measurement of phase & frequency using Lissajous figures.	ETH 305-3
8.	Demonstrate the use of function generator.	ETH 305-3
9.	Study of whetstone's bridge for measurement of unknown resistances.	ETH 305-2
10.	Demonstrate the use of detectors for Ac bridge like headphone.	ETH 305-2
11.	Measurement of unknown capacitance using bridge.	ETH 305-2
12.	Measurement of unknown inductance using bridge.	ETH 305-2
13.	Demonstrate the use of use of frequency meter	ETH 305-2
14.	Demonstrate the use of any type of temperature transducer.	ETH 305-5
15.	Demonstrate any data acquisition system. (Use lab setup/video/visit).	ETH 305-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH305-1 Describe various characteristics of measuring instruments.		
1	**Fundamentals of Measuring Instruments** 1.1 Classification of Instruments: Absolute , Secondary Instruments	**6**	**NA**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.2 Definitions of Static characteristics of Instruments: Accuracy, Precision, Sensitivity, Resolution, Static error, Reproducibility, Drift, Dead Zone. 1.3 Definitions of dynamic characteristics of Instruments: Speed of response, Lag, fidelity, Dynamic error. 1.4 Types of Errors- Gross, Systemic, Random 1.5 Units of measurement of fundamental quantity. 1.6 Definition of Standards and their classification.		
	ETH305-2 Determine the unknown values of components using bridges and demonstrate various digital meters.		
2	**Measurement of Electrical Parameters** 2.1 Bridge balance condition for DC bridge. 2.2 Block diagram, principle of working and numerical of DC bridges: Whetstone's bridge, Guarded whetstone's bridge, Kelvin's bridge. 2.3 Block diagram, principle of working and numerical of AC bridges: Capacitance comparison bridge, Inductance comparison bridge, Maxwell's bridge, Hay bridge, Schering's bridge, Wien's bridge. 2.4 Concepts of ADC & DAC 2.5 Advantages and Disadvantages of Digital Instruments and comparison with analog instruments. 2.6 Definition of Average & RMS value. 2.7 PMMC- Working Principle, Construction. 2.8 Resolution, Sensitivity and Accuracy of digital display. 2.9 Digital Voltmeter-Successive approximation type, Digital frequency meter, LCR, Q meter- Block diagram and operation only	8	NA
	ETH305-3 Explain & demonstrate the use of various test instruments.		
3	**Test &Measuring Instruments** 3.1 Oscilloscope subsystems- 3.1.1 Display subsystems- CRT, Deflection of electron beam in CRT, sensitivity. 3.1.2 Vertical deflection subsystems- Input Coupling selector, Input attenuator, Pre-amplifier, Main vertical amplifier, delay line. 3.1.3 Horizontal deflection subsystems- Trigger circuit, Time base generator, Main Horizontal amplifier. 3.1.4 CRO Probes- General block diagram of CRO probe, passive voltage probe, and their compensation, Active voltage probes, current probes. 3.2 CRO-Block diagram of single beam dual trace and dual beam oscilloscope. 3.3 Block diagram of Digital storage oscilloscope.	9	NA

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks

	3.4 Uses of CRO- Frequency and phase measurement, Tracing of diode and transistor characteristics.
	    3.5 Signal generator-AF and RF type- Block diagram and Operation only.
	    3.6 Function generator - Block diagram, Simple controls and operation only.
	    3.7 Specifications.
	    3.8 Concept of time domain and frequency domain Instruments.
	    3.9 Spectrum & Logic analyzer- Block diagram and Operation only.		

	Sub-total	**23**	**--**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH305-4 Interpret working of various types of sensors and transducers.		
4	**Sensors and Transducers** 4.1 Instrumentation System: Block diagram of Instrumentation system, function of each block. 4.2 Sensors and Transducer: definition, difference betweensensors and transducers ,classification of sensors 4.3 Thermal, optical, magnetic and electric sensors: working principle and applications 4.4 Transducer: Need for Transducer, selection criteria of transducer, types: primary and secondary, active and passive, analog and digital, resistive, capacitive, inductive(Linear variable differential transformer (LVDT), Rotary variable differential transformer (RVDT), Piezo electric transducer	9	NA
	ETH305- 5 Measure physical quantities using various types of transducers and sensors.		
5	**Application of Sensors and Tranducers**	9	NA

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	5.1 Temperature measurement types: Resistance Temperature Detector (RTD)– (PT-100) , Thermistors, Thermocouple – Seeback & Peltier effect , Type J, K, R, S,T etc. (Based on material, temperature ranges) 5.2 Pyrometer– Optical type 5.3 Pressure measurement types: Bourdon Tube, Bellows, Diaphragm 5.4 Flow measurement types: variable head flow meter, venturimeter, orifice plate. Variable area flow meter: Rotameter, electromagnetic flow meter. 5.5 Special transducers and measurement: Humiditymeasurement using hygrometer, pH measurement		
	ETH305-6 Maintain signal conditioning and data acquisition systems.		
6	**Data Acquisition System** 6.1 Signal conditioning: Introduction, types, block diagram and working of AC and DC signal conditioning circuits. 6.2 Data Acquisition Systems (DAS): Introduction, block diagram, working and applications of DAS	**4**	**NA**
	Sub-total	**22**	**--**

G. Assessment Criteria

i) Formative Assessment of Practical: -
Every assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	10
	Application	10
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
TOTAL		**50**

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**

H. Instructional Methods:

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

I. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

J. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Electrical & Electronic Measurements & Instrumentations	A.K. Sawhney	Dhanpat Rai & Co

K. Text Books

Sr. No	Name of Book	Author	Publication
1	Modern Electronic Instrumentation & Measurement Techniques	W.D. Cooper	Pearson Education,
2	Electronic Instruments	H.S.Kalsi	Tata Mc Grow Hill

L. 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

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COURSE ID:

COURSE NAME   : **BASIC PYTHON PROGRAMMING**
COURSE CODE   : **ETH306**
COURSE ABBREVIATION : **HBPP**

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 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			
-	-	-	-	-	25	10	25@	10	-	-	50

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,
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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: -

Electronics based industries needs to deal with creating circuits design, simulation, signal processing 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 given problems.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry/employer expected outcome throughvarious teaching learning experiences:

Develop programs using python to solve wide-reaching electronics engineering related problems.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

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

- **ETH306-1 - Develop script to demonstrate use of basic building blocks of python.**
- **ETH306-2 - Implement conditional and looping statements for given problem statement.**
- **ETH306-3 - Perform operations on sequence structures in python.**
- **ETH306-4 - Implement basics of object oriented programming concepts.**
- **ETH306-5 - Create modules and packages for given purpose.**

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH306-1	2	-	-	-	-	-	-	-	-
ETH306-2	2	-	-	1	-	-	-	-	-
ETH306-3	1	1	1	2	-	-	-	-	-
ETH306-4	1	2	2	2	-	-	-	-	-
ETH306-5	1	1	1	2	-	-	-	-	-

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F. CONTENT:

I) Practical exercises

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

(Minimum 12 of the following practical exercises are to be performed)

Sr. No.	Laboratory experiences	Skills to be developed	CO
1.	*Install and configure Python IDE. Write Python program to display message on screen. (Any relevant python IDE like IDLE/PyCharm/VSCode/Jupiter Notebook/OnlinePython Compiler.)	Install Python Integrated Development Environment.	ETH306-1
2.	*a) Write simple Python program to calculate equivalent registers connected in series and parallel.Accept values of R1, R2 and R3 from the user. *b) Write simple Python program to calculate value ofvoltage by applying Ohm's law. Accept value of Current(I) and Resistance(R) from the user.	Use operators in Python	ETH306-1
3.	*Write program to check whether entered frequency isradio frequency or audio frequency.	Implement two-way branching statement	ETH306-2
4.	*a)Write program to display various radio frequencybands using if..elseif ladder. *b)Write program to display resistor color code usingswitch statement.	Implement multi-waybranching statement	ETH306-2
5.	*a. Write a simple Python program to demonstrate useof control loops: i) while ii) do while *b. Create a simple program, to demonstrate use of: forloop in Python (e.g.: various pattern building, printing multiplication table, checking palindrome number etc.)	Implement control loops for solving iterative problems	ETH306-2
6.	*Write Python program to perform following operations on List: a) Create b) Access c) Update d) Delete elements from list.	Perform basic operations on the Lists	ETH306-3
7.	Develop Python program to perform following	Execute various tupleoperations	ETH306-3

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Sr. No.	Laboratory experiences	Skills to be developed	CO
	operations on Tuples: a) Create b) Access c) Update Delete Tuple elements		
8.	Write Python program to perform following operationson Set: a) Create b) Access c) Update d) Delete Access Set elements	Implement various set operations	ETH306-3
9.	*Create a program to perform following operations onDictionaries in Python: a) Create b) Access c) Update d) Delete e) Looping through Dictionary	Execute various operations on Dictionaries	ETH306-3
10.	a) *Create python program to demonstrate use of mathbuilt-in function. b) *Create python program to demonstrate use of string built-in function.	Use built-in mathematical functions andstring functions in python	ETH306-4
11.	Write python programs to define function with arguments. a) Calculate factorial of a number b) Swapping of two variables	Create user defined functions in Python	ETH306-4
12.	Write programs to define function with default arguments.	Implement function with default arguments	ETH306-4
13.	*Create a program to demonstrate use of: Built-in module (e.g. numeric, mathematical functional andprogramming module) in Python.	Use built-in python mathematical modules	ETH306-5
14.	Write program to create a user-defined module (e.g.:building calculator) in python.	Write user-defined module in python	ETH306-5
15.	*Develop Python program to demonstrate use of NumPy package for creating, accessing and performing different array operations.	Use python built-in packages	ETH306-5
16.	Write program to demonstrate the use of user definedpackages in Python.	Implement user-defined packages in python	ETH306-5

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II)   Theory

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
ETH306-1 Develop script to demonstrate use of basic building blocks of python.			
1	**Basic Python's Constructs** 2.10 Introduction to Python- Python as scripting Language, Programming language Vs Scripting Language (C vs Python), Python's Technical Strength, Application in different domains 2.11 Python's building blocks- Identifiers, Keywords, Variables, Constants, Indentation, Comments in python 2.12 Python's Data Types – Numbers, Strings, List, Tuples, Dictionaries, Sets 2.13 Input and Output statements in python 2.14 Operators in Python- Operators as Arithmetic, Assignment, Unary Minus, Relational, Logical, Boolean, Bitwise, Membership, Identity, Operator precedence and Associativity	6	-
ETH306-2 Implement conditional and looping statements for given problem statement.			
2	**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	5	-
ETH306-3 Perform operations on sequence structures in python.			
3	**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,	7	-

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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 a Set, Built in functions with Set, Set 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.		
ETH306-4 *Implement basics of object oriented programming concepts.*			
4	**Functions with Basic OOP concepts**	7	-
	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		
ETH306-5 *Create modules and packages for given purpose*			
5	**Modules and Packages in Python**	5	-
	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		

G. 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	Technical preparedness for practical	05
Psychomotor	Operating skills/Algorithm/ flowchart	05

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	Observation/Logic/ Program/Result	05
Affective	Discipline and punctuality	05
	Procedure/ Safety Measures/ Decency/ Presentation	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	Neat & complete circuit Diagram / schematic Diagram/ Algorithm/ Flowchart/ Program	5
2	Procedure followed to achieve the result	5
3	Observations, Result, Output, Sample Calculations with relevant formulae	5
4	Proper Graphs, workmanship and Safety measures	5
5	Oral	5
	Total	**25**

H. Instructional Methods:
7. Lectures cum Demonstrations
8. Class room practices
9. Use of projector and soft material for demonstration
4. Laboratory work

I. Teaching and Learning resources:
Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

J. Reference Books:

Sr. No	Author	Title	Publisher with ISBN Number
1	Giancarlo Zaccone	Natural Computing with Python	BPB, ISBN:9789388511612
2	Martin C. Brown	Python: The Complete Reference	Tata McGraw Hill ISBN: 9789387572942
3	Yashwant Kanetkar	Let Us Python	BPB, ISBN: 978-9391392253
4	Kumar Naveen, Taneja Sheetal.	Python Programming: A modularapproach	Pearson, ISBN: 978-9352861293

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5	Mark Lutz and DavidAscher	Learning Python	O'Reilly, ISBN: 978-1449355739
6	Paul Barry	Head First Python	O'Reilly, ISBN: 978-1449382674
7	John Guttag	Introduction to Computation andProgramming Using Python	MIT Press, ISBN: 978-0262529624
8	David Beazley	Python Essential Reference	Addison-Wesley Professional, ISBN: 978-0672329784
9	Dr. R. Nageswara Rao	Core Python Programming	DREAMTECH PRESS, ISBN: 978-9386052308

K. Learning Website & Software

Sr. No	Link / Portal	Description
1	https://www.programiz.com/python-programming	Python Programming
2	https://python-iitk.vlabs.ac.in/Introduction.html	Virtual Lab for Python Programming-Basic Constructs in Python
3	https://www.geeksforgeeks.org/python-programming-language/	Python Programming
4	https://intellipaat.com/academy/course/introduction-to-pytho n-programming-free-course/	Online Course-Python Programming
5	https://www.w3schools.com/python/	Python Programming
6	https://www.tutorialspoint.com/python/index.htm	Python Programming
7	https://www.python.org/	Python Programming
8	https://spoken-tutorial.org/tutorial-search/?search_foss=Pyt hon+3.4.3&search_language=English	Spoken Tutorial on Python Programming
Note : Teachers are requested to check the creative common license status/financial implications of the suggestedonline educational resources before use by the students		

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Programme	:- ALL
Semester	**: THIRD**
Course Title	**: ESSENCE OF INDIAN CONSTITUTION**
Course Code	**: CCH205**

A. 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 futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

B. 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.

C. COURSE SEMESTER LEARNING OUTCOMES (COS)
Students will be able to achieve & demonstrate the following COs on completion of course based learning

D. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme Actual Contact Hrs./Week CL	TL	LL	SLH	NLH	Credits	Paper Duration	Theory FA-TH Max	SA-TH Max	Total Max	Total Min	Practical FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	SLA Max	SLA Min	Total Marks
CCH205	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 4 Hrs

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 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.

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

E. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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

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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 Teritories and their limitations.	**3**

3	**CCH 205.3.** State Government.
	    3.1 Governor –Role and power.
	    3.2 Chief Minster and council of ministers.
	    3.3 State secretariat.
	    3.4 Administrative Regions of Maharashtra.
		3

	SECTION -II	

4	**CCH205.4** 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	**CCH205.5**. 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	**CCH205.6.** 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

F.   LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES
        : N.A.

G.   SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING /   SKILLS DEVELOPMENT (SELF LEARNING)

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

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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

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

Seminar

1 Differences in the ideals of Social democracy and Political democracy.
2 Democracy and Women's Political Participation in India.
3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.
- Art 356 and its working in Post-Independent India.
- Women's Resrvation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.

i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

H. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE
REQUIRED : NOT APPLICABLE

I. **SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE**
(Specification

Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Semester	U-Semester	A-Semester	Total Marks
1	I	Constitution and Preamble	CO1	4				
2	II	Fundamental Rights and Directive Principles	CO2	4				
3	III	Governance and Amendments	CO3	4				
4	IV	Electoral Literacy and Voter's Education	CO4	3				
Grand Total				15				

J. **ASSESSMENT METHODOLOGIES/TOOLS**

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

Assignment, Self-learning and Terms work Seminar/Presentation

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

K. **SUGGESTED COS - POS MATRIX FORM**

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 Semester										

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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, 6thedition, 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_const itutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-c onstitution	Parts of constitution

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SEMESTER IV COURSES

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COURSE ID:

COURSE NAME   : **MICROCONTROLLERS**

COURSE CODE   : **ETH307**

COURSE ABBREVIATION   :   **HMCS**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	00	
	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	-	-	150

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.

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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/electronics where automation and monitoring are needed. They include product lines ranging from small consumer electronic products to sophisticated industrial process controllers. A 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 SEMESTER LEARNING OUTCOMES (COs)

ETH307-1: Interpret prominent features of different kinds of microcontrollers.

ETH307-2: Interpret the salient architectural features of 8051 microcontroller

ETH307-3: Develop and maintain assembly language program for different operations

ETH307-4: Interface and program different I/O devices with 8051 in assembly
ETH307-5: Maintain different 8051 based applications

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix
 [Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH307-1	1	1	2	-	-	-	-	2	2
ETH307-2	1	3	2	-	-	-	-	2	2
ETH307-3	-	3	3	1	-	-	-	2	2
ETH307-4	1	2	3	1	-	-	-	3	3
ETH307-5	1	2	-	-	-	-	-	3	3

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F. CONTENT:

I) Practical exercises

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

Sr. No.	Laboratory experiences	CO
1.	Identification of various blocks of 8051 microcontroller development board.	ETH307-2
2.	Identify different menus available in compiler software KEIL and demonstrate their use.	ETH307-1
3.	Develop an Assembly Language Program (ALP) for addition of two numbers using various addressing modes and assembler directives.	ETH307-3
4.	Develop an ALP to perform arithmetic operations: addition, subtraction, multiplication and division on 8-bit data.	ETH307-3
5.	Develop an ALP to perform arithmetic operations: addition, subtraction on 16-bit data.	ETH307-3
6.	Develop an ALP to perform addition of BCD data stored at external and store result in internal memory.	ETH307-3
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.	ETH307-3
8.	Develop an ALP to transfer data from source to destination locations of internal/ external data memory.	ETH307-3
9.	Develop an ALP to exchange block of data from source to destination location of internal/ external data memory.	ETH307-3
10.	Develop an ALP for identifying smallest number from the given data bytes stored in internal/ external data memory.	ETH307-3
11.	Develop an ALP for identifying largest number from the given data bytes stored in internal/ external data memory.	ETH307-3
12.	Develop an ALP for arranging numbers in ascending order stored in internal/ external data memory.	ETH307-3
13.	Develop an ALP for arranging numbers in descending order stored in internal/ external data memory.	ETH307-3
14.	Interface LED with microcontroller and turn it 'ON' with microcontroller interrupt.	ETH307-4
15.	Interface 4 X 4 LED matrix with 8051 to display various pattern.	ETH307-4
16.	Interface 7-segment display to display the decimal number from 0 to 9.	ETH307-4
17.	Interface relay with microcontroller and turn it 'ON' and 'OFF'.	ETH307-4
18.	Develop an ALP to generate delay using timer register.	ETH307-4
19.	Develop an ALP to generate pulse and square wave by using timer delay.	ETH307-4

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Sr. No.	Laboratory experiences	CO
20.	Develop an ALP to transfer 8 bit data serially on serial port.	ETH307-4
21.	Interface LCD with 8051 microcontroller to display the characters and decimal numbers.	ETH307-5
22.	Interface the given keyboard with 8051 and display the key pressed.	ETH307-5
23.	Interface ADC with 8051 microcontroller and verify input/output.	ETH307-5
24.	Interface DAC with 8051 microcontroller to generate square wave, triangular wave, saw-tooth wave.	ETH307-5
25.	Interface Stepper motor to microcontroller and rotate in clockwise and anticlockwise direction at the Given angle	ETH307-5
26.	Design water Semester controller using any suitable open source simulation software to detect and control the water Semester in a tank.	ETH307-5
27.	Interface temperature sensor LM35 to 8051 to read temperature, convert it to decimal and send the value to Port 0 with some delay.	ETH307-5

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH307-1 Interpret the salient features of various types of microcontrollers.		
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. 1.3 Comparison of Microcontroller and Microprocessor on basis of: Memory, Complexity, Type of Architecture, Cost, Applications, Typical examples of Microcontrollers and Microprocessors 1.4 Need of Microcontroller 1.5 Introduction and technical specifications of various microcontrollers : 1.5.1 8051 Microcontroller 1.5.2 PIC Microcontroller 1.5.3 AVR Microcontroller 1.5.4 ARM Microcontroller	06	08

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.5.5 Compare all listed microcontroller with the parameters(Bits,Memory,instruction set & memory architecture) 1.6 Introduction to Microcontroller programming simulation software like – KEIL compiler and explain Software Development Cycle: Editor, Assembler, Compiler, Cross-Compiler, Linker, Locator		
	ETH307-2 Interpret the salient architectural features of microcontrollers IC 8051		
2	**Architecture of 8051Microcontroller** 2.1 8051 Architecture:Features and Selections factors for Microcontroller 2.1.2 Architectural Block diagram of 8051, function of each block 2.1.3 Pin diagram, function of each pin 2.1.4 Memory organization of Internal memory (RAM and ROM) 2.1.5 Reset and clock circuit 2.1.6 Various registers and SFRs of 8051 2.2 Special Features of 8051 2.2.1 Boolean Processor 2.2.2 Power saving options- idle and power down mode.	12	12
	ETH307-3 Develop assembly language program and Maintain the program features for given operations.		

3	**8051 Instruction Set and Programs**
	
	3.1 Overview of 8051 instruction set
	   3.1.1 Instruction Format for 8051 Microcontroller
	   3.1.2 Introduction to Assembler and Various addressing modes
	3.2 Classification of instructions
	   3.2.1 Data transfer instructions
	   3.2.2 Arithmetic instructions
	   3.2.3 Logical instructions
	   3.2.4 Branching instructions
	   3.2.5 Bit manipulation instructions
	   3.2.6 Stack, subroutine and interrupt related instructions
		12	14

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.2.7 Assembler Directives: ORG, DB, EQU, END, CODE, DATA 3.3 Simple Programs based on above instructions and directives.		
	Sub-total	**30**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH307-4 Interface and program different I/O devices with 8051 in assembly		

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.
		10	14

	ETH307-4 Interface and program different I/O devices with 8051 in assembly		

5	**Serial communication and Interrupt programming**
	5.1 Serial port of 8051
	   5.1.1 Serial communication SFRs: SCON,SBUF,PCON
	   5.1.2 Modes of serial communication
	   5.1.3 Simple programs for serial communication
	5.2 8051 Interrupts
	   5.2.1 Interrupts and polling concept.
	   5.2.2 Interrupts SFRs: IE,IP
	   5.2.3 Simple programs based on interrupts and polling method
	5.3 Memory interfacing: Program and data memory
		12	14

	ETH307-5 Maintain different 8051 based applications		

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
6	**Peripheral interfacing and Applications** Interfacing diagram with programming of following with 8051 6.1 Key-board interfacing (4X4 Matrix keyboard), concept of key bouncing and debounce logic. 6.2 LCD display interfacing 6.3 8 bit ADC and DAC interfacing (0808/0809) 6.4 DC and Stepper Motor interfacing 6.5 Temperature sensor (LM35) interfacing using ADC to 8051 6.6 Water Semester controller design using 8051	**08**	**08**
	Sub-total	**30**	**36**

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to Microcontrollers	02	2	4	**8**	ETH307-1
I / 2	Architecture of Microcontroller8051	02	4	6	**12**	ETH307-2
I / 3	8051 Instruction Set and Programs	02	6	6	**14**	ETH307-3
II /4	8051 Internal Peripherals and Related Programs	02	4	8	**14**	ETH307-4
II /5	Serial communication and Interrupt programming	02	6	6	**14**	ETH307-4
II / 6	Peripheral interfacing and Applications	02	2	4	**8**	ETH307-5
	Total Marks	**12**	**24**	**34**	**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

Psychomotor	Application	05
	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:

10. Lectures cum Demonstrations
11. Class room practices
12. 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	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

L. Text Books

Sr. No	Name of Book	Author	Publication
1	Mazidi, Mohmad Ali;	The 8051 Microcontroller and Embedded	Pearson

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	Mazidi, Janice Gelispe; MckinlayRoline D.	system	Education
2	Pal, Ajit,	Microcontroller Principle and Application	PHI Learning

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

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COURSE ID :

COURSE NAME : **DIGITAL COMMUNICATION**

COURSE CODE : **ETH308**

COURSE ABBREVIATION : **HDCM**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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			
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 .

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.

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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:

Digital transmission offers data processing option and flexibility which is not available with analog transmission. By eliminating the need for time-consuming face to face interactions, digital communication in various forms makes it easier for customers to reach out to organizations at a time that is convenient and non-disruptive to them. This is technology group subject, which will enable student to comprehend facts, concepts & working principle of digital communication system. It also familiarizes the student with information theory, measurement of information rate &capacity. This subject helps the student to understand the concept of various pulse modulations, Digital modulation techniques, coding methods and error control, multiplexing & multiple access techniques and S.S. modulation. The knowledge acquired by students will help them to apply it in various modern communication systems.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH308-1 Identify basic components in Digital Communication and describe its functions

ETH308-2 Classify, compare and illustrate the operation of pulse modulation systems .

ETH308-3 Analyze performance of different digital modulation techniques.

ETH308-4 Use Coding methods and Error control techniques as per need .

ETH308-5 Interpret concept of multiplexing and multiple access techniques

ETH308-6 Interpret the concept of various spread spectrum techniques

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix
 [Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH308-1	2	2	-	1	-	-	--	2	--
ETH308-2	2	2	-	2	--	2	--	2	2
ETH308-3	3	-	2	2	-	2	--	3	2
ETH308-4	2	3	3	3	3	2	--	3	3
ETH308-5	-	2	2	--	-	--	--	2	1
ETH308-6	-	2	2	2	--	--	--	2	2

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F. CONTENT:

I)   Practical exercises

The following practical exercises shall be conducted in the *Laboratory* of the Institute in practical sessions of batches of about 20- 22 students: (Any 10)

Sr. No.	Laboratory experiences	CO
1.	Generation of natural and flat top sampling signals.	**ETH308**-2
2.	Generation of Pulse Amplitude modulation / demodulation signal	**ETH308**-2
3.	Generation of Pulse width modulation /demodulation signal	**ETH308**-2
4.	Generation of Pulse Position modulation/demodulation signal	**ETH308**-2
5.	Generation of Pulse code modulation and demodulation signal	**ETH308**-2
6.	Determine the nyquist rate for given signal by using suitable simulation tool.	**ETH308**-2
7.	Generation of delta modulation and demodulation signal.	**ETH308**-3
8.	Generation of adaptive delta modulation and demodulation signal.	**ETH308**-3
9.	Generation of ASK modulation & demodulation signal	**ETH308**-3
10.	Generation of FSK modulation & demodulation signal	**ETH308**-3
11.	Generation of PSK modulation & demodulation signal	**ETH308**-3
12.	Generation of QPSK modulation & demodulation signal	**ETH308**-3
13.	Construct the circuit for generation of Hamming code for 4 bit data	**ETH308**-4
14.	Construct the circuit for one bit error correction using Hamming code	**ETH308**-4
15.	Generate a TDM signal using any simulation software	**ETH308**-5
16.	Generate a FDM signal using any simulation software	**ETH308**-5

II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH308-1 Identify basic components in Digital Communication and describe its functions		
1	**Introduction of Digital Communication** 1.1 Basic digital communication system(block diagram and function of each block)	**5**	**8**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.2 Communication Channel characterisitcs: Baud rate, Bit rate bandwidth, repeater distance. 1.3 Hartleys law, Shannon-Hartley theorem 1.4 channel noise and its effect 1.5 Entropy (definition and equation) 1.6 Advantages and disadvantages of digital communication 1.7 Comparison between analog and digital communication		
	ETH308-2 Classify, compare and illustrate the operation of pulse modulation systems		
2	**Pulse Communication** 2.1 Introduction, comparison with Continuous Wave Modulation, advantages 2.2 Sampling: sampling theorem, Nyquist rate and aliasing, natural & flat top. 2.3 PAM, PWM, PPM (definition, generation, block diagram, waveform analysis, and their comparison) 2.4 Pulse code modulation- block diagram of PCM transmitter & receiver, 2.5 Quantization, quantization error 2.6 Companding, 2.7 Inter symbol interference 2.8 Delta modulation- block diagram of DM, slope overload, granular noise. 2.9 ADM, DPCM, block diagram and its working, Advantages and disadvantages	10	14
	ETH308-3 Analyze performance of different digital modulation techniques.		
3	**Digital Modulation Techniques** 3.1 concept of coherent and non-coherent detection 3.2 Definition & waveforms, block diagram and working of their transmitter and receiver of following types: 3.2.1 ASK:BASK,QAM 3.2.2 FSK:BFSK ,MFSK 3.2.3 PSK:BPSK,QPSK,MPSK 3.3 Advantages and constellation diagram and waveforms 3.4 Bandwidth, spectrum for each modulation technique and their comparison	7	12
	Sub-total	22	34

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Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH308-4 Use Coding methods and Error control techniques as per need .		

4	**Coding methods and Error control**
	4.1 Source coding, shannon fano coding , Huffman coding.
	4.2 error detection& correction codes
	    4.2.1 Using parity, Hamming code & CRC code
	 4.3 Linear block code-calculation of minimum Hamming distance, error detection capability, error correction capability, Hamming code generation
	4.4 Line coding: Need, properties
	    4.4.1Unipolar RZ and NRZ, Polar RZ and NRZ,
	    4.4.2 Bipolar NRZ (AMI), split phase and differential Manchester, Polar quaternary and their waveforms
	4.5 Channel coding: Error, Causes of error and its effects,.
	4.6 Comparison between different coding
	4.7 simple numerical
		8	12

	ETH308-5 Interpret concept of multiplexing and multiple access techniques		

5	**Multiplexing and Multiple Access**
	
	 5.1 Need of Multiplexing,
	 5.2 TDM, FDM, CDM, definition , block diagram and their comparison.
	 5.3 Introduction to WDM.
	5.4 E & T carrier multiplexing hierarchy
	5.5 Access technique –Introduction, need and methods
	  5.5.1 Time DivisionMultiple Access (TDMA)
	. 5.5.2 Frequency Division MultipleAccess FDMA
	  5.5.3 Code Division Multiple Access CDMA
	  5.6 Advantages of TDMA over FDMA.
		7	10

	ETH308-6 Interpret the concept of various spread spectrum techniques		
6	**Spread spectrum modulation** 6.1 Introduction, Advantages over fixed frequency PN Sequence, generation and maximum length sequence spread spectrum modulation 6.2 block diagram of spread spectrum modulation system. 6.3 Direct sequence spread spectrum signal. jamming margin, processing gain, Eb/No ratio	8	14

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	6.4 Frequency hop spread spectrum, slow frequency hopping, and fast frequency hopping, comparison of FHSS and DSSS 6.5 Application S. S. modulations		
	Sub-total	**23**	**36**

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	**Understand**	**Apply**		
I / 1	Introduction of Digital Communication	4	4	-	8	ETH308-1
I / 2	Pulse Communication	4	4	6	14	ETH308-2
I / 3	Digital Modulation Techniques	2	4	6	12	ETH308-3
II /4	Coding methods and Error control	-	4	8	12	ETH308-4
II /5	Multiplexing and Multiple Access	2	4	4	10	ETH308-5
II / 6	Spread spectrum modulation	4	6	4	14	ETH308-6
	Total Marks	16	26	28	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**

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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:

13. Lectures cum Demonstrations
14. Class room practices
15. 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	Digital communication	Sanjay Sharma	S.K.Katariya and sons
2	Digital communication	Rao Ramkrishna P.	Mc Graw Hill Education
3	Digital communication	Simon Haykin	John Wiley and sons
4	Communication Systems	R.P.Singh,S.D.Sapre	Tata Mcgraw hill

L. Text Books

Sr. No	Name of Book	Author	Publication
1	V. K. Mehta	Electronics Devices and Circuit Theory	S.Chand
2	Electronic communication system	Wayne Tomasi	Pearson
3	Modern Digital and communication	B.P.Lathi	Oxford university press

M. Learning Website & Software

i)   https://nptel.ac.in/courses/117105077

ii) www.learningaboutelectronics.com

iii) www.electronics-tutorials.com

iv) https://www.vlab.co.in/

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COURSE ID:

COURSE NAME : POWER ELECTRONICS

COURSE CODE : ETH309

COURSE ABBREVIATION : HPTX

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Class room Learning	04	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	00	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASEDONLL&TL				BASEDON 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	-	-	-	-	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   .

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) credits equivalent to 30Notionalhrs.

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 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 consumermarketetc.Thiscourseisdevelopedtoempowerthestudentstoapplytheirknowledge to solve broad electronic engineering application problems.

ii)INDUSTRY/EMPLOYEREXPECTEDOUTCOME

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 SEMESTER LEARNING OUTCOMES (COs)

ETH309 -1 Identify and use relevant power electronics components, firing circuits in Power electronic circuits

ETH309-2 Identify and use relevant power firing circuits/commutation circuit/protection circuits in Power electronic circuits. .

ETH309-3 Use the controlled rectifier in relevant industrial circuit.

ETH309 -4 Use the Chopper in relevant industrial circuits.

ETH309-5 Use relevant Inverter/ cyclo-converter in industrial circuits

ETH309-6 Implement and use of relevant circuit in power electronics applications

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

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

Cos	Programme Outcomes POsand PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/De velopment of solutions	PO 4 Engineering Tools, Experimenta tion and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Manageme nt	PO 7 Life-long Learning	PSO1 Operatea nd Maintain	PSO2 Supervisio n and Providing Solution
ETH309-1	3	2	-	3	-	-	--	2	--
ETH309-2	3	2	-	2	--	--	--	3	1
ETH309-3	3	-	-	2	-	--	--	3	1
ETH309-4	3	1	-	2	--	--	--	3	--
ETH309-5	3	2	-	3	-	--	--	3	1
ETH309-6	-	-	--	3	--	--	2	3	3

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F. CONTENT:

I)   Practical Exercises (Any10)

Sr. No.	Laboratory experiences	CO
1.	Test the SCR(usingIC2N4103oranyotherequivalent)in forward conduction state and measure holding current (I_H) and latching current (I_L).	ETH309-1
2.	Test the forward and transfer characteristics of given IGBT(BUP402 or Any other equivalent).	ETH309-1
3.	Test the performance of DIAC(DB3/DB4)and plot its V-I characteristics.	ETH309-1
4.	Test the variation of R, C in R/RC triggering circuit on firing angle of SCR Measurement of output voltage by changing firing angle through Variation in resistor, capacitor in R and RC triggering circuits of SCR.	ETH309-2
5.	Basic Diac- Triac Full-wave phase control.	ETH309-2
6.	Test the variation of R ,C in UJT triggering circuit of SCR.	ETH309-2
7.	Observe and verify Input-Output waveforms of Class C-Complimentary type commutation circuit.	ETH309-2
8.	Test the performance of class-D commutation circuit.	ETH309-2
9.	Use the CRO to observe the output waveform of Half Controlled Rectifier With resistive and inductive load and determine the output voltage	ETH309-3
10.	Use the CRO to observe the output waveform of Full Controlled Rectifier using mid-point and bridge configuration. Use resistive as well as inductive load with free-wheeling diode and determine the output voltage	ETH309-3
12.	Use the CRO to observe the output waveform of Full Controlled Rectifier using mid-point and bridge configuration. Use resistive as well as inductive load with free-wheeling diode and determine the output voltage	ETH309-3
13.	Find the output voltage of Jones's Chopper	ETH309-4
14.	Study Step Down Chopper with resistive–inductive load Measure output voltage of step-up chopper for different values of duty cycles.	ETH309-4
15.	Test the Series Inverter circuit to measure the output frequency and output voltage	ETH309-5
16.	Test the Parallel Inverter circuit to measure the output frequency and output voltage	ETH309-5
17.	Study single phase mid-point cyclo-converter with resistive and inductive load	ETH309-5
18.	Speed control of DC series motor using SCR	ETH309-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH309-1 Identify and use relevant power electronics devices, firing circuits in Power electronic circuits.		
1	**Power Semiconductor Devices** 1.1 Classification of Thyristor family devices 1.2 Construction ,working principle, V-I characteristics and applications of Power diode, Power transistor, Power MOSFET and IGBT. 1.3 SCR-Construction,working principle, V-I characteristics, Two transistor analogy, latching and holding current for SCR 1.4 LASCR, TRIAC,GTO,SCS - Construction, working principle, V-I characteristics . 1.5 Triggering devices : UJT, PUT, SUS, SBS, DIAC - Construction, working principle, V-I characteristics	9	9
	ETH309-2. Identify and use relevant power firing circuits/commutation circuit/protection circuits in Power electronic circuits.		
2	**Triggering and Commutation methods of SCR** 2.1 Turn-ON methods of SCR Forward voltage triggering , thermal triggering , Radiation triggering , dv/dt triggering ,gate triggering, 2.2 Gate trigger circuits: DC Gate triggering , AC Gate triggering and pulse Gate triggering 2.3 Gate Triggering Circuits: Resistance firing Circuit, Resistor-Capacitor(RC) firing Circuit, UJT triggering Circuit, PUT-relaxation oscillator circuit 2.4 Turn OFF(commutation) methods: Natural and Forced Commutation, Types: Class-A, Class-B, Class-C, Class-D, Class- E, Class- F 2.5 SCR protection circuits: di/dt protection , dv/dt protection . Snubber circuit , Electronics crowbar protection circuit	9	12

	ETH309-3.Use the controlled rectifier in relevant industrial circuit.		

3	**Phase controlled rectifiers**
	   3.1 Phase control parameters: Firing angle and conduction angle
	3.2 Single phase half wave controlled rectifier: circuit diagram, working and waveforms with R and RL-load, effect of free -wheeling diode with RL-load, numerical
	  3.3 Single phase full wave controlled Rectifier(Centre tapped and Bridge): circuit diagram, working and waveforms with R and RL load, effect of freewheeling diode with RL load
	3.4 Semi-converters: circuit diagram, working and waveforms with R and RL load
	3.5 Effect of input source impedance on Single phase Full-wave controlled rectifier
	3.6 Three phase half converters with R/R_L load(firing angle 0^0 and 45^0 only)
		12	**13**

	Sub-total	**30**	**34**

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH309-4 Use the Chopper in relevant industrial circuits		

4	**Choppers**
	4.1 Classification of Choppers:
	a) According to the Input /Output voltage Semester
	b) According to Circuit operation (First -Quadrant chopper, Two- Quadrant chopper, Four- Quadrant chopper)
	c) According to the directions of output voltage and current (Class/Type A to E)
	d) According to Commutation Method
	4.2 Basic chopper operation:
	  a) Principle of Step-Down chopper
	  b) Principle of Step-up chopper
	4.3 Control Strategies: Time-ratio control , Current limit control
	4.4 Jone's Chopper
		7	**12**

	ETH309-5 Use relevant Inverter/cyclo-converter in industrial circuits		

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			16	16

5	**Inverters and Cyclo-converter**
	5.1 Classification of Inverters
	   5.1.1 Series inverter: Basic, Modified and Improved Series inverter
	   5.1.2 Parallel inverter: with/without feedback diode
	   5.1.3 Single phase SCR bridge inverter(simple circuit),
	      (Half/Full Bridge inverter with R/ R_L Load)
	   5.1.3 McMurray Half-bridge Inverter (circuit, waveform)
	     McMurray Full-bridge Inverter(circuit operation only) (
	     McMurray-Bedford inverter not included)
	
	5.2 Performance parameters for the inverter (Definition and importance only) : Harmonic factor of nth Harmonic, Total Harmonic Distortion, Distortion Factor, Lowest order Harmonic
	
	5.3 Voltage control of single-phase inverter(importance and methods)
	   5.3.1 External control of A.C. output voltage
	   5.3.2 External control of D.C. input voltage
	   5.3.3 Internal control of inverter:
	     a)Series inverter control and
	     b)Pulse-width modulation control : Single-pulse width modulation, Multiple-pulse width modulation, Sinusoidal-pulse width modulation
	5.4 Cyclo-converter
	   5.4.1 Basic Principle of Operation Cyclo-Converters
	5.4.2 Classification of Cyclo-Converters :
	   : Single phase to single phase Cyclo-Converters (resistive and inductive load) : Center-tapped Transformer configuration and Bridge configuration			

	ETH309-6 Implement and use of relevant circuit in power electronics applications			
6	**Industrial applications of power electronic devices** 6.1 Battery charger using SCR 6.2 Emergency light system using SCR 6.3 DC low power Flasher circuit using SCR 6.4 Static AC and DC circuit breaker using SCR 6.5 Time delay circuit using SCR and UJT 6.6 Block diagram and concept of Online and Offline UPS , Line-interactive UPS system. 6.7 SMPS :concept, block diagram and applications		7	8
		Sub-total	**23**	**36**

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

Section/ Topic no.	Name of topic	Distribution of marks(Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I/ 1	Power Semiconductor Devices	4	6		9	ETH309-1
I/ 2	Triggering and Commutation methods of SCR	2	4	6	12	ETH309-2
I/ 3	Phase controlled rectifiers	2	6	6	13	ETH309-3
II/4	Choppers	2	6	4	12	ETH309-4
II/5	Inverters and Cyclo-converter	2	6	6	16	ETH309-5
II/ 6	Industrial application of power electronics devices		4	4	8	ETH309-6
	Total Marks	12	32	26	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**

I. Instructional Methods:
1. Lectures cum Demonstrations
2. Classroom practices
3. Use of projector and soft material for demonstration
4. Virtual Laboratory

J. Teaching and Learning resources

Chalkboard, LCD presentations, Demonstrative kits, Demonstrative charts

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K. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Power Electronics.	M D Shingh /KB Khanchandani	Tata McGraw Hill, NewDelhi, 2012 or latest
2	Power Electronics	Dr.Bimbhra P.S.	Khanna Publication, New Delhi
3	Power Electronics	P C Sen	Tata McGraw Hill, New Delhi, 2012 or latest
4	Power Electronics.	Rashid M	McGraw Hill
5	Industrial Electronics and Control	S K Bhattacharya ,S Chaterjee	TTTI Chandigarh

L. Text Books

Sr. No	Nameof Book	Author	Publication
1	Power Electronics.	JS Katre	Tech-knowledge publication, Pune
2	Power Electronics.	Dr Chitode	Techmax publication,Pune
3	Industrial and power Electronics	Shingare	Electrotech Publication
4	Industrial Electronics-	Shingare	

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/power_electronics/power_electronics_transistors.htm

vi) https://www.youtube.com/watch?v=O_pqCNPs6xw

vii) https://www.youtube.com/watch?v=0nXEUkFBd8A

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COURSE ID:

COURSE NAME : SIMULATION SOFTWARE

COURSE CODE : ETH401

COURSE ABBREVIATION : HSMS

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	-	02
	Tutorial Learning	-	
	Laboratory Learning	04	
	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			
03	-	-	-	-	25	10	25@	10	-	-	50

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.**

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   * 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:

Industry expects a Diploma Engineer (technologist) to use modern day Electronic Design Automation (EDA) tools for analyzing, designing, and real time testing of analog, digital and mixed electronic circuits and their PCB layouts. These operations are useful in developing, fabricating and testing new prototype circuits. Using basic features of EDA tool prepares student for learning advanced aspects of the modern EDA tool such as MATLAB, SCILAB and Orcad Capture using the simulation software for design of complex circuits.

EDA tool such as SCILAB, MATLAB and Orcad Capture etc are very powerful mathematical computation and electronic circuit design, simulation, and analysis tools. If an engineering problem can be solved using software tool, it is usually more efficient to use the software tool than to write a program in a computer language to solve the problem.

II) INDUSTRY / EMPLOYER EXPECTED OUTCOME:

The aim of this course is to attend the following industry/ employer expected outcome through various teaching learning experiences.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

1. **ETH401- 1** Identify SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE environment.
2. **ETH401- 2** Develop SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE programs using inbuilt functions.
3. **ETH401- 3** Build communication models in SIMULINK using communication blockset.
4. **ETH401- 4** Identify and use OrCAD Capture, OrCAD PSpice and OrCAD Layout tools of OrCAD software.
5. **ETH401-5** Design schematic of electronic circuits in OrCAD Capture.
6. **ETH401-6** Simulate and create PCB layout of electronic circuits in OrCAD Pspice.

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH401-1 Identify SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE environment.	-	1.00	-	1.00	-	-	-	-	-
ETH401-2 Develop SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE programs using inbuilt functions.	2.00	1.00	2.00	1.00	-	-	-	2.00	-
ETH401- 3 Build communication models in	2.00	2.00	2.00	1.00	-	-	-	2.00	2.00

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 Operate and Maintain	PSO2 Supervision and Providing Solution
SIMULINK using communication blockset.									
ETH401- 4 Identify and use OrCAD Capture, OrCAD PSpice and OrCAD Layout tools of OrCAD software.	-	1.00	-	1.00	-	-	-	-	-
ETH401-5 Design schematic of electronic circuits in OrCAD Capture.	2.00	1.00	2.00	1.00	-	-	-	2.00	-
ETH401-6 Simulate and create PCB layout of electronic circuits in OrCAD Pspice.	2.00	2.00	2.00	1.00	-	-	-	2.00	2.00

F. CONTENT:

II) Practical Exercises

The following practical exercises shall be conducted in the *Laboratory for Simulation Software developed* by the Institute in practical sessions of batches of about 20- 22 students:
(Any 20 out of 25)

Sr. No.	Laboratory experiences	CO
1.	Introduction to SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-1
2.	SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE Command line window.	ETH401-1, ETH401-2
3.	Mathematical operations in SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-2
4.	Matrix Operations using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-2
5.	Plotting functions using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-3
6.	File handling & String manipulation using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-3
7.	Looping & Branching instructions using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-1, ETH401-2
8.	Introduction to Communication BlockSet using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-3
9.	Analysis of Amplitude Modulation using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-3
10.	Analysis of Frequency Modulation using SCILAB / MATLAB OR EQUIVALENT OPEN SOURCE SOFTWARE.	ETH401-3
11.	Introduction to OrCAD tools -OrCAD Capture, OrCAD PSpice, OrCAD Layout (OrCAD, Multisim or Equivalent Open Source Software)	ETH401-4
12.	Designing circuit using OrCAD Capture such as Rectifiers, Filters, Amplifier-Oscillators, Multivibrators. (OrCAD, Multisim or Equivalent Open Source Software)	ETH401-4, ETH401-5

Sr. No.	Laboratory experiences	CO
13.	Analysis of electronic circuits using OrCAD Pspice. (OrCAD, Multisim or Equivalent Open Source Software)	ETH401-5
14.	PCB Layout designing of of above electronic circuits using OrCAD Layout. (OrCAD, Multisim or Equivalent Open Source Software)	ETH401-6
15.	Realize Boolean expression using logic gates and verify its truth table by OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
16.	Simulate adder/subtractor and verify the truth table by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
17.	Verification of equivalent resistance formulae by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
18.	Verification of KVL by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
19.	Verification of KCL by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
20.	Clamper and Clipper Circuit by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-4, ETH401-5
21.	V-I Characteristics of Diode by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-5
22.	Simulation of Single stage CE and Two stages RC coupled amplifier using Transistor/FET by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-5
23.	Simulation of Inverting and Non-inverting amplifier using IC 741 op-amp by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-5
24.	Simulation of First Order Low Pass and High Pass Butterworth filter using IC 741 op-amp by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-5
25.	Simulation of Interpret transit analysis of phase shift oscillator/Wien bridge oscillator/ Colpitts/ Hartly Oscillators using Op-amp IC 741 and Transistor by using OrCAD, Multisim or Equivalent Open Source Software.	ETH401-5

** Note- For practical exercises 1 to 10 use MATLAB/ SCILAB or Equivalent Open Source Software and for 11 to 25 use OrCAD, Multisim or Equivalent Open Source Software.

G. 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**

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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**

H. Instructional Methods:

16. Practical Demonstrations
17. Laboratory practices
18. Use of projector and soft material for demonstration
4. Virtual Laboratory

I. Teaching and Learning resources:

Virtual laboratories, Software tutorials, Live simulation softwares etc.

J. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	Introduction to MATLABR6	Delores M. Etter, David C. Kuncicky, Doug Hull	Second Edition PEARSON Education Low Price Edition
2	Getting Started With MATLAB7	Rudra Pratap	Oxford University Press, Incorporated, 2006
3	A guide to MATLAB For Beginners and Experienced Users	Brian R. Hunt , Ronald L. Lipsman, Jonathan M. Rosenberg	Cambridge University Press
4	Introduction to P-spice using OrCAD for circuits and Electronics	M. H. Rashid	Pearson Education

K. Learning Website & Software

i)   https://in.mathworks.com/
ii)   https://www.scilab.org/
iii) https://www.cadence.com/en_US/home/tools/pcb-design-and-analysis/orcad.html
iv)   https://www.multisim.com/

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COURSE ID :

COURSE NAME   : **SIGNALS AND SYSTEMS**

COURSE CODE   : **ETH402**

COURSE ABBREVIATION   :   **HSYS**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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			
03	30	70	100	40	25	10	-	-	25	10	150

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.**

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* 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: -

In Signals and Systems a signal is a description of how one parameter varies with another parameter. For instance, voltage changing over time in an electronic circuit, or brightness varying with distance in an image. A system is any process that produces an output signal in response to an input signal. Examples of systems that manipulate signals are speech recognition, video streaming, cellular networks and medical scans such as MRI. The disciplines of signal and image processing are concerned with the analysis and synthesis of signals and their interaction with systems

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • To identify various signals and their systems for advanced technology in various departments such as aero defense, medical, military, Indian Railways, satellite communications, network based technologies, MATLAB programming etc.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH402-1 Classify signals and identify ODD and even part of signals

ETH402-2 Analyze operations on signals such as shifting, reversal, scaling etc.

ETH402-3 Identify and classify types of the systems.

ETH402-4 Describe Linear time invariant systems using mathematical models and discuss
their properties.

ETH402-5 Explain Fourier series and its properties.

ETH402-6 Explain **Fourier** – Transform properties and analyse signal and system using Z
Transform

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH402-1	2	2	1	1	-	-	-	-	-
ETH402-2	2	2	2	2	-	-	-	-	1
ETH402-3	1	2	1	2	-	-	-	1	1
ETH402-4	2	2	2	2	-	-	-	1	1
ETH402-5	2	1	1	1	-	-	-	-	-
ETH402-6	2	2	1	2	-	-	-	-	-

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F. CONTENT:

I) Practical exercises

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

(Any 10)

Sr. No.	Laboratory experiences	CO
1.	a) Introduction of MATLAB environment b) Basic operations on matrices such as addition, subtraction, multiplication, division	ETH402-1
2.	Generation of various Continuous time signals and sequence using MAT LAB inbuilt function such as, Sinusoidal signal, Unit-step signal, Ramp signal, Tria-ngular function, Exponential signal, Impulse signal,	ETH402-1
3.	Write a Program for sampling of continuous time sig-nal.	ETH402-2
4.	Generation of various Discrete time signals and sequ-ence using MATLA B inbuilt function such as, Sinusoidal signal, Unit-step signal, Ramp signal, Tria-ngular function, Exponential signal, Impulse signal	ETH402-1
5.	Operation on signals and sequences (a) WAP to plot graph of addition of 2 signals (b) WAP to plot graph of Multiplication of 2 signals	ETH402-2
6.	Operation on signals and sequences (a) WAP to plot time shifting of Discrete Time Signal (b) WAP to plot time scaling of Discrete Time Signal (c) WAP to plot time reversal of Discrete Time Signal	ETH402-2
7.	**Write a MATLAB program to find the impulse response and step response of a system from its difference equation.** **Compute and plot the response of a given system to a given input.**	ETH402-3
8.	**Checking linearity/non-linearity of a system using MATLAB**	ETH402-3
9.	**Checking causality/non- causality of a system using MATLAB**	ETH402-3
10.	WAP for convolution of two DT sequences.	ETH402-4
11.	WAP for cross-correlation of two DT sequences.	ETH402-4
12.	Program for auto-correlation of two DT sequences	ETH402-4
13.	Write a MATLAB program to generate Fourier series of a Square Wave	ETH402-5
14.	WAP to find the Fourier Transform of a given signal and plot its magnitude and phase spectrum	ETH402-6
15.	To locating the zeros and poles and plotting the pole zero maps in s-plane and Z-plane for the given transfer function	ETH402-6

II)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH402-1 Classify signals and identification of ODD and even part of signals		
1	**Introduction to signals** 1.1 A Signal: Definition 1.2 **Standard Test signals** Unit Step function, Unit Impulse function, Ramp signal, Parabolic signal, Exponential signal, Sinusoidal signal, Triangular Signal, Rectangular pulse Signal 1.3 **Classification of signals** 1.3.1 Multichannel and Multidimensional signals 1.3.2 Continuous time Vs discrete time signals 1.3.3 Deterministic Vs random signals 1.3.4 Periodic Vs aperiodic signals 1.3.5 Symmetric (Even) Vs Asymmetric (Odd) signals 1.3.6 Energy and Power signals Comparison of Energy and Power signals 1.7 (Numerical based on Odd and Even signals)	04	08
	ETH402-2 Analyze operations on signals such as shifting, reversal, scaling etc		
2	**Basic Operations on Signals** **2.1 Basic operations on Continuous time Signals** Time Shifting, Time Reversal, Time Scaling, Amplitude scaling, Signal addition, Signal multiplication **2.2 Sampling of CT signal** **2.3 Basic operations on Discrete time Signals** Time Shifting, Time Reversal, Time Scaling, Amplitude scaling, Signal addition, Signal multiplication (Numericals based on signal operations)	08	14
	ETH 103-3 Identify and classify types of the systems		
3	**Introduction to Systems** **3.1 A System:** Definition, Block diagram representation of Discrete time systems with blocks adder, a constant multiplier, a signal multiplier, a unit delay element, a unit advance element. **3.2 Classification of systems** 3.2.1 Continuous time systems and discrete time systems 3.2.2 Static and dynamic systems 3.2.3 Causal and Noncausal System 3.2.4 Linear and Nonlinear system 3.2.5 Time invariant and time variant system 3.2.6 Stable and unstable system (Numerical based on identification of systems)	10	12
	Sub-total	22	34

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH402-4 4 Describe Linear time invariant systems using mathematical models and discuss their properties		
4	**Linear time Invariant system and convolution** 4.1 Linear time Invariant system 4.2 Convolution using graphical method 4.2.1 Convolution sum of two continuous time sequences 4.2.2 Convolution sum of two discrete time sequences 4.3 Tabular method for convolution of two discrete time sequences 4.4 Properties of discrete convolution 4.5 Concept of Correlation 4.6 Types of correlation 4.6.1 Cross correlation 4.6.2 Auto correlation 4.7 Applications of correlation (Numericals based on Convolution sum using graphical method, tabular method, auto correlation and cross correlation)	09	14
	ETH402-5 Explain Fourier series and its properties		
5	**Fourier Series for Continuous & Discreate Time** 5.1 Development of **Fourier Series derivation** 5.2 Properties of **Fourier Series** Linearity, Time shifting, Frequency shifting, Ti-me reversal, Time scaling, Multiplication, Convolution (statements only)	04	06
	ETH402-6 Explain Fourier – Transform properties and analyse signal and system using Z Transform		
6	**Continuous Time & Discreate Time Fourier Transform** 6.1 Basic concept of **Fourier Transform of functions: rectangular signal, Impulse signal** 6.2 Properties of **Fourier Transform** Linearity, Time shifting, Frequency shifting, Time scaling, Multiplication, Convolution(statements and derivation with prof) **6.3 Introduction of Z-transform** 6.4 Relation between Z transform and Fourier Transform 6.5 ROC (Region of Convergence) 6.5 Pole-zero plot (Simple Numericals on Z transform and Sketch ROC) 6.6 Inverse Z transform 6.6.1 Power series method 6.6.2 Partial fraction expansion method 6.6.3 Residue method	10	16
	Sub-total	23	36

G. List of Assignments under SLA

Sr.No.	Name of Assignment
1	Solve 10 numerical based on basic operations on Continuous time Signals
2	Solve 10 numerical based on basic operations on discrete time Signals
3	Solve 10 numerical based on all systems.
4	Solve 10 numerical based on all cross correlation.
5	Solve 10 numerical based on all auto correlation.
6	Derive all fourier series properties for continuous signals
7	Derive all fourier transform properties for continuous signals

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	To Classify signals and illustrate of ODD and even part of signals	2	2	4	08	ETH402-1
I / 2	Analyze operations on signals such as shifting, reversal, scaling etc	2	4	8	14	ETH402-2
I / 3	Identify and classify types of the systems	2	2	8	12	ETH402-3
II /4	Describe Linear time invariant systems using mathematical models and discuss their properties	2	4	8	14	ETH402-4
II /5	Explain Fourier series and its properties	2	2	2	06	ETH402-5
II / 6	Transform properties and analyse signal and system using Z Transform	4	4	8	16	ETH402-6
	Total Marks	14	18	38	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

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Affective	Discipline and punctuality	05
	TOTAL	**25**

J. Instructional Methods:

19. Lectures cum Demonstrations
20. Class room practices
21. Use of projector and soft material for demonstration
22. Virtual Laboratory
23. NPTEL/Swayam course lectures

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1	'Signals & system'	Ramesh Babu	SciTech Publication
2	'Signals & System' (Schaum's out lines)	H. A HSU	Tata McGraw Hill
3	'Signal & System'	Shah & Bhagli	Mahalaxmi Publication
4	'Signals & System'	Simon Haykin, Barry Van Veen-	IInd Edition Wiley publication
5	'Signals & System'	Anand kumar	PHI Publications

M. Text Books

Sr. No	Name of Book	Author	Publication
1	Digital signal processing	N G Palan	Tech max Publication
2	Signals and systems	Dr J S Chitode	Technical Pulicatoins

N. Learning Website & Software

i. www.youtube.com

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COURSE ID:

COURSE NAME   : **CONSUMER ELECTRONICS**

COURSE CODE   : **ETH501**

COURSE ABBREVIATION : **HSAS**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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			
-	-	-	-	-	25	10	-	-	25	10	50

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.**

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* 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 usage and demand for consumer electronic appliances is increasing in both domestic as well as industries. This increases the demand for trained man power in the relevant industries. This course will provide working principle of various consumer appliances/gadgets /equipment's and skills to troubleshoot and maintain them in scientific way. The knowledge gained will help the students in the manufacturing units of these consumer gadgets or help the

students to start their own enterprise.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend the following industry/employer expected outcome through various teaching learning experiences. Maintain various consumer electronic appliances/equipment's.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH501-1 Maintain the given type of audio system.

ETH501-2 Test different types of video systems.

ETH501-3 Troubleshoot various consumer electronic appliances.

ETH501-4 Use various smart appliances.

ETH501-5 Maintain various office automation appliances.

ETH501-6 Analyze the role of communication electronics in everyday life.

Course outcomes and Programme outcomes/ Programme specific outcomes (CO-PO/PSO)   matrix
 [Note: Correlation Semesters: 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 / Develop ment of solutions	PO 4 Enginee ring Tools, Experim entation and Testing	PO 5 Enginee ring Practice s for society, sustaina bility and Environ ment	PO 6 Project Manage ment	PO 7 Life-long Learni ng	PSO1 Operat e and Mainta in	PSO2 Supervisi on and Providing Solution
ETH501-1	3	1	1	3	1	1	3	3	--
ETH501-2	2	1	2	3	1	1	3	3	--
ETH501-3	3	1	2	3	1	1	3	3	--
ETH501-4	2	1	2	3	3	1	3	3	1
ETH501-5	2	1	2	3	1	1	3	3	1
ETH501-6	2	1	2	3	1	1	3	3	2

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F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the Laboratory in the practical session of batches of about 20- 22 students. Any 12 experiments should be performed.

Sr. No.	Laboratory experiences	CO
1.	Test and measure the various parameters of a microphone.	ETH501-1
2.	Test the given speaker and plot its frequency response.	ETH501-1
3.	Measure voltages at different sections of Hi-Fi amplifier.	ETH501-1
4.	Connect CCTV Cameras to DVR/Rerecord and replay.	ETH501-2
5.	Measure voltage of Power supply, Audio section and Video section of LCD TV. LLO 7.2 Compare the above measured voltage with standard voltage.	ETH501-2
6.	Troubleshoot the faults in a LCD TV- a) No picture, No Audio b) No Audio but proper picture. c) Complete dead TV.	ETH501-2
7.	Locate and rectify faults in a LED TV a) No picture, No Audio b) No Audio but proper picture) Complete dead TV.	ETH501-2
8.	Test the components and operation of the paper feed mechanism in a photocopier machine through dismantling and reassembly.	ETH501-3
9.	Identify and test various front panel controls of microwave oven.	ETH501-3
10.	Interface the scanner to the desktop computer and test its various controls.	ETH501-3
11.	Measure the signal strength of wearable antenna.	ETH501-4
12.	Display faults in smart wrist bands - a) display not working b) poor brightness.	ETH501-4
13.	Interface the laser printer to the desktop computer and identify various controls.	ETH501-5
14.	Interface and configure LED projector using various controls.	ETH501-5
15.	Create new interactive whiteboard pages using Interactive whiteboard simulation software like Mimio Studio, SMART Learning Suite Online.	ETH501-5
16.	Test audio and video settings for a video conferencing session.	ETH501-5
17.	Analyze the signal strength and data speeds of mobile network in different environments.	ETH501-6
18.	Compare internet service providers (ISPs) to find the plan that best suits your needs and budget.	ETH501-6

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II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH501-1 Maintain the given type of audio system.		
1	**Audio Fundamentals** 1.1 Basic characteristics of sound signal: Intensity and loudness, pitch, frequency response, fidelity, sensitivity and selectivity 1.2 Audio Amplifiers: Mono, stereo, quadraphonic, block diagram of Hi- Fi amplifier and its working, use of bass, treble tone controls 1.3 Microphone: Working principle and Types - condenser, crystal, electret, laser 1.4 Speakers: Working principle and types- electrostatic, dynamic, plasma arc, Bluetooth 1.5 Public Address System (PA system) and home theatre: Block diagram and working principle	06	08
	ETH501-2 Test different types of video systems.		
2	**Video Systems** 2.1 Closed circuit television (CCTV): functional block diagram, working, installation of CCTV 2.2 Liquid crystal display (LCD) television: Principle, Block diagram and working 2.3 Block diagram and working principle: Light emitting diode (LED) TV, Organic light emitting diode (OLED) TV, Quantum dot light emitting diode (QLED) television 2.4 Direct to Home (DTH) television: Block diagram and working principle 2.5 Smart interactive TV: Features and applications	07	12
	ETH501-3 Troubleshoot various consumer electronic appliances.		
3	**Consumer Electronic Appliances** 3.1 Photocopier: Block diagram and working principle 3.2 Microwave Oven: Block diagram, single chip controllers, types, wiring diagram, safety instructions, electrical specifications 3.3 Washing Machine: Block diagram, electrical specifications, types and features of (Automatic, Semi- automatic and Fuzzy Logic) washing machine	09	14

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.4 Digital Camera and Camcorder: Working principle, picture processing, picture storage, electrical specification 3.5 Scanner: Working principle, Specifications, types of scanners (Handheld, Flatbed, Sheet fed, Portable Scanners), interface cables, ports and connectors		
	Sub-total	**22**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH501-4 Use various smart appliances.		
4	**Smart appliances.** 4.1 Wearable antenna: Construction, Working principle and applications 4.2 Smart Wrist bands: Construction, applications and functional units (sensors, signal conditioning, microcontrollers, wireless connectivity, power management, firmware, storage) 4.3 Virtual Reality (VR) Headset: Functional block diagram and functional units (tracking unit, processing unit, display unit, sensors, pixel resolution, field of view),virtual reality supported platforms such as Windows Mixed Reality (WMR) 4.4 Augmented Reality(AR) devices: Functional block diagram, working principle, examples 4.5 Recycling of electronic appliances: Regulations and procedures	**06**	**10**
	ETH501-5 Maintain various office automation appliances.		
5	**Office Automation appliances** 5.1 Laser Printer: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure 5.2 Smart Interactive Board: Working procedure, features and specifications 5.3 LED Projector: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure 5.4 Biometric Attendance system: Hardware and	**09**	**14**

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Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	software components, working procedure 5.5 Video conferencing system: Components and working procedure		
	ETH501-6 Analyze the role of communication electronics in everyday life.		
6	**Communication Electronics** 6.1 I**ntroduction to Communication Electronics:** Basic building blocks of communication systems, modulation and transmission methods. 6.2 **Cellular Networks:** Cellular network technologies (2G,3G, 4G, 5G), network architecture, and mobile phone communication principles. 6.3 **Wireless Communication Technologies:** Various wireless communication technologies like Wi-Fi, Bluetooth, and their applications in consumer electronics. 6.4 **Network Fundamentals:** Network protocols (TCP/IP) network devices (routers, modems), and network topologies.	08	12
	Sub-total	23	36

G. List of Assignments under SLA

Sr. No.	Micro-projects
1	Compare Battery Life of Portable Devices
2	Control Smart Lights with Voice Commands
3	Develop a Smart Plug Scheduling App (Simulation)
4	Design a Portable Phone Charger
5	Build a Simple Security Camera System (Simulation)
6	Build a Basic Audio Amplifier
7	Design a Passive Audio Crossover (Simulation)
8	Optimize Printer Network Connectivity
9	Build a DIY Document Scanner App
10	Design a Smartphone Signal Booster (Simulation)

Above is a suggestive list of microprojects. Faculty must prepare their own list of microprojects, assignments and activities in a similar way. The faculty must allocate mix of tasks, considering the weakness and strength of the student in quiring the desired skills. If a microproject is assigned, it is expected to be completed as group of 2 or 3 students

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**

I. Instructional Methods:

24. Lectures cum Demonstrations
25. Class room practices
26. 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	The Wearable Technology Handbook	Haider Raad	Ohio publishing
2	Virtual Reality for Beginners! How to Understand, Use and Create with VR	Murray Ramirez	Khanna Book Publishing
3	Audio Video Systems: principle and practices and troubleshooting	Gupta R.G.	Create Space Independent Publishing
4	Standard handbook of Audio Engineering	Whitaker Jerry and Benson Blair	McGraw Hill
5	Handbook for Sound Engineering	ELSEVIER-British Library	ELSEVIER-British Library
6	Mastering Digital Television	Whitaker Jerry and Benson Blair	McGraw-Hill

L. Text Books

Sr. No	Name of Book	Author	Publication
1	Consumer Electronics	Bali S.P.	Pearson Education India,
2	Audio video systems: principle practices and troubleshooting	Bali R and Bali S.P.	Khanna Book Publishing

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| 3 | Innovating with Augmented Reality: Applications in Education and Industry | P Kaliraj, Devi Thirupathi | CRC Press, |
| 4 | Multimedia Communications | Jerry D. Gibson. | Academic Press Inc |

M. Learning Website & Software

i. https://ed.iitm.ac.in/~raman/agcl/VR_Paper.pdf
ii. https://www.nxp.com/assets/block-diagram/en/AugmentedReality andVirtualRealityHeadsets.pdf
iii. https://www.nxp.com/assets/block-diagram/en/SmartWatch_SMART WATCH.pdf
iv. https://www.nxp.com/assets/block-diagram/en/SmartWatch_SMART WATCH.pdf
v. https://www.nsdcindia.org/scmp/assets/image/1179656187-CCTV_ Installation_Technician__English.pdf
vi. CCTV installation handbook

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Programme Name/s   :ALL

Programme   **:- CE/EE/ME/ET/MT/IF**

Semester   **: Fourth**

Course Title   **: ENVIRONMENTAL EDUCATION AND SUSTAINABILITY**

Course Code   **CCH206**

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

III. COURSE SEMESTER 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.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

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 & TL				Based on SL		
																	Practical				
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CCH206	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	2	-	-	2	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

[Use Proforma 1 for Assessment of SLA]

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	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	**CCH206.1** 1.1 Explain the need of studying environment and its components. 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions 1.3 Explain the Concept of 5 R w.r.t. the given situation 1.4 elaborate the relevance of Sustainable Development Goals in managing the climate change 1.5 Explain the concept of zero carbon-footprint with carbon credit	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 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 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations
2	**CCH206.2** 2.1 Justify the importance of natural resources in sustainable development 2.2 Explain the need of optimum use of natural resources to maintain the sustainability 2.3 Differentiate between renewable and non-renewable sources of energy 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**Unit - II Sustainability and Renewable Resources** 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) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 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 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations
3	**CCH206.3** 3.1 Explain the characteristics and functions of ecosystem 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability 3.3 Describe biodiversity assessment initiatives in India 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India 3.5 Explain the need of conservation of biodiversity in the given situation	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Semesters, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstration

4	**CCH206.4** 4.1 Classify the pollution based on the given criteria 4.2 Justify the need of preserving soil as a resource along with the preservation techniques 4.3 Maintain the quality of water in the given location using relevant preventive measures 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms 4.5 Compare the noise Semester from different zones of city with justification 4.6 Describe the roles and responsibilities of central and state pollution control board	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man- made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 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 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise Semesters at various zones of the city 4.6 Pollution Control Boards at Central and State Government Semester: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations
5	**CCH206.5** 5.1 Explain Constitutional provisions related to environmental protection 5.2 Explain importance of public participation (PPP) in enacting the relevant laws 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem 5.4 Explain the role of information technology in environment protection	Unit – V- Environmental legislation and sustainable practices 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI . LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES: N.A.

VII. 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

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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 /Microproject/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 relavance 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

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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 judicial 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.

VIII.   ABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE
(Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Semester	U-Semester	A-Semester	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**

X. 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/assignemnt/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)/Microproject/assignemnt/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 microprojects ,assignments and similar activities using proforma 1 marks of SLA can be calculated.

XI. SUGGESTED COS-POS MATRIX FORM

Course Outcomes (COs)	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 Semester

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XII. 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 Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII. 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-fo r-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 Intiative 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 enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative 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 Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analys	SWOT analysis of Biodiversity

	is-en.pdf	
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal 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		

SEMESTER V COURSES

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	
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	--	1
Self-Learning Hours (SLH)	01	
Notional Learning (NLH)	03	

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 SEMESTER 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 Semesters: 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 manage-ment	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	**Entrepreneurship Development- Concept and Scope** **Indian Knowledge System for entrepreneurship development(IKS)** 1.1 Concepts and Overview of Entrepreneurship. Evolution and Growth of Entrepreneurship in India. Role of Entrepreneurship in Economic Development. Entrepreneurship as a career. 1.2 Traits of successful intrapreneur / entrepreneur: Consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, 1.3 Entrepreneurship: Scope in local and global market. 1.4 Intrapreneur and entrepreneur. 1.5 Types of enterprises and their features: Manufacturing, Service and trading. 1.6 Steps in Setting up of a business	03
2	**Entrepreneurial Opportunities and Selection Process:** 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. 2.2 Process selection: Technology life cycle, forms and cost of transformation, Factors affecting process selection, Location for an industry, Material handling. 2.3 Market study procedures: Questionnaire design, sampling, Market survey, Data analysis 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).	04
3	**Support Systems:** 3.1 Categorization of MSME, Ancillary Industries. 3.2 Support System-Government Agencies: MCED, NI- MSME, PMEGP, DI, KVIC. 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consolation, technology transfer and quality control, marketing and finance 3.4 Breakeven point, return of investment and return on sales.	03
4	**BUSINESS PLAN PREPARATION:** 4.1 Sources of Product for Business: Feasibility study. 4.2 Ownership, Capital, Budgeting, Matching Entrepreneur with the project, Feasibility report preparation and evaluation criteria. 4.3 Business plan preparation.	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** |

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 Semester 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   : INTERNSHIP (16 WEEKS)
COURSE CODE   : CCH505
COURSE ABBREVIATION : HINT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning		
	Tutorial Learning		
	Laboratory Learning	--	**10**
	SLH-Self Learning		
	NLH-Notional Learning		

B. ASSESSMENT SCHEME: -

PAPER DURATION	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA- TH	SA- TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
NIL	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			200
	NIL	NIL	NIL	NIL	100	40	100#	40	-	-	

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 Guidlines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor.

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 the average of two class tests of 30 marks each conducted during the semester.
2. If the candidate is not securing the minimum passing marks in FA-PR of any course, then the candidate shall be declared as "Detained" in that semester.
3. If the candidate is not securing the minimum passing marks in the SLA of any course, then the candidate shall be declared as a fail and will have to repeat and resubmit the 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. A summer 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 SEMESTER 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 Semesters:** 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 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
CCH505.3	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 – After completion of 4th semester examination and up to total sixteen 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:

The following activities are expected to be performed by the concerned department at the Institute.
Table of activities to be completed for Internship

S.N	Activity	Suggested Schedule WEEKS
1	Collection of information about the industry available and ready for extending training with its offered capacity of students (Sample Format 1)	During 4th semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15)	During 4th semester
3	Communication with Industry and obtaining its confirmation: Sample letter Format	14th week of 4th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	15th week of 4th semester
5	Enrollment of Students for industrial training (Format 3)	During 4th semester
6	Issue of letter to industry for training along with details of students and mentor (Format 4)	15 days before end of 4th semester examination
7	Organize Internship Orientation session for students	During 4th semester examination
8	Progressive Assessment of internship by Industry supervisor .	Each week (16 weeks) -5marks for each week
9	Progressive Assessment of internship by Institute Mentor at the Industry	Each quarter of 1 month(4 weeks) during training period- 5 marks for each quarter
10	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

a. The department can take help of alumni or parents of students having contacts in different industries for securing placement.
b. Students would normally be placed as per their choices; in case of more demand for a particular industry, students would be allocated considering their potential. However, preference for placement would be given to students who have arranged placement in a company with the help of their parents or relatives.
c. Principal/HOD/Faculty should address students about industrial safety norms, rules, and discipline to be maintained in the industry during training before releasing students for training.
d. The faculty members, during the industry visit 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 are followed, and safety gear is used by the 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 IN THE 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, and quality control 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

(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.
   a) If yes, whether you offer 16 weeks training: Yes/No
   b) Possible Industrial Capacity:

Students	Programme name						Total
	Civil	Mechanical	Electrical	Information Technology	Metallurgy	Electronics & Telecommunica Tion	
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 <u>fourth</u> semester at Government Polytechnic, Kolhapur , has to undergo 16 weeks of Industrial training for partial fulfillment towards completion of Diploma in _____

ii<u>.   For this fulfillm</u>ent he/she has been deputed at   industry, located at--------------------------------
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 fro 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 : _____

(Students Enrollment for Industrial Training (To *be maintained by Department*)

Sr. No. (Academic Year –)	Roll No.	Name of Student	Name of Industry	Name of Mentor at Institute

(Issue Letter to the Industry/Organization for the training along with details of students and mentors on I nstitute 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 .

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
1.			
2.			

Kindly extend all possible cooperation to the students for above. Thanking you

Yours Sincerely,

Principal
Government Polytechnic, Kolhapur

CC- Mentor.

(Undertaking by the students)

To

The Principal,

Government Polytechnic, Kolhapur

Subject: Undertaking regarding Placement for Industrial training of 16 weeks duration.

I Mr./Ms. _____ 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:Kolhapur

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	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WKN 7	WK 8	WK 9	WK 10	WK 11	WK 12	WK 13	WK 14	WK 15	WK 16	Total [80 Marks] [A]	PA Marks by Mentor faculty (20 Marks) [B]	Total [Marks 100] [A]+[B]

Name and Designation of Mentor   **Name and Designation of Industry Supervisor**

The faculty should visit the Industry at least for four times Online /Off line mode and He will give Marks for 4 Times Quarterwise. [Mentor will give marks 4 times (5 marks each time) and total of 20 marks]

EVALUATION BY MENTOR

Sr No.	Roll No	Quarter 1 Marks Out Of 5 By mentor	Quarter 2 Marks Out Of 5 By mentor	Quarter 3 Marks Out Of 5 By mentor	Quarter 4 Marks Out Of 5 By mentor	Average of column

DAILY DIARY FORMAT TO BE MAINTAINED BY STUDENT

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 inductrial training.

COURSE ID
COURSE NAME : DATA COMMUNICATION & NETWORKING
COURSE CODE : ETH404
COURSE ABBREVIATION : HDCN

P. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	07	02
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	00	
	NLH-Notional Learning	11	

Q. ASSESSMENT SCHEME:-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				Total
						Practical			
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	20	150

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.* 06 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 plays a vital role in various fields like business, academics, defense, budget research, engineering, medicine. In the present Industrial & commercial environment, the technician is expected to use digital communication skillfully. The primary purpose of this course is to give an elementary but sound fundamental understanding of how data communication work, its basic components, how they work and basic knowledge of applications of Internet. After understanding basic communication system it is worth to discuss Data Communication & Networking. Telecommunication & Data communication is the fastest growing technology & undoubtedly has strong growth in future hence students should know data transfer from one system to another through different communication networks like LAN, WAN, MAN & different switching techniques.

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.

- Implement different protocols used for data communication using various switching techniques and network topologies.
- Understand network topologies, and protocols used in various switching approaches and wireless technologies.
- Implement star and tree topologies using computers and simple protocols in C for wide range of applications.

G. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH404-1 Describe the concepts of data communication.

ETH404-2 Identify different network models and illustrate its functioning based on network devices

ETH404-3 Recognize different switching techniques and explore their applications.

ETH404-4 Detect and correct digital transmission errors and Show Protocols for Noiseless and Noisy Channels.

ETH404-5 Apply knowledge to understand different IEEE Standards.

ETH404-6 Summarize application layer protocols and describe its formats.

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

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

Cos Competency: Implement different protocols used for data communication using various switching techniques and network topologies.	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 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH404-1	3	-	-	-	-	-	2	-	2
ETH404-2	3	2	-	-	2	2	2	-	2
ETH404-3	3	-	-	-	-	-	2	-	1
ETH404-4	3	-	-	2	-	-	-	2	3
ETH404-5	2	2	1	2	2	2	2	-	2
ETH404-6	3	3	2	2	3	2	3	2	3

H. CONTENT:

II) Practical exercises

The following practical exercises shall be conducted in the Laboratory for this course in practical sessions of batches of about 20- 24 students.

Note- Minimum 10-12 Practicals are required to complete which shall address all Cos.

Sr. No.	Laboratory experiences	CO
28.	Perform Survey of any existing data communication system. • Identify data communication system components. • Explain Working and use of the data communication system. • List transmission impairments.	ETH 404-1
29.	Implement different network topologies using CISCO packet tracer. • Define the term, topology. • Compare different types of Network i.e. LAN, MAN, WAN.	ETH 404-1
30.	Compare different transmission (guided) media • Locate different transmission media and identify differences between them.	ETH 404-2
31.	Identify layout of lab network • Draw a line diagram of the topology used for computer lab networking.	ETH 404- 1,2
32.	Router, Repeater and bridge • Install and test Router / Repeater / bridge (any one).	ETH 404-2
33.	Prepare a network cable using CAT5/6 cable and RJ45 connector and test its connectivity – straight connection / cross connection.	ETH404-2
34.	Interconnect two PCs to share file and list various settings used.	ETH 404- 2,3
35.	Implement Peer to Peer Network by installing NIC Driver and assign IP address, name to node and share resources like Drives, Folder etc.	ETH 404-2,3
36.	Using HUB/Switches, install a LAN network consisting of six computers.	ETH 404-2,3
37.	Perform Flow Control and Error Control protocol (any one) using CISCO packet tracer.	ETH 404- 4
38.	Configure static and dynamic IP addresses.	ETH 404-2, 6
39.	Create connection to available wireless network.	ETH 404-4,5
40.	Use any Packet sniffing tool for network traffic management.	ETH 404-4,5,6
41.	Print documents from remote system in a network , Share folder and printer in a network (using wired and wireless system).	ETH 404-2,5
42.	Troubleshooting using TCP/IP • Understand and implement various TCP/IP utilities. • Execute TCP/IP network commands: ipconfig, ping, tracert.	ETH 404-2,4,6
43.	Configure/Test internet connectivity • Execute TCP/IP network commands: netstat, pathping, route.	ETH 404-2,4,6
44.	Implement IP addresses for intranet in Class A, Class B, Class C. • Implement Class-full Address in a given network node. • Identify range of IP Address in various classes. • Justify the reason to choose various IP address classes for creating given network.	ETH 404-6

III) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH404-1 Describe the concepts of data communication.		
1	**Introduction of Data Communication** 1.1. Data Communication – components, data representation. 1.2. Protocols, Standards, Standards Organizations. 1.3. Transmission impairment – Attenuation, Distortion, Noise. 1.4. Network definition & criteria (Performance, reliability, security) 1.5. Network topology: Mesh, ring, bus, star, hybrid 1.6. Types Of Networks :LAN,WAN and MAN. 1.7. Performance of network – Bandwidth, Throughput, Latency (Delay), Transmission time, Bandwidth delay product, Jitter	7	12
	ETH404-2 Identify different network models and illustrate its functioning based on network devices		
2	**Network models and Network Devices**Network models – 2.1. OSI(Organization and brief Functions Of each layer) 2.2. TCP/IP(Organization and Brief Functions Of each layer) 2.3. Semesters (Types) of addressing – Physical, Logical (IP), Port, and Specific addresses. 2.4. Transmission (Guided) media and types – performance, advantages and applications 2.5. Network Devices and Network Connectors, Hubs, Repeater, Bridges, Switches, Routers, Gateway.	8	14
	ETH404-3 Recognize different switching techniques and explore their applications.		
3	**Switching Techniques** 3.1 Connection oriented and Connectionless services 3.2 Switching Basics – 3.3 Circuit Switching; 3.4 Packet Switching – 3.5 Datagram approach, Virtual circuit approach. 3.6 Message Switching. 3.7 Frame Relay – Introduction ,The need of Frame Relay 3.8 Frame Relay works, Frame Relay frame format.	6	8
	Sub-total	21	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH404-4 : Detect and correct digital transmission errors and Show Protocols for Noiseless and Noisy Channel.		
4	**Error detection & correction protocol** 4.1 Data Link Control & Protocol – Framing, Flow & Error Control 4.2 Noiseless and noisy channels 4.3 Simple, Stop-N- Wait Protocol. 4.4 Stop-N-Wait ARQ Protocol. 4.5 Go Back N ARQ. 4.6 Selective Repeat ARQ.	06	10
	ETH404-5: Apply knowledge to understand different IEEE Standards		
5	**Wireless LAN and Network security** 5.1 Introduction to wired LAN - IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet (Features) 5.2 Wireless LAN systems - IEEE 802.11 - Architecture- BSS, ESS. 5.3 Physical layer: FHSS, DSSS, OFDM. 5.4 MAC layer – DCF, PCF 5.5 Cryptography: Need, Encryption model	06	10
	ETH 404-6: Summarize application layer protocols and describe its formats.		

6	**Applications Layer (organization, Brief description and applications)**
	6.1 Domain Name System (DNS)
	   Label, Domain name, Domain, Zone.
	  Root Server, Primary Server, Secondary Server,
	  Zone transfer.
	6.2 Simple Mail Transfer Protocol (SMTP), Multipurpose Internet Mail Extension (MIME), POP, IMAP
	6.3 World wide web(www)
	6.4 Uniform Resource Locator (URL)
	6.5 Hyper Text Transfer Protocol(HTTP);
	6.6 IP version 4
		09	16

	Sub-total	**21**	**36**

G : List of Assignments under SLA (Optional)

Sr. No.	List of Assignment (under SLA)	Hours allotted
26.	Tabulate important characteristics of Data communication Network	02

27.	Tabulate important characteristics of commonly available Network.	02
28.	Tabulate important characteristics of commonly available Topologies.	02
29.	Tabulate important characteristics of commonly available Transmission medium.	02
30.	Write a procedure to test Network connectivity.	02
31.	Draw a chart showing Network Model.	02
32.	Study of different types addressing.	02
33.	Study of different types Network Devices.	02
34.	Study of different types Switching.	02
35.	Write procedure to transfer file between two PC.	02
36.	Select specific error correction & detection protocols.	02
37.	Study different types of wireless LAN systems.	02
38.	Draw a cryptography diagram understand working.	02
39.	Study working of DNS,SMTP, MIME,POP,IMAP,HTTP,FTP.	02
40.	Create different types of IP addresses and URL.	02

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Concept of Data Communication	4	4	4	12	ETH 404-1
I / 2	Introduction To Networking	4	6	4	14	ETH 404-2
I / 3	Switching Techniques	2	4	2	8	ETH 404-3
II /4	Error detection & correction	2	6	2	10	ETH 404-4
II /5	Wireless LAN and Network security	2	4	4	10	ETH 404-5
II / 6	Applications Layer	4	8	4	16	ETH 404-6
	Total Marks	18	32	20	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**

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:
6. Lectures cum Demonstrations
7. Class room practices
8. Use of projector and soft material for demonstration
4. Virtual Laboratory

K) Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

LII)   Reference Books:

Sr. No	Name of Book	Author	Publication
1.	Data Communication & Networking	Achyut S. Godbole.	Tata McGraw-Hill Edition
2.	Data Communication & Networking	B.A. Forouzan.	Tata McGraw-Hill Edition(4th Edition)
3.	Data & Network Communication	Michal Miller.	Thomson Delmar Learning

M)   Learning Website & Software

1) www.nptel.ac.in
2) www.tutorialspoint.com/data_communication_computer_network.
3) freevideolectures.com › Networking › IIT Kharagpur.
4) www.concise-courses.com/security/wireshark-basics.

* * *

COURSE ID:
COURSE NAME   : **EMBEDDED SYSTEM**

COURSE CODE   : **ETH405**

COURSE ABBREVIATION   : **HEMS**

D. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	07	
	Tutorial Learning	00	
	Laboratory Learning	04	**02**
	SLH-Self Learning	00	
	NLH- Notional Learning	11	

E. 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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	--	--	150

F. 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.

  * 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)

G. i) RATIONALE: -

Embedded system is a new trend in the field of automation. The subject has been introduced in order to enhance the knowledge of microcontroller programming. This subject will help a student to design small embedded systems and write the code for the same.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: "Develop simple embedded system applications."

M. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH405-1 Classify, Define and State the functions of embedded system

ETH405-2 Choose appropriate family of microcontroller for different applications

ETH405-3 Apply Embedded C programming

ETH405-4 Interpret the communication standards of embedded systems

ETH405-5 Develop the basic embedded system applications using Arduino board
ETH405-6 Analyze the features of Real Time Operating System

Course outcomes and programme outcomes/ programme specific outcomes

(CO- PO/PSO) matrix:

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH405-1	2	2	2	1	-	-	2	2	2
ETH405-2	2	3	2	2	-	-	2	2	2
ETH405-3	2	2	3	3	-	-	2	2	2
ETH405-4	2	2	2	2	-	-	2	3	3
ETH405-5	2	1	2	2	-	-	2	3	3
ETH405-6	3	3	2	3	-	-	2	3	3

N. CONTENT:
II)   Practical exercises
The following practical exercises shall be conducted in the *Laboratory for Microcontrollers developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. No.	Laboratory experiences	CO
17.	Identification of pins of PIC18F452, ATmega328 Microcontrollers	ETH405-2
18.	Identify the different peripherals and its interfacing with PIC and AVR microcontrollers know how on the Development boards available in the laboratory	ETH405-2
19.	* Use an Arduino IDE for ATmega 328 Programming	ETH405-2

Sr. No.	Laboratory experiences	CO
20.	* Use Keil Compiler's integrated Development Environment (IDE) for developing Embedded C programs for 8051 Microcontrollers	ETH405-3
21.	* Development and execution of the program in embedded C for sending data on port lines. 1) Sending ASCII characters/numbers to a particular port 2) LED Blinking continuously 3) LED state control by push button switch 4) Get status of a pin and output it on another pin	ETH405-3
22.	Development and execution of the program in embedded C for arithmetic operation and time delay 1) LED Blinking for 500 times 2) Toggle all the bits of a port with a 250 msec delay in between 3) Sounding a buzzer connected to a port pin upon door sensor sense the open condition	ETH405-3
23.	Development and execution of the program in C to display numbers from 0 to 9 on 7 segment display interfaced with 8051 with a delay in between	ETH405-3
24.	Study of communication Protocols its types: Serial: I2C, CAN, USB, serial peripheral interface (SPI).	ETH405-4
25.	* Study of Wireless protocol : IrDA, Bluetooth, Zigbee, WiFi, LoWPAN	ETH405-4
26.	Serial Communication using RS 485C	ETH405-4
27.		
28.	* Development and execution of the program for switch and LED interface with Arduino UNO	ETH405-5
29.	* Development and execution of the program LCD Interfacing to Arduino UNO board	ETH405-5
30.	Development and execution of the program for speed control of DC motor interfaced with Arduino UNO using PWM	ETH405-5
31.	* Develop an embedded system for home automation with the use of at least 2 sensors and 2 actuators.	All COs
32.	Develop an embedded system for industrial control application with the use of at least 2 sensors and 2 actuators.	All Cos

*Note- * is compulsory practical.*

III) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH405-1 Classify, Define and State the functions of Embedded system		

1	**Introduction to Embedded System**
	1.1. Embedded system
	    1.1.1. Block diagram of Embedded system
	    1.1.2. Embedded system functions and characteristics
	    1.1.3. Classification of Embedded systems
	        1.1.3.1. Small scale, medium scale, large scale
	        1.1.3.2. Sophisticated, standalone
	        1.1.3.3. Reactive/Real time (Soft and Hard)
	    1.1.4.Steps in design and development of embedded system
		07	10

	ETH405-2 Choose appropriate family of microcontroller for different applications		

2	**Microcontroller architectures**
	
	2.1. Microcontroller types, architectures and features of different families with applications
	
	    2.1.1. 8051 Microcontroller family
	
	    2.1.2. PIC Microcontroller family
	
	    2.1.3. AVR Microcontroller family
	
	    2.1.4. ARM Microcontroller family
	
	2.2. Study of a specific microcontroller from above families: AT89S52, PIC18F452, ATmega328 etc.
		07	12

	ETH405-3 Apply Embedded C programming		
3	**Programming 8051 in Embedded C** 3.1. Overview of 8051 architecture 3.2. Embedded C syntax, data types, and time delay 3.3. I/O programming 3.4. Logic operations and conditional control 3.5. Data serialization	07	12
	Sub-total	21	34

Section –II

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH405-4 Interpret the communication standards of embedded systems		
4	**Communication Standards and Protocols** 4.1 Modes of communication: serial, parallel, synchronous and asynchronous 4.2 Serial Communication standards: RS 485, MAX 232 bidirectional Semester converter 4.3 Communication Protocols its types: Serial: I2C, CAN, USB, serial peripheral interface (SPI). 4.4 Wireless protocol : IrDA, Bluetooth, Zigbee, WiFi, LoWPAN (Overview only)	**06**	**10**
	ETH405-5 Develop the basic embedded system applications using Arduino board		

5	**Interfacing & programming Input and Output devices with ARDUINO**
	5.1 Introduction to Arduino- UNO, NANO, MEGA Boards
	5.2 Functional Block diagram of Arduino UNO Board, and Pin functions
	5.3 Introduction to Arduino IDE
	   5.3.1 Functions used in Arduino IDE: math, analog I/O, digital I/O, Timer
	5.4 Peripheral interfacing and programming with Arduino UNO:
	   5.4.1 LED, Switch, Relay
	   5.4.2 LCD, Keyboard
	   5.4.3 Stepper motor, DC Motor , DHT11 and Ultrasonic sensors
		08	**14**

	ETH405-6 Analyze the features of Real Time Operating System		
6	**Introduction to Real Time Operating System (RTOS)** 6.1 Operating System: General and Real time 6.2 Characteristics of Real Time Operating System: Consistency, Reliability, Scalability, Performance, Predictability 6.3 Functions of RTOS:Task Management, Scheduling, Resource allocation 6.4 Features of RTOS: Watchdog Timer, semaphore 6.5 Deadlock: Reason of occurrence, Deadlock detection prevention and ignoring	**07**	**12**
	Sub-total	**21**	**36**

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to Embedded System	04	02	04	**10**	ETH405-1
I / 2	Microcontroller architectures	02	04	06	**12**	ETH405-2
I / 3	Programming 8051 in Embedded C	02	06	04	**12**	ETH405-3
II /4	Communication Standards and Protocols	02	04	04	**10**	ETH405-4
II /5	Interfacing & programming Input and Output devices with ARDUINO	02	04	08	**14**	ETH405-5
II / 6	Introduction to Real Time Operating System (RTOS)	02	06	04	**12**	ETH405-6
	Total Marks	**14**	**26**	**30**	**70**	

P. 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**

Q. Instructional Methods:

27. Lectures cum Demonstrations
28. Class room practices
29. Use of projector and soft material for demonstration
4. Virtual Laboratory

R. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

S. Reference Books:

Sr. No.	Author	Name of Book	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	Dawoud Shenouda Dawoud	Peter Dawoud Serial Communication Protocols and Standards	River Publishers, Denmark, 2020 ISBN: 978-8770221542
5	J.M.Hughes	Arduino: A Technical Reference	O'REILL ISBN: 978-1491921760

T. Learning Website & Software

Sr No	Link/Portal	Description
1	https://www.microchip.com/en-us/toolsresources/develop/microchip-studio	Microchip Studio for AVR® and SAM Devices is an integrated development platform from Microchip
2	http://arduino.cc/	Link for Software Download and installation Arduino Related Hardware and
3	https://learn.sparkfun.com/tutorials/what-is-an-arduino	Arduino Basics
4	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview	Introduction and Concepts of Arduino
5	https://support.arduino.cc/	T technical documentation utorials, data sheets, guides and other
6	https://semiconductors.es/datasheetpdf/219613/ATMEGA32.html	Datasheet for ATmega Microcontrollers
7	https://www.alldatasheet.com/datasheetpdf/pdf/82338/MICROCHIP/PIC16F877A.html	Datasheet for PIC Microcontroller

*****

COURSE NAM : INDUSTRIAL ORGANISATION AND MANAGEMENT
COURSE CODE   : CCH502
COURSE ABBREVIATION   : HIOM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	
	Tutorial Learning	--	
	Laboratory Learning	--	**2**
	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.

   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:

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 Semesters : 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 Semesters 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 Semesters 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

ourse Outcome CCH502-2: Prepare organization structure for small and medium scale industry.

4	**FORMS OF BUSINESS ORGANISATION**	05	5
	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.		
SECTION II			
Course Outcome CCH502.3: Perform duties of stores in-charge, material and finance manager.			
5	**MATERIALS MANAGEMENT**	05	4
	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		
6	**FINANCIAL MANAGEMENT**	05	4
	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		
CCH502.4: Practice industrial safety rules, codes, practices and acts.			
7	**INDUSTRIAL ACT & SAFETY**	05	4
	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		
CCH502.5: Apply various modern management techniques.			
8	**MODERN MANAGEMENT TECHNIQUES**	04	4
	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		
	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 Semester- 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 ID

    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
					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

A. 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.

B. 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.

C. 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/pso) matrix

Note : Correlation Semesters : 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	PSO2
Competency: Work as a marketing personnel for electrical components or business.	3	3	2	2	3	3	3	3	3
CCH503-1:-Interpret different marketing techniques.	3	2	2	2	2	3	3	2	3
CCH503-2:-Identify different types of markets.	3	3	2	3	2	3	3	3	2
CCH503-3:-Carry out different marketing works/functions.	3	3	3	3	2	3	3	2	2
CCH503-4:-Assist in marketing work of industrial products.	2	3	3	3	2	3	3	3	3

CCH503-5:-Carry out market studies for products.	2	3	3	3	2	3	3	3	3

D. CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

II) 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

E. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive Semester- 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**

F. INSTRUCTIONAL METHODS
   a. Lectures cum Demonstrations
   c. Classroom practices

G. TEACHING AND LEARNING RESOURCES:
Chalk board, LCD presentations, Audio presentations, Question Bank

H. 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 ID

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
					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

A. 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.

B. RATIONALE:

A diploma holder in Electrical Engineering now a day finds himself entrusted with managing projects or part there off. 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.

C. 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/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	PSO1	PSO2
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 Semesters : 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

D. 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) 3.1Guidelines 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
	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 4.3Pre-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 5.2Project 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 5.8Brain Communications in a project feed back and forward 5.9 Unscheduled meetings and social get-togethers	8	7
	Total	40	35

E. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive Semester- 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

F. INSTRUCTIONAL METHODS
   a. Lectures cum Demonstrations
   b. Classroom practices

G. TEACHING AND LEARNING RESOURCES:
   Chalk board, LCD presentations, Audio presentations, Question Bank

H. 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)

I. 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 ID:

COURSE NAME   : **INTERNET OF THINGS**

COURSE CODE   : **ETH502**

COURSE ABBREVIATION   : **HIOT**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	00	**01**
	NLH- Notional Learning	07	

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			
--	--	--	--	--	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, *# 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: -

This course equips students with essential IoT knowledge, covering architecture, protocols, security, and real-world applications. They will learn to design smart solutions that enhance efficiency and automation across industries like healthcare, agriculture, and smart cities. The focus of IoT empowers students to drive innovation, optimize resources, and contribute to a smarter, more connected society.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

"Maintain system based on Internet of Things (IoT)."

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH502-1 Describe the fundamental architecture of Internet of Things (IoT).

ETH502-2 Apply programming principles to develop IoT applications with NodeMCU.

ETH502-3 Integrate sensors and actuators in IoT based system.

ETH502-4 Implement IoT communication for data handling.

ETH502-5 Describe IoT based applications in given specific field.

ETH502-6 Apply the fundamentals of 3D printing technology and its applications.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability, and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and maintain	PSO2 Supervision and Providing Solution
ETH502-1	2	2	1	-	-	-	2	2	2
ETH502-2	3	3	3	3	1	1	2	2	2
ETH502-3	3	3	3	2	2	2	3	2	2
ETH502-4	2	2	1	2	1	2	2	3	3
ETH502-5	3	3	3	2	2	2	3	3	3
ETH502-6	3	3	3	3	2	2	3	3	3

F. CONTENT:

I)   Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Internet of Things developed* by the Institute in practical sessions of batches of about 20- 22 students:
(Any 10)

Sr. No.	Laboratory experiences	CO
1	NodeMCU-ESP8266 Hardware Overview and computer interface	ETH502-1
2	Configuration of Arduino IDE for NodeMCU	ETH502-2
3	Implement LED blinking using NodeMCU	ETH502-2
4	Control LED using push button	ETH502-2
5	Measure Light Intensity Using LDR Sensor	ETH502-2
6	Interfacing Humidity sensor with NodeMCU	ETH502-3
7	Interfacing PIR Sensor with NodeMCU	ETH502-3
8	Analyze Object Detection Using IR Sensor	ETH502-3
9	Interface the ultrasonic sensor with NodeMCU and measure the distance form object	ETH502-3
10	Implement Wi-Fi Connectivity in NodeMCU	ETH502-4
11	Implement HTTP web server on NodeMCU to display sensor data.	ETH502-4
12	Monitoring and controlling light intensity using NodeMCU and cloud platform	ETH502-4
13	Design a Smart Street Light System Using LDR & Relay	ETH502-5
14	Implementation of IoT enabled Smart Home applications	ETH502-5
15	Build an IoT-Based Weather Station	ETH502-5
16	Implement a smart energy monitoring solution (PF, Voltage, Current, Energy consumption etc.)	ETH502-5
17	Create an IoT-Based Security System with Motion Detection & Alarm	ETH502-5
18	Create an IoT-Based smart irrigation system	ETH502-5
19	Calibration of 3D printer-bed Semester, temperature calibration, filament flow rate calibration	ETH502-6
20	Printing and assembling multiple parts to create functional objects	ETH502-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH502-1 Describe the fundamental architecture of Internet of Things (IoT).		
1	**Overview if IoT** 1.1 Basics of IoT: need, history, definition, characteristics, architecture of IoT with block diagram, IoT applications 1.2 IoT Semesters & Deployment Templates 1.3 IoT Applications (agriculture, smart home, smart city)	3	
	ETH502-2 Apply programming principles to develop IoT applications with NodeMCU.		
2	**IoT Hardware Platform** 2.1 Overview of NodeMCU ESP8266: Key features and specifications, Hardware architecture and GPIO pins. 2.2 Programming with Arduino IDE: Setting up Arduino IDE for NodeMCU, Creating, compiling, and uploading programs. 2.3 Applications using NodeMCU ESP8266 and Arduino IDE. (Use of functions, string, array, timer, I/O function, PWM, interface LED & switch)	3	
	ETH502-3 Integrate sensors and actuators in IoT based system.		
3	**IoT Sensors and Actuators** 3.1 Sensors: LDR, PIR, DHT11, IR, Gas sensor-MQ, soil moisture sensor, ultrasound. 3.2 Actuators: relay, DC motor, stepper motor, buzzer. 3.3 Programming and Interfacing sensors and actuators with NodeMCU: Gas sensor -MQ 4, Humidity sensor- DHT11, Photo sensors- LDR, PIR, IR with NodeMCU.	3	
	Sub-total	9	

Section –II

Sr. No	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	***ETH502-4** Implement IoT communication for data handling.*		
4	**IoT Communication Protocol and cloud integration** 4.1 Overview of IoT Communication Protocols: HTTP-REST, MQTT, CoAP (features, methods, communication, applications) 4.2 IEEE802.11: Wi-Fi (features, applications), configure Wi-Fi on NodeMCU, Wi-Fi libraries, code for connecting to Wi-Fi networks 4.3 Procedure to create HTTP webserver with NodeMCU 4.4 Introduction to IoT cloud platforms: AWS IoT, ThingSpeak, Google Cloud IoT, Microsoft Azure IoT. (Use any one for demo) 4.5 IoT networking technology: LoRa, NB-IoT, (Features and applications)	4	
	***ETH502-5** Describe IoT based applications in given specific field.*		
5	**IoT Applications** 5.1 Agriculture: Greenhouse control using IoT, Weather forecasting 5.2 Smart City: Street light control system, Traffic control System, Waste management 5.3 IoT based smart energy meter 5.4 Home automation: controlling lights, Fans, and smart lock	3	
	***ETH502-6** Apply the fundamentals of 3D printing technology and its applications.*		
6	**3D Printing for IoT** 6.1 Basic principle of 3D printing, steps in 3D printing process 6.2 Common basic slicer settings (layer height, fill density, supports, platform adhesion-skirt, brim, raft, shell thickness) 6.3 Post processing techniques, need of post processing, steps in post processing 6.4 IoT Enclosures for Prototyping	2	
	Sub-total	9	

G. Assessment Criteria

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	10
	Application	10
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
TOTAL		**50**

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	10
2	Preparedness for practical	10
3	Neat & complete Diagram.	10
4	Observations & handling of instrument.	10
5	Oral Based on Lab work and completion of task	10
TOTAL		**50**

H. Instructional Methods:

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

I. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative c

J. Reference Books:

Sr. No.	Author	Name of Book	Publication
1	Arshdeep Bahga, Vijay Madisetti	Internet of Things: A Hands-On Approach	University Press, ISBN: 9788173719547
2	Raj Kamal	INTERNET OF THINGS Architecture and Design Principles	McGraw Hill Education (India) Private Limited, ISBN: 9789390727384
3	Adrin McEwen & Hakim Cassimality	Designing the Internet of things	Wiley India, ISBN: 9781118430620
4	Sudip Misra, Anandarup Mukherjee, Arijit Roy	Introduction to IoT	Cambridge University Press, ISBN:9781108842952
5	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	Cisco Press, ISBN: 9781587144561
6	Richard Blum	Sams Teach Yourself Arduino™ Programming in 24 Hours	Pearson Education, Inc. ISBN: 9780672337123
7	Rahul Dubey	An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications	Cengage India Private Limited, ISBN: 9789353500931931

K. Learning Website & Software

Sr No	Link/Portal	Description
1	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au th_0130009449730539521875_shared/overview	IoT Platform
2	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au th_01329474210427699229893_shared/overview	"Mastering IoT with Arduino". Infosys Spring board online course for Thinkspeak platform.
3	https://www.arduino.cc/en/software	Arduino IDE software
4	https://www.tinkercad.com/projects subject=arduino&sort=views	Arduino projects on Tinkercad
5	Introduction to Internet of Things - Course (nptel.ac.in)	Complete coverage of IoT
6	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_au th_01384301295320268828657_shared/overview	IoT Automation with ESP8266 with Projects

COURSE ID :
COURSE NAME : **PROJECT**
COURSE CODE : **ETH503**
COURSE ABBREVIATION : **HPRJ**

R. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	**02**
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	02	
	NLH-Notional Learning	06	

S. 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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
---	----	----	----	-----	-----	-----	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, *# 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 inclusion of project in the curriculum provides students with a well-rounded education, blending theoretical knowledge with practical implementation. It equips them with technical expertise, problem-solving abilities, and industry-relevant skills, making them competent professionals in the field of Electronics and Telecommunication Engineering.

Students learn various theoretical concepts related to E**lectronics, Communication systems, Microcontrollers, Signal processing, Networking, and Embedded systems**. A project allows them to apply these concepts in real-world applications, strengthening their understanding. Students gain hands-on experience with **hardware components, circuit design, programming, and troubleshooting techniques**. This enhances their technical competence and makes them industry-ready. It also encourages students to think critically, analyze problems, and develop innovative solutions.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The set of **technical, analytical, problem solving, managerial, and interpersonal skills** that students develop while working on projects. These competencies prepare students for real-world applications, industry roles, entrepreneur and higher studies and prepare them to excel in their career in the field of engineering and technology.

I. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH502-1 Identify the problem through literature survey.

ETH502-2 Select, collect and use required information/knowledge to solve the problem.

ETH502-3 Design a system to solve the identified problem.

ETH502-4 Troubleshoot the hardware and software of designed system.

ETH502-5 Communicate effectively and confidently as a member and leader of team.

ETH502-6 Prepare and present project proposals/project/seminar report.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH502-1	3	3		-	2	1	3	-	2
ETH502-2	3	3	3	3	-	1	3	1	2
ETH502-3	3	3	3	3	3	3	3	3	3
ETH502-4	3	-	3	3	-	2	3	3	3
ETH502-5	3	-	-	2	3	3	-	2	2
ETH502-6	3	-	-	-	3	3	3	-	3

J. CONTENT:

Project activity is performed in groups. A group can be of minimum 2 and maximum of three students. Group formation of students and allotment of guide should be done at the beginning of the semester by Project Coordinator.

In order to inculcate following skills into students, faculty should guide them to select proper projects with respect to sub points given under each skill.

1. Technical Proficiency
- Application of core electronics principles in designing, analyzing, and testing circuits.
- Hands-on experience with **microcontrollers, sensors, actuators, and embedded systems**.
- Proficiency in **circuit simulation tools** like Proteus, Multisim, and MATLAB.
- Understanding and implementation of **PCB design, soldering, and prototyping** techniques.

2. Practical Problem-Solving Skills
- Ability to identify, analyze, and troubleshoot **hardware and software issues**.

- Development of innovative solutions for **real-world problems in automation, IoT, and communication systems**.

- Integration of **analog and digital circuits** for improved system efficiency.

3. Industry Relevance and Employability
- xposure to **emerging technologies** like IoT, robotics, wireless communication, and smart systems.

- Hands-on experience with **programming languages such as C, Python, and Embedded C** for electronics applications.

- Knowledge of **industry standards, safety regulations, and sustainable electronics design**.

4. Project Management & Teamwork
- Effective planning, execution, and management of projects within **time and budget constraints**.

- Enhancement of teamwork and leadership skills through **collaborative project development**.

- Experience in preparing **technical documentation, project reports, and research papers**.

5. Innovation and Entrepreneurial Opportunities
- Encouragement to develop **new product ideas, prototypes, and innovative solutions**.

- Opportunities for **startup incubation, patents, and commercializing project ideas**.

- Contribution to advancements in **electronics, automation, and communication technologies**.

6. Communication and Presentation Skills
- Ability to **document and present technical findings** effectively.

- Development of **public speaking and technical writing skills** for conferences, project demonstrations, and job interviews.

- Exposure to **industry practices in project documentation and report preparation**.

Project should be performed in stages as given below. Each stage is addressing one CO.

Stage	CO	Description of Activity to be performed by student

Stage-I **Project Selection and Planning**	CO1	- Identify project domain (Hardware, software, Embedded, IoT, Communication, networking etc.) - Select a project topic based on interest and feasibility - Define project objectives and scope - Conduct preliminary research and literature review - Form a project team and assign roles - Prepare a project proposal and seek approval from faculty
Stage-2 Requirement Analysis	CO2	- Gather user/client requirements (if applicable) - Study technical and functional requirements - Perform feasibility study (technical, financial, and operational) - Prepare Software Requirement Specification (SRS) or technical documentation
Stage– 3 Design and Development	CO3	- Create system architecture or technical design - Develop flowcharts, circuit diagrams, or CAD models (depending on project type) - Select appropriate tools, software, or materials - Start coding, prototyping, or fabricating the project - Test individual modules/components
Stage–4 Testing and Implementatio n	CO 4	- Perform unit testing of different modules - Integrate all components and perform system testing - Debug and fix errors - Conduct performance evaluation and quality testing - Deploy or demonstrate the working prototype
Stage –5 Presenting and demonstrating the project to enhance technical communication	CO5	- Clearly explain your work using technical terms that everyone understands. - Document your findings, test results, and changes systematically. - Confidently communicate project idea, progress and results to faculty and evaluators. - Prepare and assign speaking roles for team presentation. - Address disagreements professionally focusing on solutions.

Stage – 6 Documentation and Report Writing	CO6	• Prepare detailed project documentation • Include introduction, methodology, design details, results, and conclusion • Format the report as per the institution's guidelines • Cite references and include diagrams/screenshots • Create a PowerPoint presentation summarizing the project • Demonstrate the working model or prototype to faculty and other students • Answer questions from them • Collect feedback and make necessary improvements.

I :-Assessment Criteria
i) Self-Learning Assessment of Project: -
Assessment of each CO is done for 50 marks as per Rubrics given below. Average marks of all COs will be marks allotted to SLA out of 50.

1. Project Proposal & Planning CO 1: (50 Marks)

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Project Idea & Relevance	The idea is innovative, feasible, and highly relevant to the field.	The idea is relevant and feasible but lacks innovation.	The idea is acceptable but needs improvement in feasibility or relevance.	The idea is weak or not well-defined.	The idea is unclear or lacks purpose.
Problem Definition & Objectives	Clearly defined problem statement with well-structured objectives.	Clear problem statement with minor refinements needed.	Problem statement is somewhat clear but objectives need more clarity.	Problem statement is vague and lacks clear objectives.	Problem statement is unclear and objectives are missing.
Feasibility Study	Strong technical, financial, and operational feasibility analysis.	Feasibility analysis is done but needs minor refinements.	Feasibility study is present but lacks depth.	Feasibility study is incomplete or weak.	No feasibility study provided.
Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

2. **Requirement Analysis & Literature Review (50 Marks)**

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Understanding of Requirements	Requirements are well-identified, structured, and well-documented.	Most requirements are identified but need minor refinements.	Requirements are identified but lack depth and clarity.	Some requirements are missing or poorly defined.	Requirements are unclear or not defined.
Literature Review	Extensive review with relevant references and a	Adequate research with good references.	Basic research with minimal references.	Limited research with weak references.	No research or references provided.
Finalizing requirements	90% finalized	75% finalized	60% finalized	40% finalized	20% finalized
Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

3. **Design & Methodology (50 Marks)**

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)

System Design / Technical Design	Well-structured design with detailed diagrams/models.	Design is mostly complete but needs minor improvements.	Basic design provided with missing details.	Design is incomplete or lacks clarity.	No proper design provided.
Tools & Technology Used	Appropriate selection and justified use of tools and technologies.	Mostly appropriate tools with minor improvements needed.	Tools are relevant but not well justified.	Tools are inappropriate or not well applied.	No proper tools/technologies used.
Implementation Plan & Timeline	Well-defined timeline with tasks properly scheduled.	Timeline is defined but minor adjustments needed.	Timeline is present but lacks clear milestones.	Timeline is vague or not well-structured.	No proper timeline provided.
Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

4. **Testing and Implementation (50 Marks)**

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Development & Execution	Project is progressing as per plan with major	Good progress but minor delays in execution.	Project is moving forward but	Limited progress with significant delays.	No progress made.

	milestones achieved.		with some major delays.		
Technical Skills & Implementation	Strong technical skills applied effectively in the project.	Good technical skills but minor improvements needed.	Basic technical skills applied but needs improvement.	Weak technical implementation with errors.	Poor or no technical implementation.
Testing Procedures	Well-defined test cases and rigorous testing performed.	Testing performed with minor missing elements.	Basic testing done but lacks thoroughness.	Minimal testing with errors remaining.	No testing conducted.
Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

5. Presenting and Demonstrating (50 Marks)

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Bug Fixing & Improvements	Identified and resolved all critical issues.	Fixed most issues but some minor ones remain.	Fixed some major issues but minor bugs still exist.	Attempted to fix issues but project still has major flaws.	No bug fixing or improvements done.
Teamwork & Collaboration	Excellent coordination and teamwork among members.	Good teamwork with minor communication issues.	Teamwork is fair but lacks consistency.	Weak teamwork with noticeable conflicts.	No teamwork or collaboration evident.

Project Demonstration	Working model demonstrated effectively.	Working model with minor glitches.	Partially working model demonstrated.	Attempted but model is non-functional.	No demonstration.
Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

6. **Documentation & Report Writing (50 Marks)**

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Clarity & Structure	Well-organized report with clear structure.	Mostly clear with minor formatting issues.	Basic structure but lacks clarity in some sections.	Poorly structured with many missing elements.	No proper report or very disorganized.
Technical Details & References	Detailed technical content with proper citations.	Good technical content but minor gaps.	Basic technical details with minimal references.	Poor technical content with weak references.	No technical details or citations provided.
Presentation Quality	Well-structured, engaging, and professional.	Good presentation with minor refinements needed.	Basic presentation but lacks engagement.	Poor presentation with many issues.	No proper presentation.

Project diary and documentation	Entries are consistently recorded, well-organized, and timely.	Most entries are timely and well-organized.	Some entries are missing or lack consistency.	Few entries recorded on time.	No entries recorded on time.
Punctuality and overall contribution	Always takes responsibility for assigned tasks and ensures completion.	Responsible but missing timely completion of task	Usually responsible but may need reminders.	Sometimes neglects tasks or requires frequent follow-ups.	Often fails to complete tasks or ignores responsibilities.

ii) Summative Assessment of Project:
External examiner will do the assessment as per rubrics given below for 50 Marks.

Criteria	Excellent (10 or 9)	Good (8 or 7)	Satisfactory (6 or 5)	Needs Improvement (4 or 3)	Poor (2 or 1)
Technical Knowledge & Application	Deep understanding, innovative solutions applied effectively	Good application of concepts with minor errors	Basic understanding but lacks innovation	Limited knowledge, frequent mistakes	Poor understanding, major errors in application
Design & Methodology	Logical, well-structured, and technically sound design	Mostly well-designed but has minor flaws	Basic structure but lacks depth or efficiency	Weak design, lacks structure or technical depth	Poorly structured, ineffective methodology
Implementation & Execution	Fully functional project with excellent performance	Mostly functional with minor issues	Partially functional but significant limitations	Limited functionality, major issues	Project does not function properly
Presentation & Documentation	Well-structured, detailed, error-free report with strong visuals	Well-documented, minor errors in formatting or content	Basic report with some errors, weak visuals	Poorly structured report with missing details	No report or poorly written and formatted document

Conclusion Contribution	Strong conclusion with insightful recommendations and real-world impact	Good conclusion, minor lack of depth	Basic conclusion with minimal recommendations	Weak or missing conclusion, little relevance	No clear conclusion or impact

Maximum Marks of Summative assessment = 50

SEMESTER VI COURSES

COURSE ID:
COURSE NAME : OPTICAL FIBER &SATELLITE COMMUNICATION
COURSE CODE : ETH406
COURSE ABBREVIATION : HOSC

T. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	Tutorial Learning	00	
	LaboratoryLearning	02	
	SLH-SelfLearning	02	
	NLH-Notional Learning	08	

U. 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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	-	-	25	10	150

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: @InternalAssessment, #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: -

Optical communication technology is developing at very fast pace. Cost trends for fiber vs copper, better transmission quality, high data rate, large band width, and reduction in fiber maintenance expense are the major reasons for fast adaptation of this mode of communication. Today in different communication scenarios satellite applications plays important role. The knowledge of satellite communication systems and equipment is very essential. This course will facilitate students to apply the basic principles of optical communication system and satellite communication system to maintain different types of applications based on it.

ii) INDUSTRY/EMPLOYEREXPECTED OUTCOME

a. Maintain optical communication networks.
b. Maintain satellite communication systems.
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K. COURSESEMESTERLEARNINGOUTCOMES(COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs.

ETH406-1 Interpret the functions of the various blocks of optical fiber communication system.
ETH406-2 Measure the optical fiber cable parameters and select proper optical sources and use it in OFC system as per requirement
ETH406-3 Select proper optical detector and use it in OFC system as per requirement
ETH406-4 Select relevant architecture of optical networks for the given application.
ETH406-5 Select up link and down link frequencies for various satellite services.
ETH406-6 Maintain Satellite services.

Course outcomes and programme outcomes/programme specific outcomes
(CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH406-1 Interpret the functions of the various blocks of optical fiber communication system.	2	1	1	1	-	-	-1	2	1
ETH406-2 Measure the optical fiber cable parameters and select	1	2	1	1	--	--	1	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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
proper optical sources and use it in OFC system as per requirement									
ETH406-3 Select proper optical detector and use it in OFC system as per requirement	1	-	1	1	-	--	1	2	1
ETH406-4 Select relevant architecture of optical networks for the given application.	-	-	1	1	--	--	1	2	2
ETH406-5 Select up link and down link frequencies for various satellite services.	1	2	1	1	-	--	-1	2	2
ETH406-6 Maintain Satellite services.	-	2	1	1	--	--	-1	2	1

L. CONTENT:

I) Practical exercises

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

Sr. No.	Laboratory experiences	CO
1.	Identify various layers and parts of an optical fiber cable.	ETH406-1
2.	Test the performance of Pulse width modulator and demodulator (PWM)where optical fiber cable is used as transmission media.	ETH406-1
3.	Calculate Numerical Aperture (NA)and acceptance angle for the given optical fiber cable	ETH406-1
4.	Connect the given Optic cable with relevant optical connector and test the performance of cable.	ETH406-1
5.	Join optical fiber cables using Splicing machines. (Virtual lab/Demonstration in industry/ video scan be used in case of non- availabity of the sicon machine in the lab)	ETH406-1
6.	Test the performance of the given photo-diode (Detector) use LED As an optical source.	ETH406-2

7.	Test performance of given photo-diode (Detector) use LASER As Optical source.	ETH406-2
8.	Calculate bandwidth of optical fiber for Analog Link.	ETH406-2
9.	Observe the change in power Semester of optical fiber due to cleaning effects in the fiber	ETH406-2
10.	Measure attenuation losses for the given length of optical fiber cable.	ETH406-2
11.	Measure bending of the given optical fiber optical cable.	ETH406-2
12.	Demonstrate attenuation losses for the given length of optical fiber cable with the help of OTDR.	ETH406-2
13.	Test performance of optical detector PN Photodiode	ETH406-3
14.	Test performance of optical detector Phototransistor	ETH406-3
15.	Demonstrate the working of OTN. (Virtual lab/Demonstration in industry/videos can be used in case of non-availabity in the lab)	ETH406-4
16.	Test the performance of audio satellite link for the specified uplink and downlink frequency.	ETH406-5
17.	Develop a program using a relevant simulation tool to calculate the time of a satellite for the given velocity and altitude basedonKepler's third law	ETH406-5
18.	To measure the Propagation Delay of signal in a satcom link.	ETH406-5
19.	Detect the satellite link fail operations and re-establish the link.	ETH406-6
20.	Establish a link to transmit and receive three separate signals (audio, video, tone) simultaneously through satellite link.	ETH406-6
21.	To send telecommand and receive the telemetry data and study the operation of codec	ETH406-6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
ETH406-1 Interpret the functions of the various blocks of optical fiber communication system.			
1	**Fundamentals of Fiber Optic Communication** 1.1 Optical fiber communication system: Block diagram, Advantages, Disadvantages, applications 1.2 Construction of fiber optic cable 1.3 Classification based on modes of propagation of light and index profile. 1.4 Reflection, refraction, Total internal reflection (TIR), Snell's law, critical angle, numerical aperture, acceptance angle and acceptance cone - (numerical on above concepts)	9	10

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.5 Splicing techniques- Fusion splice, V-groove splice, and elastic tube splice		
ETH406-2 Measure the optical fiber cable parameters and select proper optical sources and use it in OFC system as per requirement		
2	**Optical Losses and Optical sources** 2.1 Losses in optical fiber: Absorption loss, scattering loss, dispersion loss, radiation loss, coupling g loss 2.2 Optical Time Domain Reflectometer (OTDR): Working Principle, Specification and Applications 2.3 Types and requirements of optical sources. 2.4 Direct and indirect Bandgap Semiconductor 2.5 LED: Concept Homojunction and hetro junction LED, materials used for construction of LED 2.5.1 Types of LED: - a) Planar LED: construction and working b) Surface emitting: construction and c) Edge emitting LED: construction and working 2.6 LASER: - 2.6.1 Principle Of working: Absorption, Spontaneous, stimulated emission & population inversion of radiation 2.6.2 Types Of LASERS a) Fabry –Perot Cavity Resonator- construction and working b) Semiconductor injection laser- construction and working Optical Detectors.	12	14
ETH406-3 Select proper optical detector and use it in OFC system as per requirement		
3	**Optical Detectors** 3.1 Requirements of optical detectors and Principle of optical photo detectors 3.2 Types of photo detectors 3.3 Photo detector characteristics – quantum Efficiency, Responsivity 3.4 p-n Photodiode 3.4.1 construction and working, 3.4.2 Electrical Characteristic 3.4.3 Spectral response 3.5 p-i-n photodiode 3.5.1 Construction and working, 3.5.2 Electrical Characteristic, 3.6 Avalanche photodiode 3.6.1 Construction and working 3.6.2 Spectral response,	9	10

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.6.3 APD characteristics: - sensitivity, Operating speed, noise 3.7 Phototransistor – 3.7.1 construction and working, 3.7.2 Electrical characteristics		
	Sub-total	**30**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH406-4 Select relevant architecture of optical networks for the given application.		
4	**Optical network.** 4.1 Optical Network Components: Working principle and types of couplers, isolators, Circulators, Multiplexers, and filters, Amplifiers, Splitter, Optical Switches, wavelength converters. 4.2 WDM: Basic Concept, Features. 4.3 SONET: Architecture only. 4.4 **System considerate:** System requirement, Link margin, Power penalties: Definition and causes only, Link Power Budget, Rise time Budget, Power Budgeting process: example to calculate a link loss budget and Rise time Budget (use a tabular or spreadsheet form).	10	12
	ETH406-5 Select uplink and down link frequencies for various satellite services.		
5	**Overview of Satellite Systems.** 5.1 Working principle, concepts and basic components of Satellite system Earth segment, Space segment, active and passive satellite, geostationary and geosynchronous satellites 5.2 Frequency allocations for satellite services, Uplink and downlink frequency, satellite frequency bands 5.3 Basic terminologies used in satellite communication: latitude, longitude, look angle, elevation angle, station keeping, propagation delay time , velocity, look angle and footprint 5.4 Communication Satellite orbits and its types: LEO, MEO, elliptical orbit and GEO, parameters and characteristics of various orbits Kepler's law, Apogee and Perigee Heights,	10	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Orbit Perturbations, Effects of a non-spherical earth, Atmospheric drag, effect of eclipse on satellite motion		
	ETH406-6 Maintain Satellite services.		
6	**Satellite segments and Services** 6.1 Satellite earth station: Block diagram; Antenna subsystem, LNA, Power subsystem, Telemetry Tracking and Command (TTAC) subsystem, Attitude Control, spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal control transponder: Single, double conversion and regenerative type 6.2 Space link: Equivalent Isotropic Radiated Power (EIRP), Transmission Losses: Free-space transmission loss, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionosphere losses 6.3 Satellite Applications: GPS: Global positioning system (GPS): concept, working principle, transmitter, and receiver	**10**	**12**
	Sub-total	**30**	**36**

M. List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	List out the specification of various optical devices used in the industries.	02
2.	Using LED as optical source, photodiode as optical detector and plastic fiber cable make prototype optical communication system.	02
3.	Undertake Internet survey for various optical fiber cables available in market.	02
4.	Undertake a survey of different OTDRs available in market, along with their specifications.	02
5.	Prepared report on splicing techniques used at RailTel, Reliance and BSNL or any other such organization.	02
6.	Make flow diagram of Fiber to Home (FTH).	02
7.	Visit any earth station nearby to your house/college and observe the function of different components of satellite system and submit report on it.	02
8.	Write report on various antennas and modulation techniques used for television signal transmission.	02
9.	Visit ISRO website and collect the information related to satellite launching and submit report on it.	02
10.	Collect the information related to Indian satellites program.	02

11.	Prepare an Internet based report on the different types of launch vehicles used for satellite launching.	02
12.	Prepare a survey report on the different types of antennas used for Satellite communication.	02

**Eight out of 12 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Fundamentals of Fiber Optic Communication	2	4	4	10	ETH406-1
I / 2	Optical Losses and Optical sources	2	8	4	14	ETH406-2
I / 3	Optical Detectors	2	8	-	10	ETH406-3
II /4	Optical network	4	4	4	12	ETH406-4
II /5	Overview of Satellite Systems	4	6	2	12	ETH406-5
II / 6	Satellite segments and Services	2	8	2	12	ETH406-6
	Total Marks	16	38	16	70	

O. 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	Marksallotted
1	Attendanceatregularpractical	05
2	Preparednessforpractical	05

3	Neat& completeDiagram.	05
4	Observations& handlingofinstrument.	05
5	OralBasedonLabworkandcompletionoftask	05
	TOTAL	**25**

P. Instructional Methods:

9. Lectures cum Demonstrations
10. Classroom practices
11. Use of projector and soft material for demonstration
4. Virtual Laboratory

Q. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

R. Reference Books:

Sr. No	Name of Book	Author	Publication
1	Electronic communications Systems: Fundamentals Through Advanced	Tomasi,Wayne	PearsonEducationIndia, NewDelhi **ISBN-13:**978-8131719534
2	FiberOptic Communication	Kolimbiris, Harold	Pearson Prentice Hall, New Delhi,2004;ISBN978-81-317-1588-8
3	TheABCsofFiberOptic Communication	Warier,Sudhir	ARTECHHOUSE, Canton street Norwood,MA,ISBN9781630814144
4	FiberOpticCommunication	Kieser,	McGrawHillHigherEducation,New Delhi ,2013, ISBN: 9781259006876,
5	Data Communications and Networking	Gerd Forouzan, BehrouzA	Mc Graw Hill Higher Education, New Delhi, 2013, ISBN: 9781259064753
6	Optical Fiber Communications Principles and practice	Senior,JohnM.	Pearson EducationLimited, New Delhi,2010,ISBN: 9788131732663,
7	Satellite Communications	Roddy Dennis	TataMcGraw-Hill,NewDelhi,fourth edition ,2017 **ISBN-13:**978-0070077850

8	Satellite Communication	Katiyar, Sapna	Katsonpublications, 3"edition2013 ISBN-978-93-5014-481-7
9	Satellite communication concepts and applications	RaoRajaK.N.	PHIlearningPrivatelimited ,New Delhi , second edition, 2012 ISBN-978-81-203-4725-0
10	Satellite communication systems, techniques and technology	Gerard Maral, Bousquet Michel, Zhili Sun	Wileypublication, NewDelhin5th Edition,2009 ISBN: 978-0-470-71458-4

S. Learning Website & Software

a) Opticalwavelength bands:
http://www.bbcmag.com/2008issues/june08/BBPJune08OtoL.pdf

b) Forvirtuallab:-http://iitg.v1ab.co.in/?sub=59&brch=269

c) For virtuallab:-http://vlab.co.in/

d) LEDdatasheet:-http://www1.futureelectronics.com/doc/EVERLIGHT%C2%A0/334-15 TlCl-4WYA.pdf

e) Forfibercleaningvideo:https://www.youtube.com/watch?v=MMmRdFs96JY

f) http://www.netes.com.tr/uploadx/dosyalar/93DA75C4C94A4B78E5E0SEDBBfl3SF0AA.pdf

g) https://recommendedforyou.xyz/books/g4/25739?q=Sate1lite%20communication%20lab%20manual

h) http://istc.co.in

i) https://www.isro.gov.in/

j) https://www.nasa.gov/

g) http://www.satcoms.org.uk/satellite/vsat-tutorials.asp?

****

COURSE ID :
COURSE NAME   : PLC and SCADA
COURSE CODE   : ETH407
COURSE ABBREVIATION   : HPCS

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	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	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.

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:

PLCs and SCADA systems are widely used in industrial automation. With the growth of smart factories and the Internet of Things, automation expertise is highly valued. PLC and SCADA professionals are sought after for process improvement and automation in industries worldwide. There is skill expansion with hands-on skills with ladder logic programming, PLC troubleshooting, and SCADA system integration. SCADA systems can collect data for predictive maintenance and operational analysis, supporting real-time decision-making.

Knowledge in SCADA will help students understand how data can be monitored, visualized, and controlled remotely. This will help in developing skills to improve system efficiency and minimize downtime by automating manual processes.

PLCs are critical in maintaining process accuracy, safety, and reliability. PLC and SCADA knowledge will enhance student's ability to design more complex and industrial-grade automation solutions. Industries increasingly rely on automation for cost reduction, production scalability, safety enhancement, and operational visibility. Mastery of PLC and SCADA equips employees to meet these needs, making them highly desirable candidates.

D.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. **Proficiency in Industrial Automation**
   The students will understand PLC programming, ladder logic, and SCADA system configuration for real-time process control and monitoring.

2. **Data Collection and Remote Monitoring**
   Familiarity with SCADA's role in PLC based systems, collecting and analyzing real-time data for predictive maintenance, reporting, and enhanced decision-making.

E. COURSE SEMESTER LEARNING OUTCOMES (COs):

ETH407-1 Identify various components PLC and illustrate their function
ETH407-2 Select PLC input and output modules as per need of application
ETH407-3 Interpret and apply various PLC instructions

ETH407-4 Develop ladder diagram programming for various industrial applications

ETH407-5 Enable to design and implement basic SCADA solutions for industrial automation.

ETH407-6 Develop various industrial applications using PLC SCADA interfacing

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH407-1 Identify various components PLC and illustrate their function	-	-	-	-	-	-	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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH407-2 Select PLC input and output modules as per need of application	-	2	2	-	-	-	2	2	2
ETH407-3 Interpret and apply various PLC instructions	-	2	2	-	-	-	2	2	2
ETH407-4 Develop ladder diagram programming for various industrial applications	-	3	3	3	3	3	3	3	3
ETH407-5 Enable to design and implement basic SCADA solutions for industrial automation	-	3	3	3	2	-	3	3	3
ETH407-6 Develop various industrial applications using PLC SCADA interfacing	-	3	3	-	3	3	3	3	2

F. CONTENT:
i) PRACTICAL EXERCISES:
The following practical exercises shall be conducted in the *Laboratory for Programmable Logic Controller* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. No.	Laboratory experiences	CO
1.	Identify various parts of given PLC and front panel status indicators.	ETH407-1

2.	Perform the PLC software installation for given PLC and perform switching between PLC operating modes: RUN, STOP, REMOTE and PROGRAM modes.	ETH407-1
3.	Demonstration of Sinking and Sourcing in a DC Input Module.	ETH407-2
4.	Demonstration of Sinking and Sourcing in a DC Output Module.	ETH407-2
5.	Demonstrate correct wiring techniques for interfacing input and output devices with a PLC.	ETH407-2
6.	Identifying and Configuring given PLC I/O Addresses.	ETH407-3
7.	Write and Verify truth table of Logic gates by execution of ladder program.	ETH407-3/4
8.	Write and verify ladder program for blinking of two lamps by using timer.	ETH407-3/4
9.	Write and verify ladder program for traffic signal control for two way directions.	ETH407-3/4
10.	Write and verify ladder program for elevator control.	ETH407-3/4

11.	Write and verify ladder program for metallic and non-metallic object counter using Up Counter.	ETH407-4
12.	Write and verify ladder program for any analog sensor such as RTD, thermocouple, thumbwheel switch, etc.	ETH407-2/3/4
13.	Develop / test ladder program for rotating stepper motor in forward and reverse direction at constant speed.	ETH407-2/3/4
14.	Perform the given SCADA Software Installation for interfacing given PLC	ETH407-5
15.	Use various functions of SCADA simulator editor to develop simple program.	ETH407-5
16.	Develop a SCADA mimic diagram and tag database for ON-OFF control of lamp.	ETH407-6
17.	Develop a SCADA mimic diagram and tag database for Tank Semester control system.	ETH407-6
18.	Develop a SCADA mimic diagram and tag database for traffic light control system.	ETH407-6
19.	Develop a SCADA mimic diagram and tag database for conveyor system.	ETH407-6
20.	Create trend for any one application for above experiment.	ETH407-6

ii) Theory:

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH407-1 Identify various components PLC and illustrate their function		

	PLC Fundamentals
	1.1 Evolution and Role of PLC in Automation
	1.2 Advantages and disadvantages of PLC
	1.3 Different systems for Industrial automation: PLC, HMI, SCADA, DCS, Drives (only introduction)
	1.4 PLC Classification based on Type and Size: Fixed PLC and Modular PLC (nano/pico , mini, micro, medium, large)
	1.5 PLC Architecture: Block diagram and description
	    1.5.1 CPU –function, scanning cycle,
	    1.5.2 Power supply- function, Block diagram.
	    1.5.3 Memory – function & organization of ROM & RAM
	    1.5.4 Input modules- function, diff. input devices used with PLC(only name & their uses)
	    1.5.5 Output modules- function, diff. output devices used with PLC(only name & their uses)
	1.6 PLC Operation
	    1.5.1 PLC operation modes
	    1.5.2 PLC operating cycles
	1.7 PLC characteristics
	    1.7.1 Racks
	    1.7.2 Application Specific Modules
	    1.7.3 Redundancy
	    1.7.4 Speed of Execution
		10	12

	ETH407-2 Select PLC input and output modules as per need of application		

2	**PLC Hardware**
	2.1 Discrete input modules:
	    2.1.1 Block diagram,
	    2.1.2 Sinking and sourcing concept in DC input modules.
	    2.1.3 Specifications of AC and DC input modules.
	2.2 Discrete output modules:
	    2.2.1 Block diagram description,
	    2.2.2 Specifications of AC and DC output modules.
		08	08

	2.2.3 Sinking and sourcing concept in DC Output Module
	2.3 Wiring diagram to interface input and output devices to input
	   and output module of PLC
	2.4 Analog input and output modules:
	   2.4.1 Block diagram,
	   2.4.2 Typical wiring details for interfacing i/o devices
	   2.4.3 Specifications
	I/O module selection criterion		

	ETH407-3 Interpret and apply various PLC instructions		

3	**PLC Instruction Set**
	3.1 I/O addressing of PLC
	3.2 Relay type instructions - NO, NC, One shot, Latch and
	   Unlatch.
	3.3 Timer instructions - On delay timer, off delay
	   Timer, Retentive timer and Timer reset.
	3.4 Counter instructions - up counter, down counter, high speed
	   counter, counter reset.
	3.5 Comparison instructions – Equal, Not equal, Greater, Greater
	   than equal, Less, Less than equal, Limit test.
	3.6 Arithmetic Instruction: ADD,SUB,MUL,DIV, NEG
	3.7 Data handling instructions – Move, Masked Move.
	3.8 Logical instructions – AND, OR, EX-OR, NOT.
	3.9 Miscellaneous instructions – Sequencer instructions (SQI,
	SQO, SQL, SQC), scale with parameter, subroutine and PID
	instructions.
		12	14

	Sub-total	30	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH407-4 Develop ladder diagram programming for various industrial applications		

4	**PLC Programming and Applications**
	4.1 Ladder Programming for logic functions
	4.2 PLC ladder programming for Boolean Algebra
	4.3 Simple programming examples using ladder programming language based on relay, timer, counter, logical, comparison, Data handling and Miscellaneous instruction.
	4.4 PLC applications based on
	    4.4.1 Object counter
	    4.4.2 Motor/Lamp sequence control
	    4.4.3 Two way traffic light control
	    4.4.4 Car parking system
	    4.4.5 Tank Semester control
	    4.4.6 Bottle filling plant
	    4.4.7 Stepper motor control
	    4.4.8 Elevator Control
	4.5 Programming based on analog sensor such as ADC, thumbwheel switches, RTD/thermocouple
		10	14

	ETH407-5 Enable to design and implement basic SCADA solutions for industrial automation.		

5	**Introduction to SCADA systems**
	5.1 Introduction to SCADA,
	5.2 Typical SCADA architecture/block diagram,
	5.3 Types of SCADA:
	    5.3.1 Single Master Single Remote
	    5.3.2 Single Master Multiple Remote
	    5.3.3 Multiple Master Multiple Remote
	5.4 Benefits of SCADA
	5.5 SCADA system hardware
	    RTUs, MTUs, Communication System
	5.6 Various editors of SCADA (only list)
		08	10

	ETH407-6 Develop various industrial applications using PLC SCADA interfacing		

| 6 | **SCADA Interfacing and Applications**
 6.1 Interfacing SCADA system with PLC: Connection diagram, Object linking and embedding for process control (OPC) architecture
 6.2 Steps in creating SCADA screen for simple object
 6.3 Steps for linking SCADA objects (defining tags and items) with PLC ladder program using OPC
 6.4 Concept of tags, Types of tags, addressing of tags
 6.5 Applications of SCADA
     6.5.1 ON-OFF control of lamps
     6.5.2 Traffic light control
     6.5.3 Tank Semester control
     6.5.4 Elevator system
     6.5.5 Conveyor system
     6.5.6 Water distribution system | 12 | 12 |
| | **Sub-total** | **30** | **36** |

G. List of Assignments under SLA:

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Write a report on the history of PLCs (since the 1960s) and how they replaced relay-based control systems.	02
2.	Prepare a power point presentation explaining how all these systems (PLC, HMI, SCADA, DCS and Drives work together in an automated factory.	02
3.	Write a report on how redundancy increases system reliability and minimizes downtime in critical industries.	02
4.	Provide examples of where application specific modules are used in industries.	02
5.	Discuss how input and output modules protect connected devices from high currents or voltage spikes.	02
6.	Design wiring diagrams for interfacing common input devices (e.g., push buttons, limit switches, sensors) and output devices (e.g., relays, motors, lamps) to PLC input/output modules.	02
7.	Discuss safety considerations when wiring and interfacing external devices to PLC modules.	02
8.	Create wiring diagrams for connecting analog sensors (e.g., temperature sensors, pressure transducers) to analog input modules.	02
9.	Design a wiring diagram for controlling analog output devices (e.g., variable speed drives, proportional valves) with an analog output module.	02
10.	Write a case study for selecting input and output modules for a hypothetical automation project, explaining the rationale behind your choices.	02

11.	Design a sequence control program using the SQO instruction to control a series of outputs (e.g., 4-way traffic light controls).	02
12.	Create a program using subroutines to perform repetitive tasks (e.g., controlling multiple conveyor belts with the same logic). Explain how subroutines help modularize and simplify large PLC programs.	02
13.	Design a basic PID control program (or write the pseudo code) to control a temperature system or motor speed. Discuss the benefits of using PID control in industrial processes.	02
14.	Combine multiple instructions (e.g., timers, counters, comparison, and arithmetic) in a single program to solve a real-world automation problem (e.g., controlling a filling station, traffic light, or batch processing system). Document your program logic and explain how each instruction contributes to achieving the control objective.	02
15.	Create a real-world application that demonstrates multiple logic gates working together (e.g., controlling a motor based on multiple input conditions).	02
16.	Automatic street light controller: Prepare a PLC based system to control the street light as per the intensity of natural light.	02
17.	Home automation: Implement the versatile automation system for home that can automate any three home appliances	02
18.	Design a SCADA system to monitor tank Semesters, flow rates, pump status, and water quality parameters (e.g., pH Semesters)	02
19.	Write a report on different editors of SCADA	02
20.	Write a brief explanation of how an MTU processes data received from RTUs and issues control commands. Discuss how the MTU is connected to the central monitoring station.	02
21.	Explore SCADA simulation software (e.g., Ignition, WinCC, Intouch) to simulate a simple communication between an MTU and RTU.	02
22.	Write a short report on OPC (Object Linking and Embedding for Process Control) and its role in SCADA-PLC communication.	02
23.	Design a SCADA interface for a simple two-way traffic light system. Use timers to switch between red, yellow, and green lights. Display real-time status indicators for each light.	02
24.	Design a SCADA screen for a 3-floor elevator system. Add buttons for each floor and a visual indicator showing the current floor. Implement control logic to move the elevator up and down and open/close doors.	02
25.	Railway gate automation: Prepare a PLC and SCADA based system to open or close the proto type rai1way gate automatically.	02
26.	Bottle filling station: Prepare a PLC and SCADA based system for proto type bottle filling station.	02

****Six** out of 26 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	**PLC Fundamentals**	4	2	6	12	ETH407-1
I / 2	**PLC Hardware**	2	2	4	08	ETH407-2
I / 3	**PLC Instruction Set**	2	6	6	14	ETH407-3
II /4	**PLC Programming and Applications**	-	4	10	14	ETH407-4
II /5	**Introduction to SCADA systems**	2	4	4	10	ETH407-5
II / 6	**SCADA interfacing and Applications**	-	4	8	12	ETH407-6
	Total Marks	10	22	38	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 Of Concept	05
	Application of Concept	05
Psychomotor	Operating Skills, Observations	05
	Drawing / drafting skills, Results	05
Affective	Discipline and punctuality, Safety measures	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	Conceptual understanding	05
2	Practical performing Skills	05
3	Neat & complete Diagram.	05
4	Observations, results	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	Programmable logic controllers	F.D. Petruzella	Example Product Manufacturer; 3rd edition (2004)
2	Intro. To Programmable logic control	Gary Dunning	Delmar Publishers
3	Industrial Electronics & Control	S.K. Bhattacharya & S. Chaterjee	Tata McGraw-Hill
4	Programmable Logic controller and industrial automation an introduction	Mitra, Madhuchandra; Sengupta, samarjit	Penram international Publication, 2015, Fifth reprint, ISBN:9788187972174
5	Supervisory control and data acquisition	Boyar, S.A.	ISA publication (4th edition) ISBN:978-1936007097

6	Practical SCADA for industry	Baily David; Wright Edwin	Newnes (an imprint of Elsevier), 2003 ISBN:0750658053

M. Learning Website & Software:

Sr. No.	Particulars
1	www.allthingsplc.info
2	www.plcdev.com
3	www.plcacademy.com
4	Software: - www.fossee.com
5	Software: - www.logixpro.com
6	Software: - www.plctutor.com
7	Software: -www.ellipse.com
8	PLC Tutorial (Allen Bradley): - https://www.youtube.com/watch?v=guQwwyyc5Ss&list=PLI78ZBihrkE3nnGIj2 WmHb_GoWjFlfFIu
9	PLC tutorial: - (Siemens): - https://www.youtube.com/watch?v=jzy0so3h_kc&list=PLI78ZBihrkE1yvv_jpds F24RpDF1Pye-z
10	SCADA tutorial (In touch editor): https://youtu.be/3c8VevhxfH4

COURSE ID:
COURSE NAME   **: MOBILE & WIRELESS COMMUNICATION**
COURSE CODE   **: ETH408**
COURSE ABBREVIATION   **: HMCM**

V. LEARNING SCHEME:

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

W. 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	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.

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 next generation of mobile communications technology has already begun to bring various services to consumers and businesses. Mobile communications technology will be one of the most important drivers of industry, economic, societal growth and will also generate millions of new jobs. This course will develop the skills to maintain the latest wireless communication-based applications. This course will account students with revolution in mobile and wireless communication

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry/employer expected outcome through various teaching learning experiences:

"Maintain mobile and wireless communication system"

X. COURSE SEMESTER LEARNING OUTCOMES (COs)

The students will be able to achieve and demonstrate following COs on completion of the course

ETH408-1 Describe concept of Wireless communication and compare various wireless
　　　Standards
ETH408-2 Describe terminologies used and components of Cellular mobile communication
ETH408-3 Analyze basics of cellular mobile communication system.
ETH408-4 Understand principles of GSM System, its architecture and call processing.
ETH408-5 Interpret IS –95 system features, architecture, and call processing.
ETH408-6 Compare short range and long range latest wireless technologies.

**Course outcomes and programme outcomes/ programme specific outcomes
(CO- PO/PSO) matrix**
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH408-1	3	-	-	1	-	-	1	-	--
ETH408-2	3	-	-	-	-	-	1	-	-
ETH408-3	3	3	3	3	2	2	2	3	3
ETH408-4	3	2	2	3	1	2	2	3	2

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 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH408-5	3	2	2	2	2	2	1	3	2
ETH408-6	3	3	3	3	2	2	2	3	2

Y. CONTENT:

I. Practical exercises

The following practical exercises shall be conducted in the *Laboratory* in practical sessions of batches of about 20- 25 students:

Sr. No.	Laboratory experiences	CO
1.	Identify different sections and components of mobile phone such as ringer section, dialer section, receiver section and transmitter section, camera, microphone, speaker,	ETH408-1
2.	Identification inbuilt sensors of Mobile handset and test their performance	ETH408 -1
3.	Test and troubleshoot battery charger and power management section of handset	ETH 408-2
4.	Test and troubleshoot sim card section of mobile handset	ETH 408-2
5.	Determine channel capacity of cellular service area comprised of 4/7/12 macrocells with 8/12/16 channels per macrocell	ETH 408-3
6.	Determine channel capacity if each Macrocell is split into 4 minicell and further each minicell is split into 4 microcells.	ETH 408-3
7.	For the 7-cell cluster and 168 voice channel cellular system, determine assignment of voice channels to each cell if omnidirectional antenna is used at cell site	ETH 408-3
8.	For the 7-cell cluster and 168 voice channel cellular system, determine assignment of voice channels to each sector if 3 sector 120 degree and 6 sectors 60-degree directional antenna is used at the cell site	ETH 408-3
9.	Determine coverage area of a split cell which has radius half of original cell	ETH 408-3
10.	Execute basic AT commands using GSM module	ETH 408-4
11.	Establish a personal area network of mobile devices using Bluetooth	ETH 408-6
12.	Make a hotspot connection on Wi-Fi on any two devices	ETH 408-6
13.	Write a visit report after visiting BSNL Mobile Switching Centre	ETH 408

II. Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH408-1 Describe concept of Wireless communication and compare various Wireless Standards		
1	**Wireless Communication basics** 1.1 Wired versus Wireless Media 1.2 Advantages and Disadvantages of Wireless Communication 1.3 Short range and long-range wireless systems 1.4 First generation wireless mobile radio standard i.e. AMPS and N-AMPS 1.5 Second generation wireless mobile radio standard i.e. GSM And IS-95 1.6 Third generation wireless mobile radio standard i.e. UMTS 1.7 Comparison between these standards	08	10
	ETH 408-2 Describe terminologies, components of Cellular communication		
2	**Basics of Cellular System** 2.1 Cellular fundamentals – cell, cell structure, cell size, cluster 2.2 Cellular communication system – Base station, mobile station, Traffic channel (Forward and Reverse), Control channel (forward and Reverse), Roaming, Handoff 2.3 Basic block diagram of cellular mobile communication System. Concept of MSC, HLR, VLR 2.4 Block diagram of analog and digital cell phone. Block Diagram of Transmitter, Receiver, Frequency synthesizer, Logic section of analog cell phone 2.5 Sensors used in cell phones.	10	10
	ETH408-3 Analyze basics of cellular mobile communication system.		
3	**Fundamentals of Mobile communication** 3.1 Concept of channel capacity. Frequency Reuse technique, Locating cochannel cells, Frequency reuse distance 3.2 Channel assignment Strategies. 3.3 Antennas for base stations 3.4 Handoff strategies 3.5 Interference in cellular systems. 3.6 Techniques to improve coverage and capacity in cellular system – Cell splitting, cell sectoring, Microcell zone concept, Repeaters for range extension	12	14
	Sub-total	30	34

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH408-4 Understand principles of GSM System, its architecture and call processing.		
4	**GSM (Global System for Mobile)** 4.1 G.S.M services & features. 4.2. G.S.M system architecture 4.3 G.S.M radio subsystems. 4.4 G.S.M channel types: GSM traffic channels and control channels 4.5 Call routing in GSM: Mobile terminated call and mobile originated call sequence. 4.6 GSM Frame structure and types. 4.7 Authentication and security in GSM 4.8 Identifiers used in GSM	12	14
	ETH408-5 Interpret IS –95 system features, architecture, and call processing.		
5	**IS – 95 CDMA (Code Division Multiple AAccess)** CDMA Fundamentals 5.1 Frequency and channel specifications of IS – 95 5.2 IS -95 system architecture 5.3 IS – 95 forward and reverse channel structure 5.4 IS – 95 Call processing stages 5.5 Security and authentication in IS – 95 5.6 Handoff types in IS – 95 5.7 Comparison between GSM and IS -95	10	14
	ETH408-6 Compare short range and long range latest wireless technologies.		
6	**Recent Tireless Technologies** 6.1 Features, architecture, frequency band of Wi-Fi 6.2 Features, architecture, frequency band of Bluetooth 6.3 Features of 4 G Mobile system. VoLTE concept, features of VoLTE. 6.4 Features of 5 G mobile systems and services offered 6.5 Comparison of 1G, 2 G, 3G, 4 G mobile systems	08	08
	Sub-total	30	36

Z. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

1) Compare specifications / features of various mobile phones in market

2) Collect information regarding special services provided by various mobile service providers

3) Prepare a report on TRAI regulations related to mobile communication

4) Prepare a report on FCC regulations for spectrum allocation / interference

5) Prepare a report on how radiations from BTS and Mobile handset are dangerous to human

6) Prepare a report on various wireless devices available in market like wireless charger, speakers, handsfree

7) List general procedure to repair mobile handset

8) Prepare a list of equipments and software required to troubleshoot mobile handset

Industrial Visit

Visit nearby BSNL mobile MSC / base station and prepare a detailed report on their setup of system

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Wireless Commuication Basics	6	4	-	10	ETH408-1
I / 2	Basic of Cellular System	4	6	-	10	ETH408-2
I / 3	Mobile Communication	4	6	4	14	ETH408-3
II /4	GSM	6	8	-	14	ETH408-4
II /5	IS_95 CDMA	6	8	-	14	ETH408-5
II / 6	Recent Wireless Systems	4	4	-	08	ETH408-6
	Total Marks	30	36	4	70	

I) ASSESSMENT METHODOLOGIES/TOOLS-

- Formative Assessment (Assessment for Learning)
- Two offline unit tests of 30 marks and average of two-unit test marks will be considered for out of 30 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- For formative assessment of laboratory learning 25 marks

- Summative Assessment (Assessment of Learning)
- End semester summative assessment is of 25 marks for laboratory learning
- End semester assessment is of 70 marks.

a: -Assessment Criteria

iii) Formative Assessment of Practical: -

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

Domain	Particulars	Marks out of 25
Cognitive	Understanding Of Concept	05
	Application of Concept	05
Psychomotor	Operating Skills, Observations	05
	Drawing / drafting skills, Results	05
Affective	Discipline and punctuality, Safety measures	05
TOTAL		**25**

iv) Summative Assessment of Practical:

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

Sr. no	Criteria	Marks allotted
1	Conceptual understanding	05
2	Practical performing Skills	05
3	Neat & complete Diagram.	05
4	Observations, results	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
5. Industrial Visit

K) Reference Books:

Sr. No	Name of Book	Author	Publication
1	Wireless Communications principles & practice	Theodore S. Rappaport	Pearson Education India; 2nd edition (1 January 2010), ISBN : 978-8131731864
2	Wireless Communications	T.L.Singal	McGraw Hill Education (1 July 2017) (India) Private Limited,New Delhi ISBN : 978-0070681781

COURSE ID:

COURSE NAME   : **MICROWAVE ENGG & RADAR SYSTEM**

COURSE CODE   : **ETH505**

COURSE ABBREVIATION   : **HMWR**

H. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	NLH- Notional Learning	06	

I. 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			
3	30	70	100	40	25	10	-	-	25	10	150

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.* 09 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: -

Microwave communication serves as the backbone of terrestrial communication and is essential for mobile communication. It plays a crucial role in providing connectivity in challenging geographical locations and for specialized applications. Microwave links and RADAR systems are well-established solutions in telecommunication. This course is designed to equip diploma engineers with the necessary skills to maintain and manage microwave and RADAR-based telecommunication systems effectively.

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:

• *Maintain microwave and RADAR based communication systems.*

AA.   COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH505-1 Use specified waveguides in microwave communication system.

ETH505-2 Evaluate microwave antenna performance for communication system design.

ETH505-3 Analyze microwave tubes and slow-wave devices for high-frequency amplification.

ETH505-4 Interpret RADAR based systems for range detection.

ETH505-5 Maintain various types of RADAR system for the specified application.

ETH505-6 Demonstrate knowledge of advanced RADAR for sensing and defense.

Course outcomes and Programme outcomes/ Programme specific outcomes (CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH505-1	3	2	2	3	-	-	2	3	2
ETH505-2	3	2	2	3	-	-	2	3	3
ETH505-3	3	2	3	3	-	-	2	3	3

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 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH505-4	3	3	3	3	2	-	2	3	3
ETH505-5	3	3	3	3	2	2	2	3	3
ETH505-6	3	3	3	3	2	2	3	3	3

BB.   CONTENT:
III)   Practical exercises
The following practical exercises shall be conducted in the Laboratory in the practical session of batches of about 20- 22 students. Any 12 experiments should be performed.

Sr. No.	Laboratory experiences	CO
33.	Use the frequency meter with microwave test bench setup to determine the frequency and wavelength of waveguide for TE10 mode.	ETH505-1
34.	Use freeware/open-source simulation tools to perform Practical is related to microwave waveguide.	ETH505-1
35.	Use a microwave test bench to observe the standing wave pattern and measure guide wavelength.	ETH505-1
36.	Use the microwave test bench setup to ensure power division in microwave tees E-plane, H-plane, and E-H plane.	ETH505-2
37.	Determine coupling factor and insertion loss for the given circulator.	ETH505-2
38.	Measure VSWR for the given Microwave load.	ETH505-2
39.	Measure attenuation of the given attenuator.	ETH505-2
40.	Determine the directivity, insertion loss and coupling factor for the given Multi- Hole Directional Coupler.	ETH505-2
41.	Use given microwave test bench setup to measure the gain of the horn antenna.	ETH505-2
42.	Determine the radiation pattern of a horn antenna using a microwave test bench.	ETH505-2
43.	Measure the isolation and insertion loss of a microwave isolator.	ETH505-2
44.	Use the microwave test bench setup to test the performance of the given Reflex Klystron tube.	ETH505-3

Sr. No.	Laboratory experiences	CO
45.	Study the operation and measure the output characteristics of an IMPATT diode.	ETH505-3
46.	Simulate and analyze the working of a PIN diode-based microwave switch.	ETH505-3
47.	Test the performance parameter of the given type of microwave active components on freeware/open-source simulation tools.	ETH505-4
48.	Test the performance of Gunn Diode for the following aspects i. V-I characteristics ii. Output power and frequency as a function of voltage	ETH505-4
49.	Use Doppler RADAR to detect the maximum range.	ETH505-5
50.	Determine the velocity of the moving object with the help of RADAR range.	ETH505-5
51.	Use RADAR system to measure the distance traveled by any object.	ETH505-6
52.	Use freeware/open-source simulation tools to performance Practical related to RADAR communication.	ETH 501-6

IV)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH505-1 Use specified waveguides in microwave communication system		
1	**Fundamentals of Microwave Engineering and Waveguides** **1.1** Microwave frequency spectrum, band designations and applications of microwave in various fields **1.2** Comparison of wave guide with Transmission line **1.3** Types of Waveguides: Rectangular, Circular, Propagation of waves in rectangular waveguides Reflection of waves from a conducting plane, dominant mode, the parallel plane waveguide, cut off wavelength, cut off frequency, group, and phase velocity *(simple numerical)* **1.4** Rectangular waveguide modes: TE, TM TEM, field patterns of TE_{10}, TE_{20}, TE_{11} modes **1.5** Circular waveguide: Advantages, disadvantages	**07**	**10**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	and applications of circular waveguide		
	ETH505-2 Evaluate microwave antenna performance for communication system design		
2	**Microwave Components and Antennas** **2.1** Multiple Junctions: Working principle and applications of E plane, H- plane, Magic Tee, and Rat-race ring **2.2** Ferrites components- Isolator, circulator and Gyrator Accessories: Flanges, Rotating coupling, Bends and corners, Taper, and Twist **2.3** Directional couplers: Two-hole directional coupler: Working principle and applications, directivity, coupling factor and isolation **2.4** Basic microwave antenna: Horn antenna and Dish antenna *(Only basic information of antennas)*	06	12
	ETH505-3 Analyze microwave tubes and slow-wave devices for high-frequency amplification.		
3	**Microwave Tubes and Semiconductor Devices** **3.1** Microwave tubes Classification Two cavity, Reflex klystron: Construction, Modulation, Bunching process, Principle of operation, Magnetron: construction, operating principle, and applications **3.2** Slow wave devices: TWT construction and principle of operation and applications, Compare Klystron and TWT. **3.3** TED (Transferred Electron Devices): Gunn diode-construction, operation principle, modes and application of Gunn diode as an oscillator Avalanche transient time device: **3.4** IMPATT diode construction, operation, and applications **3.5** PIN diode-. construction, operation, and applications Esaki diode: Tunnel diode -V-I Characteristics, equivalent circuit, application as an oscillator and as an amplifier	09	12
	Sub-total	22	34

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH505-4 Interpret RADAR based systems for range detection.		
4	**RADAR Systems and Antenna Mechanisms** **4.1** Basic block diagram of RADAR system **4.2** RADAR performance factors: RADAR range equation, factors influencing range, effect of noise **4.3** Basic pulse RADAR system: Block diagram and description, applications **4.4** Antenna Scanning (types and principle): Horizontal, vertical, helical, and spiral. Antenna Tracking (types and principle): Sequential, conical, and mono pulse **4.5** Antenna feed Mechanism: Horn and Cassegrain feed antenna	07	12
	ETH505-5 Maintain various types of RADAR system for the specified application.		
5	**Doppler RADAR, MTI Systems** **5.1** Doppler effect **5.2** CW Doppler RADAR: Block diagram, operation and application **5.3** FM CW RADAR: Block diagram, operation, and application **5.4** MTI: Block diagram, operation concept of blind speed, application, Automatic target detection RADAR **5.5** Display Methods: A-Scape PPI Beacons	08	12
	ETH505-6 Demonstrate knowledge of advanced RADAR for sensing and defense.		
6	**Advanced RADAR and SONAR Systems** **6.1** Synthetic Aperture RADAR (SAR) and Phased Array RADAR: Principles, working, and applications. **6.2** Over-the-Horizon RADAR (OTHR) and Passive RADAR: Concepts, advantages, and limitations. **6.3** Satellite-Based RADAR Systems: Applications in remote sensing, weather monitoring, and defense. **6.4** RADAR Signal Processing Techniques: Pulse compression, Doppler filtering, and target tracking. **6.5** Emerging Trends in SONAR Technology: Active and passive SONAR, underwater navigation, and military applications.	08	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Sub-total	**23**	**36**

CC.   List of Assignments under SLA

01	Explain the working principles, construction, and applications of E-plane, H-plane, and Magic Tee junctions in microwave systems.
02	Compare microwave tubes (Klystron, Magnetron, TWT) with semiconductor microwave devices (Gunn diode, IMPATT, PIN diode) based on efficiency, application, and limitations.
03	Study the characteristics and applications of different microwave antennas, including horn and dish antennas, and summarize their advantages.
04	Analyze the role of ferrite components (isolator, circulator, gyrator) in microwave communication and their practical applications.
05	Explore the concept of Over-the-Horizon (OTH) RADAR and Passive RADAR, discussing their working principles, advantages, and limitations.
06	Study the applications of Synthetic Aperture RADAR (SAR) in remote sensing and military surveillance and prepare a report on its significance.
07	Explore the emerging trends in SONAR technology, including active and passive SONAR, and discuss their importance in underwater navigation and defense.
08	Explain the concept of wave propagation in rectangular waveguides and derive the cutoff frequency for the dominant TE_{10} mode.
09	Study the working principles and applications of different types of microwave directional couplers and explain their significance in power measurement.
10	Compare active and passive microwave devices used in RADAR and communication systems, highlighting their advantages and limitations.

DD. **: Specification table for setting question paper for semester end theory assessment**

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Fundamentals of Microwave Engineering and Waveguides	2	4	4	10	ETH505-1
I / 2	Microwave Components and Antennas	2	2	8	12	ETH505-2
I / 3	Microwave Tubes and Semiconductor Devices	2	2	8	12	ETH505-3
II /4	RADAR Systems and Antenna Mechanisms	4	4	4	12	ETH505-4
II /5	Doppler RADAR, MTI Systems	4	4	4	12	ETH505-5
II / 6	Advanced RADAR and SONAR Systems	4	4	4	12	ETH505-6
Total Marks		**18**	**20**	**32**	**70**	

EE. **: 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**

FF.   : Instructional Methods:

    30. Lectures cum Demonstrations
    31. Class room practices
    32. Use of projector and soft material for demonstration
    4.   Virtual Laboratory

GG.   : Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

HH.   : Reference Books:

Sr. No.	Name of Book	Author	Publication
1	RADAR systems and radio aids to navigation	Sen, A. K. and Bhattacharya, A. B	Mercury Learning & Information, PVT.LTD. New Delhi, 2017, ISBN: 978-1683921189
2	Microwave Engineering	David M. Pozar	4th Edition, Wiley, ISBN 978-0-470-63155-3
3	Microwave Engineering	Gupta, Sanjeev	Khanna Publication, 3rd edition, 2015, ISBN: 9788174090878
4	Microwave and RADAR Engineering	Gautam, A. K.	SK Kataria Publications. ISBN: 978-9350141519

II. : Text Books

Sr. No	Name of Book	Author	Publication
1	Electronics Communication System	Kennedy, George; Davis, Brendan; Prasanna	Mc Graw Hill, New Delhi, 5th edition, ISBN: 978-0071077828

| 2 | Microwave devices and circuits | Liao Samuel Y | PHI Learning, New Delhi, ISBN: 978-8131762288 |
| 3 | Microwave and RADAR Engineering | Kulkarni, M. | Umesh Publications, New Delhi, 2009, ISBN978-8188114009 |

JJ: Learning Website & Software

Category	Website & Software	Description
Online Courses & Tutorials	NPTEL https://archive.nptel.ac.in/courses/108/103/108103141/	Indian government initiative offering lectures on microwave engineering and RADAR systems.
	Coursera https://www.coursera.org/learn/microwave-antenna	Offers courses on microwave engineering, antennas, and RADAR systems from top universities.
	MIT Open Course Ware https://shorturl.at/EjjC6	Free educational resources on electromagnetic waves, antennas, and RADAR fundamentals.
Simulation Software	HFSS (ANSYS High-Frequency Structure Simulator) https://www.ansys.com/products/electronics/ansys-hfss	Industry-standard electromagnetic simulation software for microwave and RF components.
	CST Studio Suite https://www.3ds.com/products/simulia/cst-studio-suite	Advanced 3D EM simulation software for antenna and microwave circuit design.
	OpenEMS https://www.openems.de/	Free open-source electromagnetic field solver for waveguide and antenna simulations.
	QUCS (Quite Universal Circuit Simulator) https://qucs.sourceforge.net/	Open-source circuit simulator useful for microwave component analysis.

*****

COURSE ID:
COURSE NAME   : INDUSTRIAL INTERNET OF THINGS

COURSE CODE   : ETH506

COURSE ABBREVIATION   : HINI

L. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	NLH- Notional Learning	06	

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M. 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			
3	30	70	100	40	25	10			25	10	150

N. 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)

O. i) RATIONALE: -

The rapid adoption of Industry 4.0 and Smart Manufacturing has led to the integration of Industrial IoT (IIoT) into traditional automation systems. IIoT enables real-time monitoring, predictive maintenance, and remote control of industrial assets, leading to increased efficiency, reduced downtime, and optimized production. This course is designed to equip students with hands-on experience in IIoT technologies, industrial communication protocols, and cloud-based data analytics.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

"Maintain system based on Industrial Internet of Things (IIoT)."

P. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH506-1 Describe the fundamentals of Industrial IoT, Industry 4.0, and automation.

ETH506-2 Configure Raspberry Pi as an IIoT Gateway for industrial automation.

ETH506-3 Interface Raspberry Pi GPIO using Node-RED and Data Visualization using Grafana.

ETH506-4 Implement industrial communication protocols for IIoT data exchange.

ETH506-5 Analyze sensor data using cloud and predictive maintenance.

ETH506-6 Analyze cyber security challenges and IIoT case studies.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability, and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and maintain	PSO2 Supervision and Providing Solution
ETH506-1	2	2	1	-	1	1	2	2	2

ETH506-2	3	3	3	2	1	1	2	2	2
ETH506-3	3	3	3	2	2	2	3	2	2
ETH506-4	2	2	1	2	1	2	2	3	3
ETH506-5	3	3	3	2	2	2	3	3	3
ETH506-6	3	3	3	3	2	2	3	3	3

R. CONTENT:

III)   Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Internet of Things developed* by the Institute in practical sessions of batches of about 20- 22 students:
(Any 10)

Sr. No.	Laboratory experiences	CO
1	Develop a simple PLC ladder logic program for an industrial task	ETH506-1
2	Set up and configure Raspberry Pi OS with network settings and remote access (SSH & VNC).	ETH506-2
3	Execute basic Linux commands to manage files, packages, and services on Raspberry Pi.	ETH506-2
4	Install and configure an MQTT broker (Mosquitto) on Raspberry Pi for IIoT applications.	ETH506-2
5	Install and start Node-RED and create a basic flow using inject and debug nodes.	ETH506-3
6	Interface LED/relay with Raspberry Pi GPIO and control digital output using Node-RED.	ETH506-3
7	Interface push button/switch with Raspberry Pi GPIO and monitor digital input status.	ETH506-3
8	Install and configure InfluxDB and store time-series sensor data.	ETH506-3
9	Install and start Grafana server and access the web interface.	ETH506-3
10	Create dashboards in Grafana to visualize real-time and historical data using charts, gauges, and indicators.	ETH506-3
11	Publish GPIO sensor data using MQTT and subscribe to monitor real-time values.	ETH506-4
12	Establish Modbus TCP/RTU communication between Raspberry Pi and PLC and read registers/coils.	ETH506-4
13	Connect Raspberry Pi with a PLC using Modbus TCP/IP and verify data exchange.	ETH506-4
14	Design and implement a complete IIoT gateway system integrating GPIO/PLC, MQTT, Node-RED, database, and Grafana dashboard.	ETH506-4
15	Send real-time GPIO/PLC data from Raspberry Pi to a cloud platform and verify online monitoring.	ETH506-5
16	Configure threshold-based alerts in Grafana to generate notifications for abnormal sensor/PLC values.	ETH506-5
17	Configure firewall rules on Raspberry Pi to allow only required IIoT services (SSH, MQTT, Node-RED, Grafana).	ETH506-6

IV) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH506-1 Describe the fundamentals of Industrial IoT, Industry 4.0, and automation.		
1	**Introduction to IIoT & Industrial Automation**	6	8
	1.4 Difference between IoT and IIoT		
	1.5 Role of IIoT in Industry 4.0 & Smart Manufacturing		
	1.6 IIoT System Architecture & Deployment		
	1.6.1 IIoT Layers: Sensor, Edge, Gateway, Cloud, Analytics		
	1.6.2 Selecting IIoT Components: Sensors, PLCs, Edge Devices, Cloud		
	1.6.3 Industrial Communication Protocols Overview (Modbus, MQTT, OPC-UA)		
	1.7 PLC Based automation and SCADA system for IIoT (Overview only)		
	1.8 Edge Computing vs. Cloud Computing in IIoT (with Real-World Examples)		
	ETH506-2 Configure Raspberry Pi as an IIoT Gateway for industrial automation.		
2	**Raspberry Pi as an IIoT Gateway**	10	14
	2.4 Importance of IoT gateways in IIoT architecture		
	2.5 Introduction to Embedded Linux and Python for IIoT		
	2.5.1. Basic Linux Commands and File System		
	2.5.2. Python Libraries for IIoT (paho-mqtt, pymodbus, etc.)		
	2.6 Installing and Configuring Raspberry Pi for IIoT		
	2.6.1. Setting up Raspberry Pi OS & networking		
	2.6.2. Connecting to Industrial Ethernet & Wi-Fi Networks (basic firewall/security settings)		
	2.7 Interfacing Raspberry Pi with IIoT Devices		
	2.7.1. Configuring Raspberry Pi as an MQTT Broker		
	2.7.2. Setting up Modbus Server & Client for PLC		

Sr. No	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Communication		
	2.8 Industrial Dashboards (Grafana, Node-RED)		
	ETH506-3 Interface Raspberry Pi GPIO using Node-RED and Data Visualization using Grafana.		

3	**Raspberry Pi GPIO Interfacing & Data Visualization**
	
	3.4 Introduction to Raspberry Pi GPIO
	
	    3.4.1 GPIO pin configuration
	
	    3.4.2 Digital input and output concept
	
	    3.4.3 Pin numbering (BCM/GPIO mode)
	
	    3.4.4 Safety precautions
	
	3.5 Digital Input Interfacing
	
	    3.5.1 Push button / switch interfacing
	
	    3.5.2 Reading sensor signals through GPIO
	
	    3.5.3 Status monitoring
	
	3.6 Digital Output Control: LED interfacing, Relay interfacing, controlling loads using GPIO
	
	3.7 GPIO Access using Node-RED: Installing Node-RED GPIO nodes, Reading GPIO inputs, Controlling GPIO outputs, Creating basic automation flows
	
	3.8 Data Storage using Database (overview): Sending data to InfluxDB
	
	3.9 Data Visualization using Grafana: Connecting database to Grafana, Creating dashboards, Line charts and gauges
		6	12

	Sub-total	**22**	**34**

Section –II

Sr. No	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH506-4 Implement industrial communication protocols for IIoT data exchange.		
4	**Industrial Communication Protocols** 4.6 Modbus: Basics and Working 4.6.1 Introduction to Modbus protocol	8	14

	4.6.2 Modbus RTU and Modbus TCP pverview		
	4.7 MQTT for IIoT Communication		
	4.7.1 MQTT QoS Semesters (0, 1, 2)		
	4.8 Modbus communication between Raspberry Pi & PLC		
	4.9 Data transfer using MQTT		
	4.10 Practical Example: Sending PLC Sensor Data to cloud IoT CoreData transfer from PLC/SCADA to cloud using MQTT		
	4.10.1 Practical Example: Sending PLC Sensor Data to cloud IoT Core		
	4.10.2 Node-RED Implementation for Real-time Data Visualization		
ETH506-5 Analyze sensor data using cloud and predictive maintenance.
5	**Cloud Computing & Predictive Maintenance in IIoT**	**8**	**14**
	6.5 Introduction to cloud computing: Concept of cloud computing, Need for cloud in IIoT, Edge vs Cloud computing		
	6.6 Cloud-based data storage: Sending sensor data to cloud, Basic cloud storage concept, introduction to any one platform (ThingSpeak / AWS IoT or equivalent)		
	6.7 Data Logging & Visualization		
	5.3.1 Real-time data logging		
	5.3.2 Dashboard visualization using Grafana, Node-RED		
	5.3.3 Hands-on: Connecting IIoT data to cloud dashboards		
	6.8 Predictive Maintenance & Industrial Data Analytics		
	5.5.1 Preventive vs. Predictive maintenance		
	5.5.2 Machine Learning for Industrial Analytics		
	5.5.3 Vibration & Temperature-based Fault Detection		
ETH506-6 Analyze cybersecurity challenges and IIoT case studies.
6	**IIoT Security & Industrial Case Studies**	**7**	**8**
	Basics of Cybersecurity in IIoT		
	6.1.1 Need for security in industrial systems		
	6.1.2 Common risks in connected devices		
	6.1.3 Importance of data protection		
	6.2 Common Threats in IIoT: Unauthorized access, Malware and ransomware, Data loss or tampering		
	6.3 Blockchain for Secure IIoT Communication		
	6.2.1 Role of blockchain in industrial automation, Use		

	cases in supply chain & manufacturing			
	6.4 Case Studies of IIoT in Industry			
	6.3.1 Smart factories, energy grids, logistics, predictive maintenance			
	6.3.2 Real-world IIoT success stories, Predictive maintenance in wind turbines			
	Sub-total		**23**	**36**

S. List of Microprojects/ Assignments/ Other Activities under SLA

Sr.No	List of Assignment (any one of the following under SLA)	Hrs Allotted
1	Explain the role of IIoT in Industry 4.0 and its impact on industrial automation.	04
2	Differentiate between traditional industrial automation and IIoT-enabled automation.	04
3	Illustrate the working of PLCs and SCADA with real-world industrial examples.	04
4	**Design** a basic architecture diagram for an **IIoT system using Raspberry Pi**.	04
5	Classify different types of industrial sensors and actuators used in IIoT applications.	04
6	Describe the working principles of Modbus, OPC-UA, and MQTT in IIoT systems.	04

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to IIoT & Industrial Automation	02	2	4	**8**	ETH506-1
I / 2	Raspberry Pi as an IIoT Gateway	02	6	6	**14**	ETH506-2
I / 3	Raspberry Pi GPI Interfacing & Data Visualizatio	02	4	6	**12**	ETH506-3
II /4	Industrial Communication Protocols	02	4	8	**14**	ETH506-4

II /5	Cloud Computing & Predictive Maintenance in IIoT	02	6	6	**14**	ETH506-5
II / 6	IIoT Security & Industrial Case Studies	02	2	4	**8**	ETH506-6
	Total Marks	**12**	**24**	**34**	**70**	

U. Assessment Criteria

iii) 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**

V. Instructional Methods:

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

W. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

X. Reference Books:

Sr. No.	Author	Name of Book	Publication
1	Alasdair Gilchrist	Industry 4.0: The Industrial Internet of Things	Apress,ISBN: 978-1484220467
2	Frank Lamb	Industrial Automation	McGraw Hill Education (India) Private Limited, ISBN: 978-0071816458

3	Derek Molloy	Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux	Wiley India, ISBN: 978-1119188681
4	Simon Monk	Raspberry Pi Cookbook	O'Reilly Media ISBN: 978-1491939108
5	Maneesh Rao	Internet of Things with Raspberry Pi 3	Packt Publishing ISBN: 978-1788627402
6	S. M. Bashi, S. A. Samad, and N. A. Ahmad	Industrial Sensors and Controls in Communication Networks	CRC Press ISBN: 978-1466516513
7	Andrzej M. Pawlak	Sensors and Actuators in Mechatronics: Design and Applications	CRC Press, ISBN: 978-0849337734
9	Giacomo Veneri & Antonio Capasso	Hands-On Industrial Internet of Things	Packt Publishing, ISBN:9781789533184
10	Sravani Bhattacharjee	Practical Industrial Internet of Things Security	Packt Publishing, ISBN: 978-1788625828
11	Peter Waher	Mastering MQTT	Packt Publishing, ISBN: 978-1787124223
12	Jürgen Beyerer	Predictive Maintenance in Smart Factories	Springer

Y. Learning Website & Software

Sr No	Link/Portal	Description
1	https://professionalprograms.mit.edu/online-program-internet-of-things/	MIT Professional Education: Industrial Internet of Things
2	https://www.coursera.org/learn/industrial-internet-of-things	Coursera: Industrial Internet of Things (IIoT) – University of Michigan
3	https://online.stanford.edu/courses/xee100-introduction-internet-things	Stanford Online: Introduction to Internet of Things
4	https://academy.advantech.com/	Advantech IoT Academy (Free Courses on IIoT, SCADA, PaaS, etc.)
5	https://www.ptc.com/en/products/thingworx	ThingWorx by PTC (IIoT Platform for Industrial Applications)
6	https://thinger.io/	Thinger.io (Open-source IoT Cloud Platform)

*****

COURSE ID:
COURSE NAME   **: VLSI APPLICATION**
COURSE CODE   **: ETH507**
COURSE ABBREVIATION   **: HVLA**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME: -

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

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 CMOS technology plays an important role in IC fabrication process. Functional capabilities of this technology lead to advanced Very Large-Scale Integration, large density of components, high speed of operation, less area with less power dissipation. Therefore, imparting knowledge of VLSI and its tools is need of today. After completion of this course, students will be able to develop applications in the area of digital electronics using VLSI design tools.

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. Maintain and Debug VLSI based application.

2. Able to use VLSI design tools.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH507-1 Use relevant Advance Digital Design for circuit minimization.
ETH507-2 Understand the architecture of CPLD/ FPGA.
ETH507-3 Interpret CMOS technology circuits with their specifications.
ETH507-4 Use relevant VHDL model for given application.
ETH507-5 Develop VHDL program for the given application.
ETH507-6 Interpret VHDL Simulation and Synthesis.

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH507-1 Use relevant the Advance Digital Design for circuit minimization.	3	2	3	2	3	1	3	2	2
ETH507-2 Understand the architecture of CPLD/ FPGA.	3	2	2	1	1	1	2	2	2

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 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH507-3 Interpret CMOS technology circuits with their specifications.	3	1	1	2	2	2	2	2	1
ETH507-4 Use relevant VHDL model for given application.	3	2	2	2	2	2	3	3	2
ETH507-5 Develop VHDL program for the given application.	3	3	3	3	2	2	3	3	2
ETH507-6 Interpret VHDL Simulation and Synthesis.	3	3	3	2	2	3	3	3	3

F. CONTENT:

III) Practical exercises

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

Sr. No.	Laboratory experiences	CO
1.	Identify internal block and pin configuration of FPGA & CPLD using datasheet.	ETH507-1/2
2.	Develop flow chart of CMOS using relevant website.	ETH507-3
3.	Install EDA tool (VHDL) for VLSI application.	ETH507-2
4.	Implement any two gates using Data flow and Behavioral model.	ETH507-4
5.	Implement Half /full adder / subtractor using FPGA	ETH507-4
6.	Implement 8:1 multiplexer using FPGA	ETH507-4
7.	Implement 1:8 Demultiplexer using FPGA	ETH507-4

8.	Implement T& D-flip-flop using FPGA	ETH507-4
9.	Implement 2:4 Decoder using FPGA	ETH507-4
10.	Implement 8:3 Encoder using FPGA	ETH507-4
11.	Implement up-counter using FPGA	ETH507-4
12.	Implement synchronous counter using FPGA	ETH507-4
13.	Implement binary to gray code converter using FPGA.	ETH507-4
14.	Build /Test DAC using FPGA.	ETH507-5
15.	Implement Stepper motor controller using FPGA.	ETH507-5
16.	Implement four Bit ALU or sequence generator using FPGA.	ETH507-5

IV)   Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH507-1 Develop design flow for the given application using VLSI tools.		
1	**Basics of Advance Digital Design** 1.1 Review of Sequential Logic: Asynchronous and Synchronous, Meta-stability, Noise margins, Power Fan-out, Skew (Definitions only) 1.2 Advantages and Disadvantages of K-map reduction techniques, Quine-McCluskey method 1.3 Finite state machines, Moore and Mealy Models, state machine notation 1.4 Examples on Moore and mealy: counter, sequence detector.	8	12
	ETH507-2 Understand the architecture of CPLD/FPGA.		
2	**ASIC Design flow and PLD's** 2.1 Introduction to ASICs and ASIC Design Methodology (only ASIC design flow) 2.2 Evolution of programmable devices, classification. 2.3 Building blocks of FPGAs/CPLD Architecture: Xilinx 9500 CPLD, FPGA SPARTEN-3 and Xilinx XC4000 FPGA Family 2.4 Comparison of CPLD and FPGA	8	12
	ETH507-3 Interpret CMOS technology circuits with their specifications.		
3	**Fundamentals of CMOS Fabrication Technology** 3.1 Introduction of BJT and CMOS parameters	7	10

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.2 Basic gates using CMOS Inverter, NOR, NAND, MOS transistor switches, transmission gates, CMOS inverter characteristics. 3.3 Complex logic using CMOS 3.4 Estimation of resistance and capacitance layout. 3.5 Fabrication process: Overview of wafer processing, Oxidation, epitaxy, deposition, Ion-Implementation and diffusion, silicon gate process. 3.6 Basics of NMOS, PMOS and CMOS: nwell, pwell, twin tub process.		
	Sub-total	**23**	**34**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH507-4 Use relevant VHDL model for given application.		
4	**Introduction to VHDL** 3.1 Introduction to HDL: History of VHDL, Pro's and Con's of VHDL 3.2 VHDL Flow elements: -Entity, Architecture, configuration, package, library only definitions. 3.3 Data Types, operators, operations. 3.4 Signal, constant and variables (syntax and use). 3.5 VHDL Modeling: - Data flow, Behavioral, Structural.	7	12
	ETH507-5 Debug VHDL program for the given application.		
5	**VHDL Programming** 5.1 Concurrent constructs (when, with). 5.2 Sequential Constructs (process, if, case, loop, assert, wait) 5.3 VHDL program to implement Flip Flop, Counter, shift register, MUX, DEM UX, ENCODER, DECODER, MOORE, MEALY machines. 5.4 Test bench and its applications.	7	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH507-4 Use relevant VHDL model for given application.		
4	**Introduction to VHDL** 3.1 Introduction to HDL: History of VHDL, Pro's and Con's of VHDL 3.2 VHDL Flow elements: -Entity, Architecture, configuration, package, library only definitions. 3.3 Data Types, operators, operations. 3.4 Signal, constant and variables (syntax and use). 3.5 VHDL Modeling: - Data flow, Behavioral, Structural.	7	12
	ETH507-6 Maintain FPGA based circuit.		
6	**HDL Simulation and Synthesis** 6.1 Event scheduling, sensitivity list, zero modeling, simulation cycle, comparison of software and hardware description language, delta delay. 6.2 HDL Design flow for synthesis 6.3 Efficient Coding Styles, optimizing arithmetic expression, sharing of complex operator.	8	12
	Sub-total	22	36

G. List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Prepare the survey report on the VLSI based applications.	02
2.	Compare technical specifications and applications of various types of memory, CPLDs, FPGA and Prepare report.	02
3.	Refer basic requirement of PC configuration to install VLSI EDA tool.	02
4.	Give seminar on any course relevant topic.	02
5.	Conduct library / internet survey regarding different data sheet and manuals related CPLD, FPGA.	02
6.	Prepare power point presentation on VLSI and their applications.	02
7.	Undertake a market survey of companies' profile related to VLSI and prepare report.	02
8.	Search for video / animations / power point presentation on internet for complex topic related to the course and make a presentation.	02
9.	Prepare report of CMOS fabrication process.	02
10.	Market Survey related to CMOS IC's and prepare report.	02
11.	Develop four-bit addition/subtraction.	02

12.	Develop square wave generator of Frequency = 1 Hz/ 100Hz.	02
13.	A shopkeeper requires an alarm system when a customer enters the shop through exits door. Develop a VLSI based system.	02
14.	An indication for any maloperation in the given application is to be indicated by blinking of LEDs. Build a VLSI based system for the same.	02

**Six out of 14 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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

Section / Topic no.	Name of topic	Distribution of marks (Semester wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Basics of Advance Digital Design	4	2	6	12	ETH507-1
I / 2	ASIC design flow and PLD's	2	4	6	12	ETH507-2
I / 3	Fundamentals of CMOS Technology	2	4	4	10	ETH507-3
II /4	Introduction to VHDL	2	6	4	12	ETH507-4
II /5	VHDL Programming	2	4	6	12	ETH507-5
II / 6	HDL Simulation and Synthesis	-	6	6	12	ETH507-6
	Total Marks	12	26	32	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	VHDL Basics to programming	Gaganpreet Kaur	Pearson Education India, 2011 ISBN 10: 8131732118 ISBN 13: 9788131732113
2	Digital Logic: Application and design	John M. Yarbrough	C.L Engineering, ISBN 10: 0314066756 ISBN 13: 978 0314066756
3	An engineering approach to digital design	Willian I. Fletcher	Prentice- Hall of India ISBN-13: 978-0132776998 ISBN-10: 0132776995
4	Principles of CMOS VLSI Design: A system perspective	Neil H. E. Weste Kamran Eshraghian	Pearson Education ISBN 10: 0201082225 / **ISBN** 13: 9780201082227
5	VHDL programming by example	Douglas Perry	Tata Mcgraw-hill; 4 edition (2002) ISBN-10: 0070499446 ISBN-13: 978-0070499447
6	Introduction to VLSI Design	Eugene D. Fabricus	McGraw Hill ISBN-13: 978-0070199484 ISBN-10: 0070199485
7	VLSI design and EDA tools	Sarkar & Sarkar	Scitech Publications (India) Pvt Ltd (December , 2013) ISBN-10: 8183714978 ISBN-13: 978-8183714976
8	Xilinx Manual	Xilinx	www.xilinx.com

M. Learning Website & Software

a. http://rti.etf.bg.ac.rs/rti/ri5rvl/tutorial/TUTORIAL/HTML/HOMEPG.HTM
b. http://iiith.vlab.co.in/?sub=21&brch=66&sim=531&cnt=1&lan=en-IN
c. http://www.vlsiencyclopedia.com/2012/12/loop-statement.html
d. https://books.google.co.in/books?id—RjdYEY8divwC&pg—SA3-PA47&.1pg—SA3-PA47&dcrvlsi+next+statement&source=bl&ots=oS8dg9uQL6&sig=KHciaQMIgQ5CW kpC

c8Yfew_7h20&h1=en&sa—X&ved=0ahUKEwjx_5LQk5bLAhVRSo4KHeoGDDM Q6AEIPjAHI4v—onepage&q=v1sicY020next%20statement&f=false

e. http://only-vlsi.blogspotin/2007/12/vIsi-design-flow.htm **I**
f. http://www.vhdl.renerta.com/source/vhd00014.htm
g. http://www.csee.umbc.edu/portal/help/VHDL/summary.html
h. http://vlab.co.in/ba_labs_all.php?id=1

COURSE ID   :
COURSE NAME   : ROBOTICS
COURSE CODE   : ETH 504
COURSE ABBREVIATION : HROB

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	-	-	-	-	25	10	50#	20	25	10	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, *# 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 rationale behind the study of robotics lies in its ability to enhance automation, efficiency, and innovation across various industries. Robotics integrates engineering, computer science, and AI to design intelligent machines that perform tasks with precision and consistency. It improves productivity, ensures safety in hazardous environments, and expands human capabilities in fields like manufacturing, healthcare, space exploration, and logistics. By studying robotics, students and professionals gain the skills to develop advanced systems, optimize industrial processes, and contribute to technological advancements that shape the future of automation and artificial intelligence.

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. Understand implementation of control strategy, sensors & electronics devices.
2. Understand different types of effectors and actuators.
3. Understand methods of robot programming

E. COURSE SEMESTER LEARNING OUTCOMES (COs):

ETH 504-1 Understand industrial robot and safety

ETH 504-2 Identify basic components of industrial robot

ETH 504-3 Select industrial robot for given applications

ETH 504-4 Select actuator and sensor for given robotic application

ETH 504-5 Maintain industrial robot

ETH 504-6 Program robot for given application

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

[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH 504-1 Understand industrial robot and safety.	3	2	-	3	2	2	--	2	--
ETH 504-2 Identify basic components of industrial robot.	3	2	-	2	3	3	--	3	2
ETH 504-3 Select industrial robot for given applications.	3	2	2	2	2	3	--	3	3
ETH 504-4 Select actuator and sensor for given robotic application.	3	1	1	2	3	3	--	3	2
ETH 504-5 Maintain industrial robot.	3	2	2	2	3	3	--	3	1
ETH 504-6 Program robot for given application.	3	2	-3	3	3	3	--	3	3

F. CONTENT:

i) PRACTICAL EXERCISE

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	ETH 504-1
2.	Maintenance and troubleshooting of industrial robot	ETH 504-1

3.	Demonstration of teach pendant	ETH 504-2
4.	Operate robot for basic motions using teach pendant	ETH 504-2
5.	Interfacing of end effectors	ETH 504-2
6.	Demonstration of motor and drive	ETH 504-4
7.	Demonstration of pneumatic system	ETH 504-4
8.	Robot programming basic: Basic robot program instructions: MOVE, POINT, WAIT, SET, IF, ELSE, LOOP, HALT, JUMP	ETH 504-5
9.	Robot programming for conditional statements.	ETH 504-5
10.	Industrial robot program for merged movements, circular and arc movements	ETH 504-5
11.	Setup and programming for vision system	ETH 504-5
12.	Setup and programming for voice command	ETH 504-5,6
13.	Setup and programming for colour sensing	ETH 504-5,6
14.	Setup and programming for material sensing	ETH 504-5,6
15.	Setup and programming for suction-based pick and place setup	ETH 504-5,6
16.	Setup and programming for gluing application	ETH 504-5,6
17.	Setup and programming for logistic sorting setup	ETH 504-5,6
18.	Setup and programming for gasketing /sealing	ETH 504-5,6

ii) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH 504-1 Understand industrial robot and safety		
1	**Introduction to Industrial Robotics and safety** 1.1 Introduction, definition, need, brief history of industrial robots 1.2 Automation: Type of automation, Need for automation 1.3 Application of robots in industries 1.4 Types of robots 1.5 Laws of robot 1.6 Safe practices while handling 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.	04	
	ETH 504-2 Identify basic components of industrial robot		
2	**Components and Anatomy of Industrial Robot** 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	08	
	ETH 504-3 Select industrial robot for given applications		
3	**Industrial Robot Selection** 3.1 Why to use a robot?	10	

	3.2 Selection and classification of industrial robots. 3.3 Defining parameters of robots. 3.4 World statistics of industrial robotics 3:5 Robots in industry 3.6 Major robot manufacturers		
	Sub-total	**22**	

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
4	***ETH 504-4 Select actuator and sensor for given robotic application*** **Industrial Robots: Actuators, Drives and Sensors** 4.1 Actuators and types: Pneumatic, Hydraulic and Electric 4.2 Need of pneumatic system, Basic components of pneumatic system, Compressor, Valves, Actuators 4.3 Different electric rotary actuators, Recent advances in actuators 4.4. Drive and drive system: Pneumatic, Hydraulic and Electric, Drive Systems. 4.5 Robotic sensors: Introduction to sensors in robotics, Classification of sensors: Tactile sensors, Touch sensors, Force sensors, Force sensing wrist, Joint sensing, Tactile array sensors, Proximity and Range sensors, Miscellaneous sensors and Sensor based systems, Uses of sensors in robotics. 4.6 Encoders: Incremental and Absolute encoders. 4.7 Desirable features of sensors in robotics.	**04**	

	ETH 504-5 Maintain industrial robot		
5	**Industrial Robot: Installation, Programming and Maintenance** 5.1 Industrial robot installation: Lifting and mounting of robotic arm and controller. 5.2 Connecting power cables, Encoder cables and Teach pendant 5.3 Robot operation, Switching modes, Jogging, Homing 5.4 Managing robot errors and faults, Logging in and configuring I/O 5.5 Robot programming: 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 5.6 Maintenance of industrial robot: Inspection of belts and pulleys, Changing belts, Parameters measurement (Voltage/Current), Recommended spares, (Troubleshooting, Fault list)	09	
	ETH 504-6 Program robot for given application		
6	**Application of PLC and Microcontroller in Industrial Robotics** 6.1 Robots in material handling- Pick and place, Palletization. 6.2 Robots in processing operations – Spot welding, Continuous arc welding, Spray coating. 6.3 Robots in automated assemblies & inspections. 6.4 Basics and configuration of Arduino. 6.5 Basics of Microprocessors. Configuration and use of Raspberry Pi	10	
	Sub-total	23	

G. List of Assignments under SLA:

Sr. No.	List of Assignment (under SLA)
1.	Explain robotics key components and how it integrates with AI and automation.
2.	Discuss the historical development of robotics.
3.	Explain the different types of robots
4.	List the advantages and disadvantages of using robotics in the workplace? Discuss its impact on efficiency, cost, and employment.
5.	State sensors and actuators function in a robotic system? Explain their role in enabling movement and interaction with the environment.
6.	Explain ethical and social challenges arise from the increasing use of robotics? Discuss potential risks, including job displacement and privacy concerns.
7.	Describe a real-world application of robotics that has transformed an industry. Explain how it works and its impact on productivity and innovation.
8.	Visit industries having robots and prepare detail report on operational and maintenance practices.
9.	Develop robot programs for performing the various industrial operations
10.	Case study on robotics systems used in automobile/ manufacturing industry.
11.	Case study on future robot technologies.

**Six out of 11 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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:
This is not included in curriculum.

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	Industrial Robotics, Technology programming and Applications	Mikell P Groover ,Nicholas G Odrey ,et.al	Tata McGraw Hill Publication, 2012.
2	Introduction to Industrial robotics	Ramchandran Nagarajan	Pearson Education India, New Delhi, 2006, ISBN: 978-93-325-4480-2
3	Robotics and Industrial Automation	R. K. Rajput	S. Chand limited, 2008 ISBN- 9788121929974
4	A Textbook on Industrial Robotics	Ganesh S. Hegde	University Science Press, New Delhi, 2009, ISBN: C-16689/08/12
5	Introduction to Robotics	S.K.Saha	Tata McGraw Hill Publication
6	Robotics & Control ,	R.K.Mittal&I.J.Nagrath	Tata McGraw Hill Publication, 2007
7	Introduction to Robotics	John J Craig	Pearson,2009
8	Robotics Technology and flexible automation	S.R.Deb	Tata McGraw-Hill Education, 2009.
9	Robotics and Image Processing an Introduction	P.A.JanakiRaman	TataMcGraw Hill Publication 1995

L. Learning Website & Software:

Sr.No.	Perticular	Description
1	https://ifr.org/	International Federation of Robotics

2	https://nptel.ac.in/courses/112105319	NPTEL SOLE – Industrial Robotics: Theories for Implementation
3	https://nptel.ac.in/courses/112105249	NPTEL Course – Robotics
4	http://www. mechanalyzer.com/downloads-roboanalyzer.html	Simulation software: Roboanalyser
5	http://www. roboanalyzer.com/tutorials.html	Simulation Software – tutorials
6	https://www.youtube.com/watch?v=QiFbrmJTib4	Introduction to Industrial Robot
7	https://www.youtube.com/watch?v=VyfRogst1xQ&list=PL99LESDC4Rt0Ozt3wkwL6gcGxO5I9c3V7	Introduction to Industrial Robot
8	https://www.youtube.com/watch?v=_canCYWZPsc	Animation of Work Envelope
9	http://vlabs.iitkgp.ernet.in/mr/exp0/index.html#	Virtual Lab — IIT Kharagpur

*****

COURSE ID :

COURSE NAME   : **INTRODUCTION TO ARTIFICIAL INTELLEGENCE**
COURSE CODE   : **ETH508**
COURSE ABBREVIATION   : **HIAI**

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 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			
-	-	-	-	-	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, *# 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: -

An artificial intelligence course syllabus aims to give students the basic knowledge and practical skills they need to succeed in the field. It covers various topics like machine learning algorithms, neural networks, natural language processing, and robotics**.**toimpartartificialintelligenceprinciples,techniques,anditshistory.to assess the applicability, strengths, and weaknesses of the basic knowledge representation,problemsolving,and learning methods in solving engineering problems and to develop intelligent systems by assembling solutions to concrete computational problems.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

AI is revolutionizing industries by enhancing efficiency, reducing costs, and improving decision-making. Employers expect AI to automate repetitive tasks, allowing employees to focus on higher-value work, ultimately increasing productivity. Cost reduction is another key outcome, as AI-driven automation minimizes operational expenses and predictive analytics help in maintenance and resource allocation. AI also enhances decision-making by analyzing vast amounts of data to provide real-time insights, enabling businesses to make strategic choices with greater accuracy. Moreover, AI significantly improves customer experience through personalized recommendations, AI-powered chatbots, and 24/7 virtual assistance. Employers anticipate gaining a competitive edge by leveraging AI for innovation, accelerating product development, and predicting market trends. Additionally, AI contributes to workforce transformation by enabling personalized training and up skilling opportunities, enhancing employee satisfaction. As AI continues to evolve,

industries are expected to witness a shift towards smarter operations, increased automation, and data-driven strategies that drive sustainable growth and success.

E. COURSE SEMESTER LEARNING OUTCOMES (Cos

ETH508-1: Evaluate Artificial Intelligence (AI) methods and describe their foundations.

ETH508-2: Apply basic principles of AI in solutions that require problem solving, inference,

perception, knowledge representation and learning.

ETH508-3: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.

ETH508-4: Analyze and illustrate how search algorithm play vital role in problem solving

ETH508-5: Illustrate the construction of learning and expert system.

ETH508-6: Discuss current scope and limitations of AI and societal implications.

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

[Note: Correlation Semesters: 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 Manageme nt	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH508-1	2	-	1	1	-	-	-	-	-
ETH508-2	2	-	2	2	-	-	-	-	1
ETH508-3	1	-	1	2	-	-	-	1	1
ETH508-4	2	-	2	2	-	-	-	1	1
ETH508-5	2	-	1	1	-	-	-	-	-
ETH508-6	2	-	1	2	-	-	-	-	-

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for artificial intelligence programs developed* by the Institute in practical sessions of batches of about 20- 22 students:
(Any 12)

Sr. No.	Laboratory experiences	CO
1.	Write a program to conduct uninformed and informed search.	ETH508-1
2.	Write a program to conduct game search.	ETH508-1
3.	Write a program to construct a Bayesian network from given data.	ETH508-2
4.	Write a program to infer from the Bayesian network.	ETH508-1
5.	Write a program to run value and policy iteration in a grid world.	ETH508-2
6.	Write a program to do reinforcement learning in a grid world.	ETH508-2
7.	Develops mall AI based Mini Project on Predicting user's next location	ETH508-3
8.	Develop small AI based Mini Project on Detecting YouTube comment spam	ETH508-3
9.	Develop small AI based Mini Project Identifying the genreofa song.	ETH508-3
10.	Develop small AI based Mini Project Shock front classification.	ETH508-4
11.	Case Study on any one real time AI application	ETH508-4
12.	Write a program to implement Tic-Tac- Toe game problem (use any programming language).	ETH508-4
13.	Write a program to Implement A* Algorithm (use any programming language).	ETH508-5

Sr. No.	Laboratory experiences	CO
14.	Write a program to solve travelling salesman problem (use any programming language).	ETH508-6
15.	Write a PRO LOG program for Family Relationship	ETH508-6

V) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH508-1 Evaluate Artificial Intelligence (AI) methods and describe their foundations.		
1	**Artificial Intelligence and Its Issues** 1.1 Definitions:-Importance of AI 1.2 Evolution of AI 1.3 Application of AI 1.4 Classification of AI systems with respect to 1.4.1 Knowledge Inferring systems and Planning 1.4.2 Uncertainty towards learning systems.	04	-
	ETH508-2 Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.		
2	**Overview to Problem solving and Heuristic Search** 2.1 Problem solving by Search 2.2 Problem space-state space 2.3 Blind Search-types, performance measurement 2.4 Game playing mini-max algorithm 2.5 Alpha-Beta pruning	04	-
	ETH508-3 Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.		
3	**Machine Learning** 3.1 Introduction.Types of Machine Learning 3.2 Regression and Classificatio 3.3 SVM 3.4 CNN 3.5 KNN 3.6 ANN 3.7 RNN 3.8 Comparison between CNN ,ANN and RNN 3.9 Clustering	07	-

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.10 Neural Network 3.11 Applications and tools 3.12 Introduction to deep learning		
	Sub-total	**15**	**-**

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH508-4 Analyze and illustrate how search algorithm play vital role in problem solving.		
4	**Learning Systems and expert systems** 4.5 Forms of learning types-Supervised, Unsupervised, Reinforcement Learning 4.6 Learning Decision Trees 4.3 Expert systems- Stages in the development of an expert system 4.4 Probability based Expert systems 4.5 Expert systems tools 4.6 Application of expert systems	**04**	**-**
	ETH508-5 Illustrate the construction of learning and expert system.		
5	**Reinforcement Learning** 5.3 Passive reinforcement learning 5.4 Direct utility estimation 5.5 Adaptive dynamic programming 5.6 Temporal difference learning 5.7 Active reinforcement learning 5.8 Q-learning	**04**	**-**
	ETH508-6 Discuss current scope and limitations of AI and societal implications.		
6	**AI with Python** 6.1 Study of important in-built libraries of python like NumPy, SciPy, matplotlib, nltk, SimpleAI 6.2 Installing Python Setting up PATH 6.3 Running Python 6.4 Study of real time applications of AI with Python 6.5 Case Studies: AI Platforms-Azure ML, GoogleAI,Swift AI, Tensorflow	**07**	**-**
	Sub-total	**15**	**-**

G: List of Assignment

Sr.No.	Name of Assignment
1	Write a program to implement BFS (use any programming language).
2	Write a program to implement DFS (use any programming language).
3	Write a program to implement Tower Of Hanoi Problem (use any programming language).
4	Write a program to solve N-Queens problem (use any programming language).
5	Convert the Prolog predicates into Semantic Net for the given data
6	Write the Conceptual Dependency for given statements.

H: Specification table for setting question paper for semester end theory assessment: - theory paper is not in curriculum

I:-Assessment Criteria

i) Formative Assessment of Practical: -
Every assignment shall be assessed for 50 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.	Ctiteria	Marks out of 25
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat and complete Diagram	05
4	Observations and handling of instruments	05
5	Oral based on Lab work and completion of task	05
TOTAL		**25**

J) Instructional Methods:

33. Lectures cum Demonstrations
34. Class room practices
35. Use of projector and soft material for demonstration
36. Virtual Laboratory
37. NPTEL/Swayam course lectures

K) Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

M) Reference Books:

Sr. No.	Name of Book	Author	Publication
1	ArtificialIntelligence,3rd edition	Ric,E.,Knight,KandShankar, B.	TataMcGraw Hill.2009
2	Artificial Intelligence - StructuresandStrategiesfor Complex Problem Solving	Luger, G.F.	6th edition, Pearson.2008
3	KnowledgeRepresentation and Reasoning	Brachman,R.andLevesque,H.	Morgan Kaufmann.2004
4	Artificial Intelligence with Python: A Comprehensive Guide to Building IntelligentAppsforPython Beginners and Developers	PrateekJoshi	Packtpublication January 2017 Edition
5	ReinforcementLearning: An Introduction	SuttonR.S. andBarto, A.G.	MITPress. 1998

N) Text Books

Sr. No	Name of Book	Author	Publication
1	ArtificialIntelligence -AModern Approach	Russell,S.andNorvig,P.	3rdedition, Prentice Hall.2015
2	Artificial Intelligence: Foundationsof Computational Agents	Dr J S Chitode Poole, D. and Mackworth,A.	Technical Publications / Cambridge University Press.2010

O) Learning Website & Software i. www.google.com ii. www.youtube.com

COURSE ID :
COURSE NAME : DATA ANALYTICS
COURSE CODE : ETH509
COURSE ABBREVIATION : HDAL

N. 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	

O. ASSESSMENT SCHEME: -

PAPER DURA TION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		Total
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
-	-	-	-	-	50	20	50#	20	-	-	100

P. 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)

Q.

a. **RATIONALE**

Data Analytics uses statistical and computational methods to analyze data, aiding informed decision-making. Excel dashboards effectively present vital data at a glance, enhancing user interactivity. A Data Analyst collects, cleans, and visualizes Datasets to solve problems.

b. **INDUSTRY / EMPLOYER EXPECTED OUTCOME**

Perform Data Analytics in various business domains for improved decision making.

R. COURSE SEMESTER LEARNING OUTCOMES (COs)

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

ETH509-1 Elaborate the fundamental concepts of Data Analytics.

ETH509-2 Apply appropriate statistical techniques to analyze and interpret complex Datasets.

ETH509-3 Analyze numerical data by creating pivot table.

ETH509-4 Represent data in terms of various types of charts.

ETH509-5 Visualize the data using a Python library

Course outcomes and programme outcomes / programme specific outcomes (CO-PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH509-1 Elaborate the fundamental concepts of Data Analytics.	2	2	1	-	2	-	2	-	-
ETH509-2 Apply appropriate statistical techniques to analyze and interpret complex Datasets.	2	2	2	2	1	1	1	1	1
ETH509-3 Analyze numerical data by creating pivot table.	2	2	3	2	1	1	1	1	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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH509-4 Represent data in terms of various types of charts.	2	2	3	1	1	2	1	2	2
ETH509-5 Visualize the data using a Python library	1	2	2	2	2	2	2	2	2

S. CONTENT:

a. Practical exercises

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

Sr. No.	Laboratory Experiences	CO
1.	*a. Calculate mean, median, and mode for a given dataset using Excel functions (AVERAGE, MEDIAN, MODE). *b. Calculate range, interquartile range (IQR), variance, and standard deviation using Excel functions (STDEV, VAR). *c. Calculate the correlation coefficient between two variables using the CORREL function	ETH509-1
2.	*a. Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset. *b. Perform a simple linear regression analysis *c. Conduct a t-test to compare means between two groups *d. Calculate confidence intervals *e. Conduct a Chi-square test	ETH509-2
3.	*Create a Data Table a. Import a sample dataset (e.g., sales data) into Excel. b. converts the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles. c. Create a dashboard sheet that summarizes key metrics (e.g., total sales, average sales per region) using tables.	ETH509-3
4.	*Data Cleaning a. Identify and remove duplicates from a dataset. b. Use functions like TRIM, UPPER, LOWER, and PROPER to clean text data. c. Find and replace values using the Find & Replace feature.	ETH509-3
5.	Create a Pivot Table a. A basic pivot table from a dataset b. Specify and filter data in a pivot table c. Add a calculated field to a pivot table	ETH509-3

	d. Group data within a pivot table. Refresh pivot table data after making changes to the source data.	
6.	Filter and sort a PivotTable a. Apply a Filter to the PivotTable b. Sort Data in the Pivot Table. c. Add slicers to the PivotTable for interactive filtering.	ETH509-3
7.	Create a Pivot Chart a. A basic pivot chart from a dataset b. A dynamic pivot chart that updates based on user selection c. Group date items in a pivot table to summarize data by month or year d. Group product categories in a pivot table	ETH509-3
8.	*Create a Simple Chart a. A simple bar chart to visualize data sets b. A chart using non-adjacent cells to visualize data from different ranges.	ETH509-4
9.	*Create a Chart Using the Chart Wizard a. Select the chart you created and experiment with the Chart Tools options b. Modifying Charts c. Moving an Embedded Chart d. Sizing an Embedded Chart	ETH509-4
10.	*Change the Chart Type a. Create a basic bar chart using a dataset and change its type to a different chart b. Experiment with different data display options, such as adding data labels, changing the axis format, and adjusting the gridlines c. Experiment with position and style of the legend	ETH509-4
11.	a. Create a pie chart from a dataset b. Move the pie chart to a new worksheet for better visibility c. Emphasize a specific category by exploding a slice of the pie chart d. Customize the appearance of the pie chart for better presentation	ETH509-4
12.	* Create different types of plots. Write a Python script to save the plot in different formats: PNG, PDF, and SVG.	ETH509-5
13.	Application of data analytics across various industries through case study	ETH509-5

Note: Out of above suggestive Laboratory Experiences -
- '*' Marked Practicals (Laboratory Experiences) are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of Laboratory Experiences is to be performed to achieve desired outcomes.

b. Theory

Section I

Sr No	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH509-1 Elaborate the fundamental concepts of Data Analytics.		
1	**1. Unit -I Introduction to Data Analytics** 1.1. Data Analytics: An Overview, Importance of Data Analytics 1.2. Types of Data Analytics: Descriptive Analysis, Diagnostic Analysis, Predictive Analysis, Prescriptive Analysis, Visual Analytics 1.3. Life cycle of Data Analytics, Quality and Quantity of data, Measurement 1.4. Data Types, Measure of central tendency, Measures of dispersion 1.5. Sampling Funnel, Central Limit Theorem, Confidence Interval, Sampling Variation	05	-
	ETH509-2 Apply appropriate statistical techniques to analyze and interpret complex Datasets.		
2	**2. Unit - II Statistical Analysis** 2.1. Graphical techniques, box plot, skewness and kurtosis, Descriptive Stats 2.2. Correlation and Regression, Data Cleaning 2.3. Imputation Techniques 2.4. Anova and Chi Square 2.5 Scatter Diagram 2.6 Estimation and Hypothesis Testing 2.7 Sampling Distributions, Counting 2.8 Probability, Probability Distributions	06	-
	ETH509-3 Analyze numerical data by creating pivot table.		
3	**3. Unit - III Data Analytics with Excel** 3.1 Excel Dashboard: Tables and Data Grids, Dynamic Filters and Controls, Trend Analysis and Forecasting 3.2 Pivot Tables: Creating a Pivot Table Specifying Pivot Table Data 3.3 Changing a Pivot Tables, Calculation Filtering and Sorting a Pivot Table 3.4 Creating a Pivot Chart, Grouping Items 3.5 Updating a Pivot Table, formatting a Pivot Table using Slicers	06	-

Section –II

Sr No	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH509-4 Represent data in terms of various types of charts.		
4	**4. Unit - IV Data Visualization** 4.1 Creating a Simple Chart, Charting Non-Adjacent Cells 4.2 Creating a Chart Using the Chart Wizard, Modifying Charts, Moving an Embedded Chart, Sizing an Embedded Chart 4.3 Changing the Chart Type, Changing the Way Data is Displayed, Moving the Legend 4.4 Formatting Charts, Adding Chart Items, Formatting All Text, Formatting and Aligning Numbers, Formatting the Plot Area, Formatting Data Markers 4.5 Pie Charts, Creating a Pie Chart Moving the Pie Chart to its Own Sheet Adding Data Labels, Exploding a Slice of a Pie Chart	07	-
	ETH509-5 Visualize the data using a Python library.		
5	**5. Unit - V Data Visualization using Python** 5.1 Overview of Matplotlib and its role in data visualization, Installing and setting up Matplotlib in Python 5.2 Basic plotting with Matplotlib, Line plot, Scatter plots, Bar charts, Histograms, adding titles, labels, and legends to plots 5.3 Changing figure size and aspect ratio, Customizing axes (limits, ticks, and labels) 5.4 Exporting and Saving Visualizations: Saving plots in different formats (PNG, PDF, SVG), Adjusting the resolution and quality of saved plots, creating interactive visualizations using Matplotlib widgets	06	-
	Sub-total	**30**	**-**

T. List of Assignments under SLA

--NA—

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

---NA---

V. Assessment Criteria

a. 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**

b. 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**

W. Instructional Methods:

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

X. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

Y. Reference Books:

Sr. No	Name of Book	Author	Publication

1	Excel Data Analysis: Your visual blueprint for analyzing data, charts, and PivotTables	Jinjer Simon	Wiley Publication Edition: 3rd ISBN: 978- 0-470-59160-4
2	Data Analysis with Excel	A. J. Smalley	SAGE Publications Edition: 1st, 2007 ISBN 10: 0070139903 / ISBN 13: 9780070139909
3	Python Data Analytics: With Pandas, NumPy, and Matplotlib	Fabio Nelli	Apress pubication ISBN-13 :978-1484239124 ISBN-13978-1484247372
4	Python Data Science Handbook	Jake VanderPlas	Shroff/O'Reilly Publication ISBN-10- 9355422555 ISBN-13-978-9355422552
5	Business Analytics with MindTap	Jeffrey D. Camm | James J Cochran | Michael J. Fry | Jeffrey W. Ohlmann	Cengage Learning India Pvt. Ltd. Publication Edition:4th ISBN: 9789360533533

Z. Learning Website & Software:

Sr.No	Link / Portal	Description
1	https://spreadsheetpoint.com/excel/dashboard-in-excel/	Advance Excel
2	https://www.javatpoint.com/how-to-create-a-dashboard-in-excel	Excel Dashboard
3	https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel	Data Visualization
4	https://www.freecodecamp.org/news/introduction-to-data-vizualization-using-matplotlib/	Matplotlib in Python
5	https://archive.nptel.ac.in/courses/106/107/106107220/	Introduction to data analytics

Note :
Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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COURSE ID:
COURSE NAME   : **AUTOMOTIVE ELECTRONICS**
COURSE CODE   : **ETH510**
COURSE ABBREVIATION   : **HAEL**

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 DURA TION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		Total
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
--	--	--	--	--	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, *# 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 automotive sector is evolving rapidly with significant advancements in both safety and luxury due to the integration of automobile and electronics technologies. This merging of domains has led to the development of smart, efficient, and safer vehicles equipped with advanced instrumentation systems.To remain competitive in this dynamic industry, it is essential for students to gain interdisciplinary knowledge that combines automotive engineering, electronics, and computer systems. This course aims to equip students with a strong foundation in the use of microcomputers, sensors, actuators, and various instrumentation systems. Understanding these components and their roles in modern vehicles will enable students to design, develop, and innovate solutions for automotive safety, comfort, and performance.
By mastering these skills, students will be better prepared to contribute to the future of the automotive industry and keep pace with technological advancements in smart vehicle design

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:

5. **Interdisciplinary Problem-Solving Skills:** Industries require engineers who can integrate knowledge from electronics, computer systems, and automotive engineering to diagnose, design, and improve vehicle safety and performance features.

6. **Awareness of Advanced Vehicle Technologies:**
   With the rise of electric, hybrid, and autonomous vehicles, employers look for candidates knowledgeable in advanced automotive technologies and modern control systems to support innovation and future product development.

E. COURSE SEMESTER LEARNING OUTCOMES (COs)

ETH510-1 Interpret the basics of automotive fundamentals
ETH510-2 Use automotive sensors and actuators in automotive electronics
ETH510-3 Analyze electronics engine management systems
ETH510-4 Explore various vehicle management systems used in automobile
ETH510-5 Demonstrate different automotive instrumentation systems used in automobile
ETH510-6 Use electronic safety and smartness of future automotive electronic systems
              in the automobiles.

 Course outcomes and programme outcomes/ programme specific outcomes
   (CO- PO/PSO) matrix
[Note: Correlation Semesters: 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Operate and Maintain	PSO2 Supervision and Providing Solution
ETH510-1 Interpret the basics of automotive fundamentals	3	-	-	-	1	-	2	3	2
ETH510-2 Use automotive sensors and actuators in automotive electronics	3	3	2	2	-	-	2	3	3
ETH510-3 Analyze electronics engine management systems	3	3	3	2	-	-	2	3	3
ETH510-4 Explore various vehicle management systems used in automobile	3	3	3	2	2	-	3	3	3
ETH510-5 Demonstrate different automotive instrumentation systems used in automobile	3	2	2	2	2	-	3	3	3
ETH510-6 Use electronic safety and smartness of future automotive electronic systems in the automobiles.	3	3	3	2	3	-	3	3	3

F. CONTENT:
IV)   Practical exercises
The following practical exercises shall be conducted in the *Laboratory for Automotive Electronics lab developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. No.	Laboratory experiences	CO
1.	To find the location and understand the task of different components on the car	ETH510-1
2.	To know symbols of components connectors, wires.	ETH510-1
3.	Interpret the wiring diagram and understand different electrical circuits.	ETH510-1
4.	To understand how the control units are connected using different CAN bus systems.	ETH510-1

5.	To perform Alternator test	ETH510-1
6.	To perform Starter circuit test	ETH510-1
7.	To test battery	ETH510-2
8.	To measure the output voltage & observe the output waveform of a crankshaft sensor	ETH510-2
9.	To measure the output voltage & to observe the output waveform of a camshaft sensor	ETH510-2
10.	To study fuel reserve signal function, cam shaft adjustment function, air injection function.	ETH510-3
11.	To study the operation of electronic ignition systems and timing strategies.	ETH510-3
12.	To study the effect of EGR control on NOx emissions and engine performance	ETH510-3
13.	To study fuel control system and different control loops under various modes	ETH510-3
14.	To study electronic cruise control system	ETH510-4
15.	To study Antilock Braking System (ABS)	ETH510-4
16.	To study Electronic Suspension System (ESS)	ETH510-4
17.	To study Electronic Steering Control (ESC)	ETH510-4
18.	To study Fuel quantity measurement	ETH510-5
19.	To study onboard diagnostive system (OBD)	ETH510-5
20.	To measure the coolant temperature using thermistor-based coolant temperature sensor	ETH510-5
21.	To measure the oil pressure using oil pressure sensor	ETH510-5
22.	To study Collision avoiding system	ETH510-6
23.	To study Voice recognition cell phone dialing system	ETH510-6
24.	To study radar-based collision avoidance system	ETH510-6
25.	To study basic vehicle tracking system using GPS	ETH510-6

V) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH510-1 Interpret the basics of automotive fundamentals		

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
1	**Introduction to Automotive Fundamentals** 1.1 Use of electronics in automobile 1.2 Evolution of automotive electronics 1.3 Automobile physical configuration 1.4 Evolution of electronics in automobile 1.5 Survey of major automotive system 1.6 Engine control or electronic control unit 1.7 Ignition system	**04**	
	ETH510-2 Use automotive sensors and actuators in automotive electronics		

2	**Sensors and actuators**
	2.1 Speed sensors, Pressure sensors
	  2.1.1 Manifold Absolute Pressure sensor, knock sensor.
	  2.1.2 Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen Semester sensor
	  2.1.3 Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor
	2.2 Air mass flow sensor. Solenoids, stepper motors and relays
		05	

	ETH510-3 Analyze electronics engine management systems		

3	**Electronic engine management system**
	3.1 Electronic engine control: Input, output and control strategies
	3.2 Electronic fuel control system, fuel control modes: open loop and closed loop control at various modes
	3.3 EGR control
	3.4 Electronic ignition systems
	  3.4.1 Spark advance correction schemes
	  3.4.2 Fuel injection timing control
		06	

	Sub-total	**15**	

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	ETH510-4 Explore various vehicle management systems used in automobile		

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
4	**Electronic vehicle management system** 4.1 Cruise control system 4.2 Antilock braking system 4.3 Electronic suspension system 4.4 Electronic steering control 4.5 Traction control system 4.6 Transmission control	**06**	
	ETH510-5 Demonstrate different automotive instrumentation systems used in automobile		
5	**Automotive instrumentation system** 5.1 Input and output signal conversion, multiplexing 5.2 Fuel quantity measurement 5.3 Coolant temperature and oil pressure measurement 5.4 Display devices- LED, LCD, VFD and CRT 5.5 Onboard diagnostics (OBD), OBD-II, off board diagnostics	**04**	
	ETH510-6 Use *electronic safety and smartness of future automotive electronic systems in the automobiles.*		
6	**Safety and future automotive electronics system** 6.1 Airbags 6.2 Collision avoiding system 6.3 Low tyre pressure warning system 6.4 Radar warning system 6.5 Control system multiplexing 6.6 Internal navigation system 6.7 GPS navigation system 6.8 Voice recognition cell phone dialing system	**05**	
	Sub-total	**15**	

G: List of Assignments under SLA

Sr. No.	List of Assignment (under SLA)	Hours allotted
1.	Prepare a report on five key applications of electronics in modern automobiles, such as safety, efficiency, and comfort. Include real-world examples (e.g., ABS, airbags, infotainment)	02

2.	Prepare a report or presentation categorizing major automotive systems (e.g., engine, transmission, braking, suspension, electrical, HVAC). Describe the role of electronics in each system.	02
3.	Explain the working of an ECU and list at least five sensors used for engine control (e.g., oxygen sensor, throttle position sensor). Draw a simple block diagram showing data flow from sensors to actuators.	02
4.	Compare conventional ignition vs. electronic ignition systems. Describe the components of an electronic ignition system (e.g., ignition coil, spark plug, crankshaft position sensor) and explain its advantages.	02
5.	Prepare a report on the operating principles, characteristics, and applications of various automotive sensors, including speed sensors, pressure sensors (e.g., MAP and knock sensors)	02
6.	Prepare a report on the operating principles, characteristics, and applications of various automotive sensors, including temperature sensors (e.g., coolant and exhaust gas temperature sensors), and position sensors (e.g., throttle and crankshaft position sensors).	02
7.	Design and simulate control circuits for actuators such as solenoids, stepper motors, and relays used in automotive applications. Include considerations for driving these components using microcontrollers.	02
8.	Investigate the operation of air mass flow sensors. Create a report detailing their role in engine management systems, including how they influence fuel injection and ignition timing.	02
9.	Analyze different electronic engine control strategies, focusing on input and output management. Develop a case study on a specific engine control unit (ECU), detailing its control algorithms and decision-making processes.	02
10.	Compare and contrast open-loop and closed-loop fuel control modes. Perform a simulation demonstrating how each mode operates under various engine conditions, and report on their advantages and disadvantages.	02
11.	Conduct an in-depth study of EGR systems, focusing on their control mechanisms and impact on emissions. Include diagnostic approaches for common EGR-related issues.	02
12.	Explore electronic ignition systems with an emphasis on spark advance correction	02
13.	Prepare a report or presentation on working principles of adaptive cruise control systems. Develop a report detailing how these systems maintain vehicle speed and adjust to traffic conditions. Include a comparison between traditional and adaptive cruise control technologies.	02
14.	Investigate the components and operation of ABS. Create a simulation model demonstrating how ABS prevents wheel lock-up during braking. Analyze the system's impact on vehicle safety and control.	02
15.	Examine the function of electronic suspension systems, such as active and semi-active suspensions. Prepare a presentation on how these	02

	systems enhance ride comfort and handling. Include case studies of specific vehicles utilizing these technologies.	
16.	Analyze the development and advantages of electronic power steering (EPS) systems over hydraulic systems. Create a technical report discussing the control algorithms involved and their benefits in terms of fuel efficiency and steering precision.	02
17.	Study the mechanisms of TCS and its role in maintaining vehicle stability. Develop a case study on a specific TCS implementation, detailing its components, operation, and effectiveness in various driving conditions.	02
18.	Explore the evolution of transmission control systems, focusing on the transition from manual to automated transmissions. Write a paper on how electronic control units (ECUs) manage gear shifting and the integration of these systems with engine control for optimal performance.	02
19.	Design a simple automotive data acquisition system that demonstrates input and output signal conversion and multiplexing. Document the process and challenges encountered during the project.	02
20.	Design a simple automotive data acquisition system that demonstrates input and output signal conversion and multiplexing. Document the process and challenges encountered during the project.	02
21.	Analyze the importance of coolant temperature and oil pressure measurements in engine performance. Create a diagnostic guide outlining how to interpret these measurements and troubleshoot potential issues.	02
22.	Prepare a report on different display technologies used in automotive dashboards, such as LED, LCD, VFD, and CRT. Prepare a comparative analysis highlighting their advantages, limitations, and typical applications in vehicles.	02
23.	Delve into the functionalities of OBD and OBD-II systems. Using an OBD-II scanner, collect data from a vehicle and interpret the diagnostic trouble codes (DTCs). Document your findings and suggest possible solutions for the identified issues.	02
24.	Prepare a report on the operational principles of automotive airbag systems. Develop a detailed report covering the types of airbags, their deployment mechanisms, and the role of sensors in crash detection. Include a case study on a specific vehicle's airbag system, analyzing its design and effectiveness.	02
25.	Investigate modern collision avoidance systems, focusing on technologies such as automatic emergency braking (AEB) and forward collision warning. Create a presentation that explains how these systems work, their components, and their impact on vehicle safety. Discuss recent advancements and future trends in this field.	02
26.	Examine the functionality of low tire pressure warning systems. Prepare a technical report detailing the types of TPMS (direct and indirect), their	02

	components, and the importance of maintaining proper tire pressure. Include diagnostic procedures for common TPMS issues.	
27.	Delve into radar warning systems used for blind-spot detection and rear cross-traffic alerts. Create a comprehensive report that explains the underlying radar technology, system architecture, and integration into vehicle safety systems. Discuss the challenges and limitations of radar-based systems.	02
28.	Investigate the concept of control system multiplexing in modern vehicles. Develop a report that outlines the benefits of multiplexing, such as reduced wiring complexity and enhanced communication between electronic control units (ECUs). Include examples of multiplexing protocols like CAN bus and LIN bus.	02
29.	Examine the implementation of voice recognition technology for functions like cell phone dialing and infotainment control in modern automobiles. Create a report discussing the technology's evolution, current capabilities, challenges (such as noise interference), and future prospects.	02
30.	Explore the development and functionality of internal navigation systems and GPS-based navigation in vehicles. Prepare a comparative analysis highlighting the differences, advantages, and limitations of each system. Discuss the integration of real-time traffic data and user interfaces.	02

**Six out of 30 assignments covering all six COs are compulsory. As per the requirement course teacher can modify the assignments.

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 50 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	10

2	Preparedness for practical	10
3	Neat & complete Diagram.	10
4	Observations & handling of instrument.	10
5	Oral Based on Lab work and completion of task	10
	TOTAL	**50**

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	Automotive Hand Book	Robert Bosch	SAE (8th Edition), 2011
2	Automobile Electrical and Electronic Systems	Tom Denton	4th edition- Routledge – 2012
3	Automotive Electricity and Electronics	Barry Hollembeak	Delmar Cengage Learning; 5th edition, 2011
4	Understanding Automotive Electronics: An Engineering Perspective	William B Ribbens	Newne Butterworth-Heinermann, 7th edition 2012
5	Automobile Engineering	Kripal Singh Vol I and II	Standard Publishers, New Delhi
6	Advanced Microsystems for Automotive appications	L) Mayer, J. Valldorf and W. Gessner	Springer, 2009

L)   Learning Website & Software

Sr. No.	URL
1	*https://www.electronicdesign.com/markets/automotive*
2	*https://www.mentor.com/embedded-software/automotive/*
3	*https://www.avnet.com/wps/portal/apac/resources/article/automotive-electronics-top-5-tech-trends-tomorrows-smart-cars/*
4	*Search for „Automotive Electronics" on https://www.youtube.com/, https://www.google.com/*
5	*https://www.lacroix-electronics.com/market-sectors/automotive/*
6	*Search „Automotive Electronics" on https://ieeexplore.ieee.org/*
7	*https://midasmic.com/c1_en.php?class_major_id=1&class_item_id=1*
8	*Course on Automotive Electronics https://www.youtube.com/watch?v=tyP97QbrsEI&list=PLAMZfGOiiA2NYHfC2tUIJVRLWf6dTEP0I*

M) Open source simulation software:

Sr. No.	Particular	Software
1	For Engine Control & Transmission Simulation	OpenModelica, Scilab
2	For Circuit Design & Automotive Sensors	KiCad, LTspice
3	For 3D Modeling & Vehicle Dynamics	FreeCAD, SimScale
4	For Microcontroller-Based Automotive Projects	TinkerCAD
5	For Vehicle Communication & OBD-II Diagnostics	Vehicle Spy X

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