Four-Year Undergraduate Programme

Bachelor of Technology

Electronics & Communication Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering & Technology
Bachelor of Technology in Electronics & Communication Engineering

1. Vision of the Department

To serve the mission and vision of the Institute through teaching, research and service designed to provide the best electronics and communication engineering education. Our sole target is to provide strong theoretical foundation, practical engineering skills, and experience in interpersonal communication to our students, to inculcate leader ship and teamwork qualities in our students, to prepare our students for successful engagement in commercial andindustrial enterprise, and research and development.

2. Mission of the Department

M1 To equip graduates with a strong foundation in fundamental knowledge and practical engineering skills, fostering technical proficiency (critical investigation, communication, analytical, and computer skills) to enable them to effectively apply acquired knowledge in real-world scenarios
M2 To develop a skilled workforce capable of contributing significantly to societal development, emphasizing the application of Electronics & Communication Engineering aspects. Graduates will possess critical analysis and communication skills, enabling them to present their ideas effectively in both written and oral forms
M3 To inspire students to engage in impactful research aligned with industrial needs, fostering a Research & Development attitude. The emphasis is on ethical research practices thatcontribute positively to society

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the B.Tech Electronics & Communication Engineering curriculum enables graduates to attain.

PEO 1	To develop technical skills (critical investigation, communication, analytical and computer) and human relations skills (group dynamics, team building, organization and delegation) to enable students to transform the acquired knowledge into action.
PEO 2	To inculcate critical analysis and communication skills into students to effectively present their views, both in writing and through oral presentations.
PEO 3	To provide an environment for exploring the Research & Development attitude, to help thestudents in Research and Development field.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	**Problem analysis:**	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated

		conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal and environmental considerations.
PLO 4	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	**Environment and sustainability:**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PLO 8	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
PLO 10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PLO 11	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	**Demand as per recent development**	Design the solutions as per recent industrial demand objective.

PSO 2	**Software skill**	Test any apparatus with appropriate usage of software tools, gather data for prototype system.

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	22
Semester-2	18
Semester-3	23
Semester-4	21
Semester-5	22
Semester-6	20
Semester-7	22
Semester-8	19
Total Credits:	**167**

Category wise Credit distribution of the programme	
Category	**Credit**
Major Core	102
Minor Stream	00
Multidisciplinary	37
Ability Enhancement Course	9
Skill Enhancement Courses	3
Value added Courses	2
Summer Internship	4
Research Project/Dissertation	10
Total Credits:	**167**

7. Program Curriculum

Semester 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303105102	Programming for Problem Solving	4	3	2	0
2	303106101	Basic Electrical Engineering	4	3	2	0
3	303109101	Engineering Graphics	4	2	4	0
4	303191101	Mathematics-I	4	4	0	0
5	303192102	Engineering Physics-II	4	3	2	0

6	303193103	Communication Skills	2	0	0	2
		Total	**22**	**16**	**8**	**2**
Semester 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
7	303104105	Environmental Science	Audit	1	0	0
8	303105106	Information and Communication Technology	3	3	0	0
9	303107151	Basic Electronics	4	3	2	0
10	303107153	Electronic Workshop	1	0	2	0
11	303109102	Elements of Mechanical Engineering	4	3	2	0
12	303191151	Mathematics-II	4	4	0	0
13	303193152	Advanced Communication & Technical Writing	2	0	0	2
		Total	**18**	**13**	**8**	**2**
Semester 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
14	303107201	Electronic Devices	3	3	0	0
15	303107202	Electronic Devices Lab	1	0	2	0
16	303107203	Digital System Design	3	3	0	0
17	303107204	Digital System Design Lab	1	0	2	0
18	303107205	Network Theory	3	3	0	0
19	303107206	Network Theory Lab	1	0	2	0
20	303107207	Signals and Systems	3	3	0	0
21	303107208	Signal and System LAB	1	0	2	0
22	303107209	Product Realization	1	0	2	0
23	303191203	Mathematics III	4	4	0	0
24	303193203	Professional Communication Skills	2	0	0	2

		Total	**23**	**16**	**10**	**2**
Semester 4						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
25	303107251	Analog Communication	3	3	0	0
26	303107252	Analog Communication Lab	1	0	2	0
27	303107253	Analog Circuits	3	3	0	0
28	303107254	Analog Circuits Lab	1	0	2	0
29	303107255	Microcontrollers	3	3	0	0
30	303107256	Microcontroller Lab	1	0	2	0
31	303107257	Control System	3	3	0	0
32	303107258	Control System Lab	1	0	2	0
33	303107259	Probability Theory and Stochastic Processes	3	3	0	0
34	303107260	Probability Theory and Stochastic Processes LAB	1	0	2	0
35	303193252	Professional Grooming and Personality Development	1	0	0	1
		Total	**21**	**15**	**10**	**1**
Semester 5						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
36	303107301	Electromagnetic waves	3	3	0	0
37	303107302	Electromagnetic Waves Lab	1	0	2	0
38	303107303	Computer Architecture	3	3	0	0
39	303107304	Computer Architecture Lab	1	0	2	0
40	303107309	Digital Communication	3	3	0	0
41	303107310	Digital Communication Lab	1	0	2	0

42	303107308	Simulation Design Techniques	1	0	2	0
43	303107311	Summer Internship - I	2	0	0	0
44		Open Elective-1 (Compulsory Subjects :1)	2	2	0	0
45		PEC 01 (Compulsory Subjects :1)	3	3	0	0
46		PEC 01-LAB (Compulsory Subjects :1)	1	0	2	0
47	30319304	Professionalism & Corporate Ethics	1	0	1	0
		Total	**22**	**14**	**11**	**0**

PEC 01

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303107331	Power Electronics	3	3	0	0
2	303107333	Introduction to MEMS	3	3	0	0
3	303107335	Scientific computing	3	3	0	0
4	303107337	PLC & SCADA	3	3	0	0

PEC 01-LAB

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303107332	Power Electronics Lab	1	0	2	0
2	303107334	Introduction to MEMS Lab	1	0	2	0
3	303107336	Scientific Computing Lab	1	0	2	0
4	303107338	PLC & SCADA Lab	1	0	2	0

Open Elective 01

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303105304	Cyber Security	2	2	0	0
2	303109346	Renewable Energy Sources	2	2	0	0

Semester 6

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
48	303107351	VLSI	3	3	0	0
49	303107352	VLSI Lab	1	0	2	0

50	303107353	Computer Network	3	3	0	0
51	303107354	Computer Network Lab	1	0	2	0
52	303107355	Digital Signal Processing	3	3	0	0
53	303107356	Digital Signal Processing Lab	1	0	2	0
54	303107358	Electronic Measurement Lab	1	0	2	0
55		PEC 02 (Compulsory Subjects :1)	3	3	0	0
56		PEC 02-LAB (Compulsory Subjects :1)	1	0	2	0
57		**Open Elective 02**	2	2	0	0
58	303193353	Employability Skills	1	0	1	0
		Total	**20**	**14**	**11**	**0**

PEC 02

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303107381	Nano electronics	3	3	0	0
2	303107383	Information Theory and Coding	3	3	0	0
3	303107385	Bio Medical Electronics	3	3	0	0
4	303107387	Industrial Instrumentation	3	3	0	0

PEC 02-LAB

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303107382	Nano Electronics Lab	1	0	2	0
2	303107384	Information Theory and Coding Lab	1	0	2	0
3	303107386	Bio Medical Electronics Lab	1	0	2	0
4	303107388	Industrial Instrumentation Lab	1	0	2	0

Open Elective 02

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303100351	Life Science	2	2	0	0
2	303100352	Biology for Engineers	2	2	0	0
3	303100353	Engineering Geology	2	2	0	0

4	303100354	Landscape Planning and Design	2	2	0	0
5	303100355	Fundamentals of Management	2	2	0	0
6	303100356	Corporate Social Responsibility	2	2	0	0
7	303100357	Innovation and Entrepreneurship	2	2	0	0
8	303100359	Cyber Law & Ethics	2	2	0	0
Semester 7						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
59	303107401	Project-1	5	0	10	0
60	303107402	Summer Internship - II	2	0	0	0
61		Open Elective 03 (Compulsory Subjects :1)	3	3	0	0
62		PEC 03 (Compulsory Subjects :1)	3	3	0	0
63		PEC 03-LAB (Compulsory Subjects :1)	1	0	2	0
64		PEC 04 (Compulsory Subjects :1)	3	3	0	0
65		PEC 04-LAB (Compulsory Subjects :1)	1	0	2	0
66		PEC 05 (Compulsory Subjects :1)	3	3	0	0
67		PEC 05-LAB (Compulsory Subjects :1)	1	0	2	0
		Total	**22**	**12**	**16**	**0**
PEC 03						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107411	Adaptive signal processing	3	3	0	0
2	303107413	Speech and Audio Processing	3	3	0	0
3	303107415	Error Correcting Codes	3	3	0	0
4	303107427	Antennas and Propagation	3	3	0	0
PEC 03-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107412	Adaptive Signal Processing Lab	1	0	2	0

2	303107414	Speech and Audio Processing Lab	1	0	2	0
3	303107416	Error Correcting Codes Lab	1	0	2	0
4	303107428	Antennas and Propagation Lab	1	0	2	0
PEC 04						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107417	Microwave Theory and Techniques	3	3	0	0
2	303107419	Mixed Signal Design	3	3	0	0
3	303107421	Mobile Communication Network	3	3	0	0
PEC 04-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107418	Microwave Theory and Techniques Lab	1	0	2	0
2	303107420	Mixed Signal Design Lab	1	0	2	0
3	303107422	Mobile Communication Network Lab	1	0	2	0
PEC 05						
1	303107423	Satellite Communication	3	3	0	0
2	303107425	Fiber optic Communications	3	3	0	0
3	303107429	Embedded System	3	3	0	0
PEC 05-LAB						
1	303107424	Satellite Communication Lab	1	0	2	0
2	303107426	Fiber optic Communications Lab	1	0	2	0
3	303107430	Embedded System Lab	1	0	2	0
Open Elective 03						
1	303107441	Wavelet Transforms	3	3	0	0
2	303107443	Audio & Video	3	3	0	0

3	303107445	Radar & Navigation Systems	3	3	0	0
4	303107447	Operations Research	3	3	0	0
Semester 8						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
68	303107451	Project-II	5	0	10	0
69		Open Elective 04 (Compulsory Subjects :1)	3	3	0	0
70		Open Elective 05 (Compulsory Subjects :1)	3	3	0	0
71		PEC 06 (Compulsory Subjects :1)	3	3	0	0
72		PEC 06-LAB (Compulsory Subjects :1)	1	0	2	0
73		PEC 07 (Compulsory Subjects :1)	3	3	0	0
74		PEC 07-LAB (Compulsory Subjects :1)	1	0	2	0
		Total	**19**	**12**	**14**	**0**
PEC 06						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107461	Digital Image & Video Processing	3	3	0	0
2	303107463	Internet of Things	3	3	0	0
3	303107465	High Speed Electronics	3	3	0	0
PEC 06-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303107462	Digital Image & Video Processing lab	1	0	2	0
2	303107464	Internet of things Lab	1	0	2	0
3	303107466	High Speed Electronics Lab	1	0	2	0
PEC 07						
1	303107467	Wireless Sensor Network	3	3	0	0

2	303107469	Modern Digital Communication System	3	3	0	0
3	303107471	Artificial Intelligence	3	3	0	0
PEC 07-LAB						
1	303107468	Wireless Sensor Network Lab	1	0	2	0
2	303107470	Modern Digital Communication Systems Lab	1	0	2	0
3	303107472	Artificial Intelligence Lab	1	0	2	0
Open Elective 04						
1	303107481	Big data Analysis	3	3	0	0
2	303107483	Modern Manufacturing Processes	3	3	0	0
3	303107485	Spread Spectrum Techniques	3	3	0	0
Open Elective 05						
1	303107461	Digital Image & Video Processing	3	3	0	0
2	303107463	Internet of Things	3	3	0	0
3	303107465	High Speed Electronics	3	3	0	0
		Total	**167**			

8. Detailed Syllabus

Semester 1

a. **Course Name:** Programming for Problem Solving
b. **Course Code:** 303105102
c. **Prerequisite:** Requires Basic Knowledge of Computer
d. **Rationale:** This course is design to provide basic ideas of computer programming. This course also makes help to understand programming language. It will help to develop their logical abilities.
e. **Course Learning Objective:**

CLOBJ 1	Recognize and recall fundamental principles and organizations of computers, demonstrating a foundational understanding of computer architecture and design.
CLOBJ 2	Comprehend the concepts of computer programming languages, illustrating a grasp of syntax, semantics and the essential components of programming languages.
CLOBJ 3	Develop algorithms for solving basic engineering problems, demonstrating the ability to apply theoretical knowledge to practical problem-solving scenarios.
CLOBJ 4	Demonstrate proficiency in the practical application of C programming bywriting, compiling and debugging programs, showcasing the ability to implement and troubleshoot code effectively.
CLOBJ 5	Evaluate and analyse complex computational programs written in C, demonstrating the capacity to assess and understand intricate solutions to computational challenges.
CLOBJ 6	Develop simple projects using the C programming language, showcasing creativity and application of learned principles to produce functional and practical software solutions.

f. **Course Learning Outcomes:**

CLO 1	Recognize the computer's basic principles and organizations.
CLO 2	Understand Concepts of Computer Programming Language.
CLO 3	Develop the algorithm for solving basic Engineering Problems.
CLO 4	Write, Compile and debug program with C Programming.
CLO 5	Analyse the Solved, Complex Computational Program written in C.
CLO 6	Develop simple projects using C Language.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**		
L	**T**	**P**	**C**	**Internal Evaluation**	**ESE**	**Total**

				MSE	CE	P	Theory	P	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	Weightage	Teaching Hours
1	**Number System:** Introduction and type of Number system, Conversionbetween number system, Arithmetic operations on number system, Signed and unsigned number system Software, Computer Languages and Computer Program	**2%**	**3**
2	**Introduction to 'C' Programming:** Features of C language, structure of C Program, Flow Charts and Algorithms Types of errors, debugging, tracing/stepwise execution of program, watching variables values in memory.	**3%**	**3**
3	**Constants, Variables and data Types:** Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Assigning values to variables, typedef, and Defining symbolic constants.	**5%**	**2**
4	**Operators and Expression:** Introduction to Operators and its types, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associatively.	**10%**	**3**
5	**Management Input and Output Operators:** Introduction, reading a character, writing a character, formatted input, formatted output.	**5%**	**2**
6	**Control structure in C:** Decision Making & branching: Decision making with If &I .. Else statements, If.. Else statements (Nested …. Ladder), The Switch & go to statements, The turnery (?:) Operator Looping: The while statement, The break statement & The Do.. While loop, The FOR loop, Jump within loops – Programs	**15%**	**4**
7	**Array:** Introduction, One-dimensional arrays, Two-dimensional arrays, arrays, Concept of Multidimensional arrays.	**10%**	**4**
8	**String:** string , string storage , Built-in-string functions	**10%**	**3**
9	**User-Defined Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing.	**10%**	**5**

10	**Structure and Unions:** Introduction, Structure definition, declaring and initializing Structure variables, Accessing Structure members, Copying & Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions	**10%**	**5**
11	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, Pointer to array, array of pointers , functions returning apointer	**10%**	**5**
12	**Dynamic memory allocation:** Introduction to Dynamic memory allocation, malloc(), calloc(), free(), realloc()	**5%**	**2**
13	**File Management in C:** Introduction to file management andits functions	**5%**	**1**

i. Text Book and Reference Book:

1. Programming in ANSI C (TextBook) By E. Balaguruswamy | Tata McGraw-Hill
2. C Programming: Test Your Skills By Ashok Kamthane
3. Computer Fundamentals By P.K.Sinha and Priti Sinha | BPB Publications | 4th Edition
4. Star C Programming STAR Certification | C Certification Exam
5. Programming with C By Byron Gottfried | Tata McGraw Hill Education
6. C The Complete Reference By Herbert Schildt
7. Let Us C By Yeshavant Kanetkar | BPB Publications

a. Course Name: Basic Electrical Engineering
b. Course Code: 303106101
c. Prerequisite: Knowledge of Physics and Mathematics up to 12th science level
d. Rationale: Basic Electrical Engineering knowledge is fundamental as it provides a strong foundation for various engineering disciplines, promotes problem-solving skills, supports innovation, and opens doors to diverse career opportunities.
e. Course Learning Objective:

CLOBJ 1	Gain familiarity with electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLOBJ 2	Solve problems related to Alternating current, alternating voltage etc, Demonstrate a clear understanding of Pure R, L C circuit and combination of RLC, Series and Parallel combination of R, L and C etc

CLOBJ 3	Acquire knowledge of the resistor, capacitor, and inductor and their performance characteristics for series and parallel connections.
CLOBJ 4	Understand different single phase and three phase circuits.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of transformer, DC machines and AC machines.
CLOBJ 6	Study the use of LT Switch Gear, Fuse, MCB, ELCB etc.

f. Course Learning Outcomes:

CLO 1	Understand electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLO 2	Solve basic electrical circuit problems using various laws and theorems
CLO 3	Understand the role of resistor, capacitor and inductor and their performance characteristics for series and parallel connections.
CLO 4	Discuss three phase-balanced circuits.
CLO 5	Understanding the basic concepts and working principles of transformers, DC machines and AC machines.
CLO 6	Acquire knowledge about electrical installations

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Mesh and	**22%**	**10**

	Node analysis, Simplifications of networks using series and parallel combinations and star-delta conversions. Superposition, Thevenin and Norton Theorems.		
2	AC Circuits Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of instantaneous, peak (maximum), average and R.M.S. values, frequency, cycle, period, peak factor and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors, examples based on theory. Study of A.C. circuits consisting of pure resistance, pure inductance, pure capacitance and corresponding voltage-current phasor diagrams and waveforms. Development of the concept of reactance, the study of series R-L, R-C, R-L-C circuit and resonance, study of parallel R-L, R-C and R-L-C circuit, concept of impedance, admittance, conductance and susceptance in case of above combinations and relevant voltage-current phasor diagrams, the concept of active, reactive and apparent power and power factor, examples based on theory. Concept of three-phase supply and phase sequence. Voltages, currents and power relations three-phase have balanced star-connected loads and delta-connected loads along with phasor diagrams, Power and power factor measurement in balanced three-phase circuits (one, two and three wattmeter methods), examples based on theory.	**33%**	**15**
3	**Transformers** Magnetic effect of an electric current, right-hand thumb rule, Concept of m.m.f., flux, flux density, reluctance, permeability and field strength, their units and relationships, comparison between electrical and magnetic parameters. Fleming's left-hand rule. Self and mutual inductance, Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.	**20%**	**9**
4	**Electrical Machines** Construction, working and application of DC Motor and Generator. Generation of 3 phase rotating magnetic fields, Construction and working of a three-phase and Single phase induction motor and its types. Construction and working of Synchronous generator.	**15%**	**7**

5	**Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.	**10%**	**4**

i. Text Book and Reference Book:

1. Electrical Engineering Fundamentals, By V. D. Toro, Prentice Hall India, Pub. Year 1989
2. Basic Electrical Engineering, By D. C. Kulshreshtha, McGraw Hill, Pub. Year 2009
3. Fundamentals of Electrical Engineering, By Leonard S. Bobrow, Oxford University Press, Pub. Year 1996
4. Electrical and Electronics Technology, By E. Hughes Pearson, Pub. Year 2010
5. Basic Electrical Engineering, By D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, Pub. Year, 2010
6. A textbook of Electrical Technology Volume 1&2, By B. L. Theraja, S. Chand Publication

a. Course Name: Engineering Graphics

b. Course Code: 303109101

c. Prerequisite: Knowledge of Physics and Mathematics up to 12th science level

d. Rationale: "Engineering Graphics" course Provide students with a comprehensive foundation in the fundamental principles and concepts that form the backbone of mechanical engineering for various Engineering disciplines.

e. Course Learning Objective:

CLOBJ 1	Identify and name common drafting tools and their uses.
CLOBJ 2	Interpret engineering drawings and symbols.
CLOBJ 3	Demonstrate the ability to create accurate engineering drawings using industry-standard software.
CLOBJ 4	Solve engineering design problems by applying geometric and spatial concepts.
CLOBJ 5	Generate accurate and professional engineering drawings independently.
CLOBJ 6	Design and create 3D models of engineering components using computer-aided design (CAD) tools.

f. Course Learning Outcomes:

CLO 1	Identify and recall common drafting tools and their uses.
CLO 2	Interpret and explain engineering drawings and symbols.
CLO 3	Demonstrate the application of industry-standard software to create accurate engineering drawings.

CLO 4	Solve engineering design problems by applying geometric and spatial concepts.
CLO 5	Generate accurate and professional engineering drawings independently.
CLO 6	Design and create 3D models of engineering components using computer-aided design (CAD) tools.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	-	2	4	20	20	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction To Engineering Graphics** Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Types of Scales (Plain and Diagonal Scale), Dimensioning Terms and Notations, Types of Arrowheads, Lines, Lettering, Numbering and Dimensioning	5%	0
2	**Engineering Curves:** Classification of Engineering Curves, Application of Engineering Curves, Constructions of Engineering Curves - Conics, Spirals, Involutes and Cycloids with Tangents and Normal	10%	5
3	**Principles Of Projections:** Types of Projections - Oblique, Perspective, Orthographic and Isometric Projections; Introduction to Principal Planes of Projections, Projections of Points located in all four Quadrants; Projections of lines inclined to one of the Reference Plane and inclined to two Reference Planes.	10%	4
4	**Projections Of Planes:** Projections of various planes – Polygonal, Circular and Elliptical shape inclined to one of the Reference Plane and inclined to two Reference Planes; Concept of Auxiliary Plane of Projections.	10%	4

5	**Projections Of Solids And Sections Of Solids:** Classifications of basic Solids, Projections of Solids - Right Regular Prism, Pyramid, Cone, Cylinder, Tetrahedron and Cube inclined to one of the Reference Plane and inclined to two Reference Planes; Frustum of Prism, Pyramid and Cone inclined to one of the Reference Plane; Types of Cutting Planes - Auxiliary Inclined Plane, Auxiliary Vertical Plane, Horizontal Cutting Plane, Profile Cutting Plane; Sections of Solids resting on H.P/V.P and Inclined to only one of the Reference Planes; Sectional Views, True Shape of the Sections	**20%**	**10**
6	**Development Of Surfaces:** Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	**10%**	**5**
7	**Orthographic Projections:** Projections on Principal Planes from Front, Top and Sides of the Pictorial view of an Object, First Angle Projection and Third Angle Projection method; Full Sectional Orthographic Views – Side and Front, Offset Cutting views	**15%**	**0**
8	**Isometric View/Drawing And Isometric Projections:** Conversion of Orthographic Views into Isometric Projection, View or Drawing; Isometric Scale.	**15%**	**0**
9	**Overview Of Computer Aided Drafting Tool:** Introduction to Computer Aided Drafting Software; Preparation of Orthographic Projections and Isometric Views Using Drafting Software	**5%**	**0**

i. Text Book and Reference Book:

1. Engineering Drawing N.D. Bhatt & V.M. Panchal; Charotar Publishing House
2. ENGINEERING GRAPHICS P. J. Shah; S. Chand & Co., New Delhi Publications.
3. Graphic Science and Design French, T.E. Vierck, C.J & Foster; Tata McGraw Hill Publications.
4. Fundamentals of Engineering Drawing Luzadder; W. J & Duff Prentice Hall Publications.
5. Engineering Drawing and Graphics Venugopal k; New Age International Private Limited Publishers.

a. Course Name: Mathematics-I

b. Course Code: 303191101

c. Prerequisite: Knowledge of Mathematics up to 12th science level

d. Rationale: The Mathematics I syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and matrix algebra, preparing students for engineering challenges with optimized problem-solving skills.

e. Course Learning Objective:

CLOBJ 1	Develop a comprehensive understanding of definite and improper integrals, including the application of integration techniques to find areas and volumes in both Cartesian and Polar coordinates.
CLOBJ 2	Utilize differential equations to model and solve practical scenarios, demonstrating proficiency in various solution techniques.
CLOBJ 3	Analyse the convergence and divergence of sequences and series, employing tests such as the Alternating Series Test and Ratio Test
CLOBJ 4	Analyse matrix operations and determinants, exploring their properties and applications in solving systems of linear equations.
CLOBJ 5	Apply Fourier series for representing periodic functions, verifying Dirichlet's conditions.
CLOBJ 6	Solve optimization problems using multivariable calculus concepts, such as Lagrange's multiplier.

f. Course Learning Outcomes:

CLO 1	Develop understanding of fundamental mathematical concepts
CLO 2	Formulate and solve mathematical models for real-world engineering problems,
CLO 3	Integrate knowledge from different mathematical topics to analyse and solve complex engineering problems
CLO 4	Critically analyse mathematical results, interpret their engineering significance, and make informed decisions based on mathematical outcomes, fostering a deeper understanding of the subject.
CLO 5	Clearly and effectively communicate mathematical ideas, solutions, and reasoning, both in written and oral formats, demonstrating effective communication skills.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**-**	**-**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**UNIT 1 Improper Integral & Application of Definite Integral:** Evaluation of definite and improper integrals, Beta and Gamma functions and their properties Area bounded by curves in Cartesian and Polar form, Area of a region bounded by function, Area of a region bounded by curves in Parametric form, Volume by slicing, Volume of solid by revolution.	**8%**	**5**
2	**UNIT 2 First order Ordinary Differential equation:** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications	**15%**	**9**
3	**UNIT 3 Matrices:** Matrices & Determinants with Properties, Linear Independence, Rank of Matrix, System of Linear Equations, Consistency of System, Solution of system of Linear Equations by Gauss Jordan and Gauss-Elimination Method, Eigen values, Eigenvectors, Symmetric, Skew-symmetric and orthogonal Matrices, Eigen bases, Diagonalization, Cayley Hamilton Theorem and its Applications, Diagonalization, Orthogonal Transformation, Quadratic form.	**25%**	**15**
4	**UNIT 4 Sequences and Series:** Basic of Sequences, Bounded and Monotonic Sequences, Series, Convergence of sequence andseries, Geometric series, P- series, Cauchy's Integral Test, Comparison Test, Alternating Series, Absolute and Conditional convergence, Ratio test, Cauchy's Root Test, Power series, Taylor's and Maclaurin's series.	**17%**	**10**
5	**UNIT 5 Fourier Series:** Fourier Series of 2 periodic functions, Dirichlet's conditions for representation by a Fourier series, Fourier Series of a function of period 2 , Fourier Series of even and odd functions, Half range series.	**10%**	**6**
6	**UNIT 6 Multivariable Calculus (Differentiation):** Functions of Several Variables, Limit, Continuity, Partial Derivatives, Homogeneous function, Euler's Theorem for homogeneous function, Modified Euler's Theorem, Chain Rule, Implicit function,Jacobian, Tangent plane and Normal line, Maximum and Minimum Values, Lagrange 's Multiplier, Taylor's and Maclaurin's Series for functions of two variables.	**25%**	**15**

i. Text Book and Reference Book:

1. Calculus and Analytic Geometry (Textbook) By G.B. Thomas and R.L. Finney | Addison

Wesley
2. Calculus with early transcendental functions By James Stewart | Cengage Learning
3. Higher Engineering Mathematics By B. S. Grewal | Khanna Publications
4. Elementary Linear Algebra (Textbook) By Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
5. Advanced Engineering Mathematics (Textbook) By Erwin Kreyszig | Willey India Education
6. A text book of Engineering Mathematics By N.P. Bali and Manish Goyal | Laxmi Publications

a. Course Name: Engineering Physics-II
b. Course Code: 303192102
c. Prerequisite: Knowledge of Physics and some basic concepts in Mathematics like differentiation, integration, limit, differential equation, vector calculus up to 12thscience level.
d. Rationale: Knowledge of physics is essential for all Engineering branch because physics is the foundation subject of all the branches of engineering and it develops scientific temperament and analytical capability of engineering students. Comprehension of basic physics concepts enables the students to solve engineering problem logically and develop scientific approach
e. Course Learning Objective:

CLOBJ 1	Understand the basics of quantum mechanics, including Schrodinger's equations and the physical significance of wave functions..
CLOBJ 2	Apply the Schrodinger equation to analyse particles in one-dimensional potential boxes, emphasizing practical implications and tunnelling effects.
CLOBJ 3	Master concepts of energy bands, semiconductor classification, E-k diagrams, and semiconductor device analysis including P-N junction diodes.
CLOBJ 4	Comprehensively understand material classification, focusing on magnetic materials, nanomaterials, and analysing physical, thermal, electrical, optical, and magnetic properties.
CLOBJ 5	Gain expertise in laser principles, types, and applications, as well as fiber optics principles and applications. Understand optoelectronic devices, their functionalities, and practical applications.

f. Course Learning Outcomes:

CLO 1	Formulate and conceptualize various theoretical aspects and the physical phenomena at atomic level
CLO 2	Analyse the optical transition processes in semiconductors and identify the materials useful in optoelectronic devices.

CLO 3	Understand the fabrication and applications of low dimensional semiconductor devices.
CLO 4	Acquire proficiency in experimental techniques used for studying nanoscale systems, including microscopy and spectroscopy.
CLO 5	Master the principles of quantum mechanics and their application to nanoscale systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	30	60	20	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**UNIT-I: Modern Physics** Introduction about quantum Mechanics, Schrodinger's equations, Time dependent and Time Independent Wave Equation, Physical Significance of the wave Function, Application of Schrodinger equation in particle in One Dimensional Potential Box and Tunnelling effects.	20%	9
2	**UNIT-II: Band theory& Semiconductors** Energy bands in solids, Classification of Materials into, Semiconductors & Insulators, Density of state, E-k diagram, Kronig-Penny model (to introduce origin of band gap), and Effective mass. Direct and indirect band gap. Carrier Concentration in semiconductors, Fermi Level in Intrinsic and Extrinsic Semiconductors, P-N junction diode, Ohmic and Schottky Junction.	20%	9
3	**UNIT-III: Materials** Classification of materials: Magnetic materials, Nanomaterials based on semiconductors and metal oxides, Basic characteristic properties of nanomaterials, Novel Materials. Physical, Thermal, Electrical, Optical and Magnetic properties of materials.	20%	9
4	**UNIT-IV: Laser and Fiber Optics** Lasers: Interaction of radiation with Matter, Absorption, Spontaneous and Stimulated emission, Characteristics of Lasers,	20%	9

	Types of Lasers: Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers. Fiber Optics: Principle and Structure of Optical Fiber, Numerical Aperture of fiber, Types of Optical Fibers, Attenuation in Optical Fibers, Applications of Optical Fibers**.**		
5	**UNIT-V: Devices** Optoelectronic Devices: Photoconductive cell, photovoltaic cell, Photodiode, Phototransistor, LED, IR emitters, Opto coupler, X-ray diffractometer, Quantum devices and their applications.	**20%**	**9**

i. Text books and reference book:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995)

2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007)

3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).

4. Engineering Physics — HK Malek and A. K. Singh- Mc Graw Hill Publication

5 Semiconductor Optoelectronic Devices- P. Bhattacharya-Prentice Hall of India

6. Fundamentals of Physics- Halliday, Resnick and Walker

a. Course Name: Communication Skill
b. Course Code: 303193103
c. Prerequisite: Knowledge of English Language studied till 12th standard
d. Rationale: Basic Communication Skills are essential for all Engineers.
e. Course Learning Objective:

CLOBJ 1	Students will demonstrate the ability to communicate ideas clearly and effectively
CLOBJ 2	Students will develop strategies for building positive interpersonal relationships, fostering effective collaboration and teamwork.
CLOBJ 3	Students will develop active listening skills, including the ability to comprehend, interpret, and respond appropriately to spoken messages.
CLOBJ 4	Students will exhibit proficiency in written communication, crafting clear, concise, and well-organized messages across various formats (emails, reports, memos, etc.).
CLOBJ 5	Students will develop and deliver professional presentations, incorporating effective visual aids, engaging content, and confident delivery.

CLOBJ 6	Students will understand and utilize various digital communication tools and platforms, demonstrating proficiency in virtual communication.

f. Course Learning Outcomes:

CLO 1	Understand the importance of creative and critical thinking.
CLO 2	Expand vocabulary with proper pronunciation.
CLO 3	Comprehend the basics of English grammar.
CLO 4	Read & write effectively for a variety of contexts.
CLO 5	Develop confidence in speaking skills.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
					CE		Theory	P	
0	2	0	2	-	100	-	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Crazy Scientist**: • The students will be taught the importance of invention and innovation using some examples that changed the world theway it worked.	**5%**	**2**
2	**Phonetics**: • IPA Introduction (listening tracks) • Phonic Sounds • Pronunciation Practice including transcription	**10%**	**4**
3	**Vocabulary Building & Word Formation Process**: • Compounding, clipping, blending, derivation, creative respelling,coining and borrowing • Prefixes & suffixes, synonyms & antonyms, standardabbreviations (related activities will be provided)	**10%**	**2**
4	**Speaking Activity : Role play on Critical Thinking (Life boat)** • This activity topic gears towards making students do role playbased on various scenarios. • It involves giving them a scenario and asking them to	**10%**	**4**

	further develop the idea in a very interesting manner, then going on toenact it. • It aims to improve students' convincing skills.		
5	**Picture Description & Picture Connector** • Enable students to use vocabulary and useful expression todescribe the picture. • In this class the students will be trained to form logical connections between a set of pictures which will be shared withthem. • This geared towards building creativity and presentation skills.	**15%**	**2**
6	**Mine Activity: Usage of Preposition**: • Students will learn to use proper propositions by activeparticipation in the activity.	**8%**	**2**
7	**Worksheets on Identifying Common Errors in Writing:**: • Sentence structure • Punctuations • Subject-Verb Agreement • Noun-Pronoun Agreement	**12%**	**2**
8	**Reading Skills**: • The art of effective reading and its various strategies to betaught to the learners and practice exercises be given onreading comprehension.	**10%**	**2**
9	**Speech and spoken Exchanges; Extempore**: • Students will learn the correct usage of spoken language asdifferent from the written form. It will help the students in extempore speech. • This will be done by making the students give variety of impromptu speeches in front of the class: 1 minute talk onsimple topics. • To change the average speakers in the class to some of thebest Orator.	**10%**	**4**
10	**Book Review**: • The learners will identify the central idea of the book, author'sstyle and approach towards the book. • This will enable the learners to express their point of view andhone their creativity and writing skills.	**10%**	**4**
11	**Activity Session** • This will enhance the creative thinking among students. • To develop their interpersonal communication skills.	**0%**	**2**

i. Text book and Reference Books:

1. Understanding and Using English Grammar Betty Azar & Stacy Hagen; Pearson Education
2. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.

3. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
4. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press
5. Practical English Usage MICHAEL SWAN
6. A Remedial English Grammar for Foreign Student F.T. WOOD
7. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
8. Oxford Practice Grammar, John Eastwood; Oxford University Press

Semester 2

a. **Course Name:** Environmental Science
b. **Course Code:** 303104105
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to 12th science level and Biology up to 10th science level
d. **Rationale:** Basic knowledge of the environment is essential for all human beings for a good life and sustainable existence
e. **Course Learning Objective**

CLOBJ 1	Apply systems thinking to analyse the city as a system, demonstrating application
CLOBJ 2	Evaluate the role of smart citizens and approaches for citizen engagement
CLOBJ 3	Identify sources and stressors of water resources, demonstrating understanding
CLOBJ 4	Analyse the causes, effects, and control measures of population explosion

f. **Course Learning Outcomes:**

CLO 1	Understand the interrelation and interdependency of organisms and their interactions with the environment
CLO 2	Identify eco-friendly measures in engineering projects
CLO 3	Understand preventive steps for environmental protection.
CLO 4	Act as a responsible individual who is aware of efficient usage of resources and securing sustainable development

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	**0**	**0**	**Audit**	**-**	**50**	**-**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Environmental Health, Ecology And Quality Of Life** Environmental education: Objective and scope, Impact of technology on the environment, Environmental disasters: Case studies, Global environmental awareness to mitigate stress on the environment, Structure and function of an ecosystem, Ecological pyramids, Pyramid of number, Pyramid of energy and pyramid of biomass.	25%	7
2	**Pollution Prevention** Air & Noise pollution - Sources & their Effects, Case studies of MajorCatastrophes, Structure and composition of the atmosphere, Water,Soil, Marine, Thermal & Marine Pollution: The story of fluoride contamination, Eutrophication of lakes, control measures, Measuring water quality: Water quality index, Waste water treatment (general) primary, secondary and tertiary stages, Municipal Solid waste management: Sources and effects of municipal waste, Biomedical waste, Hazardous waste	20%	6
3	**Population Growth, Global Environmental Challenges & Latest Developments** Population Explosion - Causes, Effects and Control, an International initiative in population-related issues, Urbanization, Growth of the world's large cities, Water resources: Sources of water, Stress on water resources, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Variation in concentrations of GHG gases in ambient air during last millennium, Role of Environmental Information System (ENVIS) in India and similar programs run by EPA(USA), Role of soft tools like Quantum GIS, Autodesk Building Information Modelling (BIM) and City Finance Approach to Climate-Stabilizing Targets (C- FACT), Life Cycle Assessment, Bioinformatics and Optimization tools for sustainable development.	25%	7
4	**Smart Cities** Introduction to smart cities - about smart cities, what is a smart city, world urbanization, case studies of Songdo, Rio De Janeiro, what makes cities smart. City as a system of systems – Introduction, systems thinking, Milton Keynes Future Challenges, Rich picture as city challenges, Wicked problems, Development of smart city approach – core elements, open data, sustainability, privacy and ethics, development processes. Smart Citizens – their role, engaging citizens, IES Cities, Energy	30%	10

	systems, Approaches for Citizen Engagement, co- creating smart cities, cities unlocked, living labs, city problems, crowdsourcing ideas, redesigning cities for citizens, all age-friendly cities, mobility on demand, motion maps, Infrastructure, Technology and Data – urban infrastructure and its technology, future of lighting, IoT, connected objects, sensing the city, NOx eating paints and air quality sensors, safest, smart citizen kit, sensing your city, Sensored City, Cyber security for data power, open, shared and closed data, satellite data, open data revolution, Smart City Project Data Innovation – smart innovations, smart city ecosystem, data-driven innovations for smart cities Standards and Capacity Building – the role of Standard, BSI smart city Standards, Hyper Cat, ITU Smart Sustainable cities, Smart City Readiness, Lessons Learnt from Amsterdam Smart Measurements - metrics and indicators, city indicators, WCCD data portal, value proposition, integrated reporting, smart city learning and education, urban data school.		

j. Text Book and Reference Book:

1. Textbook of Environmental Studies For Undergraduate Courses (TextBook)
   By Dr Erach Bharucha | Orient BlackSwan | Second Edition, Pub. Year 2013
2. Basics of Environmental Studies
   By U K Khare | Tata McGraw Hill
3. Environmental Studies
   By Anindita Basak | Drling Kindersley(India)Pvt. Ltd Pearson
4. Environmental Sciences
   By Daniel B Botkin & Edward A Keller | John Wiley & Sons
5. Air Pollution
   By M N Rao , H .V N Rao | McGraw Hill Publishing Company Limited, New Delhi
6. Environmental Engineering
   By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous | McGraw-Hill

a. Course Name: Information and Communication Technology

b. Course Code: 303105106

c. Prerequisite: Requires Basic Knowledge of Computer

d. Rationale: This course is design to provide basic knowledge of computer components. This course helps in learning problem solving process of information and communication technology.

e. Course Learning Objective:

CLOBJ 1	To equip individuals with the necessary skills to thrive in a dynamic business environment by developing their ability to understand, adapt to, and implement new and emerging technologies throughout their professional careers.

CLOBJ 2	To understand the parameters of information and Communication Technology (ICT)systems
CLOBJ 3	To Understand the ICT tool.

f. Course Learning Outcomes:

CLO 1	Develop life-long skills including the ability to understand and implement new and emerging technologies within a business environment.
CLO 2	Analyse, design, implement, test and evaluate Information and Communication Technology (ICT)systems
CLO 2	Enable students to use ICT tools for innovation, research and implementation.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Introduction to Information and Communication Technology:** Realizing the importance of information in daily life, Development of the Internet and the WWW, Development of mobile computing and communication devices.	**5%**	**3**
2	**Problem Solving Process:** Understanding the problem, Define the problem, ,Define boundaries, Plan solution, Check solution, Top down design and stepwise refinement, Structure charts, Algorithms, Flow charts, Pseudo codes.	**25%**	**10**
3	**The Basic Components of Computer System:** Hardware, Software and Firmware , Classification of Hardware, Classification of Software, Proprietary software and Open-source software	**5%**	**3**
4	**Evolution of Processors:** Electronic age of computing, Mainframe, Mini, Micro Computers, Evolution of Micro	**10%**	**5**

	Processors, Semiconductor Technology, Logic Families & Processor Families, Processor Specifications : No. of Transistors , Buses, CPU Speed ,Number of Registers , Cache Memories		
5	**Evolution of Computer Architectures:** Stored Program Control concept, Input, Output, Memory, Control Unit and Processing Unit ,Fetch-execute cycle, Central Processing Unit (CPU), Arithmetic and Logic Unit (ALU), Control Unit (CU), CISC and RISC Architectures	**10%**	**5**
6	**Introduction to Data Types:** Decimal representation of numbers (Signed and Unsigned): Integers, Fixed Point and Floating-Point numbers. Number systems used in computing: Binary, Octal, Hexa-decimal, Conversions among number systems. Character Representations : BCD, EBCDIC, ASCII, Unicode	**10%**	**5**
7	**Type of Memories: Volatile Memories and their characteristics:** Registers, Cache Memory, Main Memory 'RAM. Non-Volatile Memories and their characteristics: Secondary Storage, Magnetic, Optical, Flash Memory, ROM , BIOS, CMOS	**10%**	**5**
8	**Introduction To Data Communication:** Components of a data communication system, Transmitter, Receiver, Communication medium, Protocols, Analog & Digital Signals, Guided media, Unguided media.	**10%**	**4**
9	**Introduction to Computer Networks:** s Definition of computer networks, Network Types: LAN, WAN, MAN, DAN, CAN LAN Topologies: Bus, Star, Ring, Mesh, Hybrid Network models: Peer to peer, Client-server, Virtual Private Networks. Testing methods: Ping and ipconfig	**15%**	**5**

i. Textbook and reference book

1. Fundamentals of Computers (Textbook) By V. Rajaraman | Prentice-Hall Of India Pvt. Limited, 2003
2. Computer Fundamentals By P.K. Sinha | BPB Publications
3. Computer Organization By Carl Hamacher | Tata McGraw - Hill Education
4. Data Communication and Networking By Behrouz A. Forouzan

a. Course Name: Basic Electronics

b. Course Code: 303107151

c. Prerequisite: Knowledge of Physics and Mathematics up to 12th science level

d. Rationale: The course provides introductory treatment of the field of Basic of Electronics to the students of various branches of engineering.

e. Course Learning Objective:

CLOBJ 1	To study basics of semiconductor & devices and their applications in different areas.
CLOBJ 2	Compare design issues, advantages, disadvantages and limitations of basic electronics components.
CLOBJ 3	To study and analyse different biasing techniques to operate transistor.
CLOBJ 4	Study the DC regulated power supply with different voltage regulator ICs.
CLOBJ 5	Study the use of sensors and transducers.

f. Course Learning Outcomes:

CLO 1	Ability to analyse PN Junctions diode under various conditions.
CLO 2	Ability to describe the behaviour of special purpose diodes.
CLO 3	Ability to design and analyse BJT under various conditions.
CLO 4	Ability to design voltage regulators for various applications.
CLO 5	To understand fundamentals of sensors and transducers

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Diode Theory and Its Applications Introduction to Ideal Diode, Effectof temperature Ideal diodes, unbiased diode and Forward and reverse bias of Diode. PIV, surge current, Diode as Uncontrolled switch. Rectifiers: Half wave, Full wave and bridge wave. IDC, VDC and Irms Measurements. Ripple factor, PIV rating. Choke and Capacitor input filter rectifiers, Clipper and Clamper circuits, Voltage multiplier: Half wave voltage doubler and full wave voltage doubler	**15%**	**10**

2	Special Purpose Diodes Construction of Zener diode, Characteristics of Zener diode, Application of Zener Diode as Voltage Regulator, load line, Optoelectronic devices (LED and Photo Diode), Seven Segment Display, Schottky diode and its Application, Varactor Diode and its Application, Understanding Datasheets.	**15%**	**6**
3	Transistor Fundamentals and its Biasing techniques Construction ofBJT, working principle of BJT, Characteristics & specifications of BJT (PNP & NPN transistors), Biased and unbiased BJT, Configuration oftransistor, concept of gain & BW, Operation of BJT in cut-off, saturation & active regions (DC analysis), BJT as switch, Transistor as an amplifier, Voltage divider bias and analysis, VDB load line and Q point.	**30%**	**15**
4	DC Regulated Power Supply Voltage Regulator-Basic series and shunt regulator, Types of voltage regulator IC: Fixed and adjustablepositive and negative linear voltage regulator, IC linear fixed voltage regulator (78XX, 79XX, LM340 Series), Linear Adjustable Regulator (IC LM317, LM337, and IC 723 IC regulator), DC Regulated Power supply, Switched mode power supply (SMPS).	**20%**	**6**
5	Introduction to Sensors and Transducers Introduction to sensors and Transducers, Comparison between sensors and Transducers, Applications of Sensors and Transducers, Types of Electronic sensors, Types of Transducers.	**20%**	**6**

i. Text Book and Reference Book:

1. Electronic Principles By A. P. Malvino | Tata McGraw Hill Publication New Delhi
2. Electronic Devices and Circuits By Jacob Millman and Halkias | Tata McGraw Hill Publication New Delhi
3. Electronic Devices and Circuits by Robert L. Boylestad and Louis Nashelesky Pearson, Prentice Hall.
4. Electronic Devices By Thomas L. Floyd | Pearson, Prentice Hall
5. Linear Electronic Circuits and Devices by James Cox, | Delmar Publication.
6. Electronic Devices and Circuits By David A. Bell | Oxford Publication

a. Course Name: Electronic Workshop

b. Course Code: 303107153

c. Prerequisite: Knowledge of Physics and basic electronics up to 12th science level

d. Rationale: The use of workshop practices in day to day industrial as well domestic life helps to solve the problems. Further, it also deals with basic introduction of system components of electrical and electronic systems, and provides hands on practice in assembling, interconnecting, testing, and repairing such system by making use of various tools used in electrical and electronic workshop. Electronic systems are built on printed circuit board (PCB) and breadboard. One need to use source instruments (power sources and signal sources), and appropriate measuring instruments to study behaviour of a system.

e. Course Learning Objective:

CLOBJ 1	Study about different wiring techniques
CLOBJ 2	Study about Types of passive elements and identification: Resistors, capacitors, Inductors and their power ratings, Value identification through colour Coding
CLOBJ 3	Study about Operating principle of Power supply, Operating principle of Multimeter measuring various parameters like voltage, current, continuity, resistance, and capacitance.
CLOBJ 4	Study about different types of active components and symbolic representations.
CLOBJ 5	Learning about Function Generator and CRO.
CLOBJ 6	Study about electrical wiring, types of wiring, Staircase wiring, Double Staircase wiring, GO Down Wiring, Demonstration of Fuse, MCB along its operation and study of ELCB, Demonstration of different types of cables, wires, probes, connectors

f. Course Learning Outcomes

CLO 1	Gain ability to understand working of Active and Passive Components
CLO 2	Ability to understand the operating of various testing and measurement instrumentation.
CLO 3	Ability to learn electrical wiring
CLO 4	Ability to design electronic circuit for the specific applications.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**50**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

List of Experiments:			
Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Electrical Component, Types of switches, relays, fuses, MCB, ELCB.Types of wires and Gauges, Sockets and Earthings, lamp Load.	**14%**	**4**

2	Basic Passive Components Types of passive elements and identification: Resistors, capacitors, Inductors and their power ratings, Value identification through colour Coding	**14%**	**4**
3	Power Supply and Multimeter Operating principle of Power supply, Operating principle of Multimeter measuring various parameters likevoltage, current, continuity, resistance, capacitance etc.	**14%**	**4**
4	Active components Types of active components and symbolic representations, Interpreting data sheet of various active components like PN junction diode, Zener diode, BJT, Power Transistor, Fixed voltage IC Regulators etc., Identification and measurement.	**16%**	**4**
5	Function Generator and CRO Basics of Function Generator, Specifications of Function Generator and operating ranges of variousparameters of available functions, operating principle of CRO, Specifications of CRO and Operating ranges of various parameters	**16%**	**4**
6	Basic Electrical & Electronics parameter, Measurement of voltage,current, frequency, phase, and Power	**10%**	**2**
7	Electrical Wiring Introduction to electrical wiring, types of wiring, Staircase wiring, Double Staircase wiring, GO- Down Wiring, Demonstration of Fuse, MCB along its operation and study of ELCB, Demonstration of different types of cables, wires, probes, connectors	**16%**	**4**

a. **Course Name:** Elements of Mechanical Engineering
b. **Course Code:** 303109102
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale:** Elements of Mechanical Engineering Course Provide students with a comprehensive foundation in the fundamental principles and concepts that form the backbone of mechanical engineering for various Engineering disciplines.
e. **Course Learning Objective:**

CLOBJ 1	Identify and basic mechanical components such as gears, bearings, Pumps, Compressor, boiler, I.C Engines.
CLOBJ 2	Understand various laws and behaviour of fluid at different conditions.
CLOBJ 3	Illustrate the operational mechanisms through diagrams, models, or practical demonstrations.

CLOBJ 4	Demonstrate construction and working principles of diverse mechanical devices, such as engines, pumps, and compressors.
CLOBJ 5	Evaluate basic problems related to I.C engine, pumps, compressors and fluids.
CLOBJ 6	Analyse and discuss the interactions and relationships between various mechanical elements within a system

f. Course Learning Outcomes:

CLO 1	Identify basic mechanical components and their functions.
CLO 2	Understand basic Properties and behaviour of various fluids.
CLO 3	Understand Construction and working of various mechanical devices
CLO 4	Apply fundamental principles to solve basic mechanical engineering problems

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Basics of Thermodynamics** Prime Movers - Meaning and Classification; Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Internal Energy, Enthalpy, Specific Volume; Thermodynamics – Definition: Change of State, Path, Process, Cycle, Thermodynamic systems, Statement of Zeroth Law, First Law and Second Law of Thermodynamics and its Applications.	10%	5
2	**Properties of Gases** Gas Laws, Boyle's law, Charles law, Combined gas law; Gas Constant, Relation between Cp and Cv Constant Volume Process; Constant Pressure Process; Isothermal Process; Adiabatic Process; Poly-tropic Process. Examples based on above topics.	15%	6
3	**Properties of Steam**	15%	6

	Types of Steam and Steam formation; Specific Enthalpy; Specific Volume; Dryness Fraction of Steam; Measurement of Dryness Fraction; Steam Table. Examples based on above topics.		
4	**Heat Engines** Definition of Heat Engine; Classification of Heat Engine; Carnot Cycle, Rankine Cycle, Otto Cycle and Diesel Cycle. **Internal Combustion Engines:** Two Stroke Petrol and Diesel Engine; Four Stroke Petrol and Diesel Engine; Measurement of Indicated Power and Brake Power: Numerical on calculation of Mechanical, Thermal and Volumetric Efficiency. Examples based on above topics.	**20%**	**10**
5	**Energy Conversion Devices** **Steam Generators:** Definition and Classification; Cochran, Lancashire, Locomotive, Babcock and Wilcox Boiler: Construction and Working; Boiler Mounting and Accessories. **Refrigeration and Air Conditioning:** Meaning of Refrigeration; Vapor Compression Refrigeration Cycle; Vapor Absorption Refrigeration Cycle; Air conditioning; Window Air Conditioning and Split Air Conditioning.	**20%**	**5**
6	**Pumps And Air Compressors** **Pumps** Definition, Classification and Application of Pumps; Types and Operation of Rotary pump, Reciprocating Pump, Centrifugal Pump. **Air Compressors** Definition, Classification and Application of Compressors; Types and Operation of Rotary and Reciprocating Air Compressor.	**10%**	**5**
7	**Motion And Power Transmission Devices** Shaft and Axle; Belt Drive; Chain Drive; Friction Drive; Gear Drive; Clutch, Coupling and Brake.	**5%**	**3**
8	**Conventional And Non-Conventional Energy Sources** Introduction and Classification of Energy Sources; Conventional Energy Sources E.g. Solid, Liquid, Gaseous and Nuclear fuels; Calorific Value of Fuels; Non-Conventional Energy Sources E.g. Solar Energy, Wind Energy, Hydro Power, Biomass and Biomass Energy; Comparison of Conventional & Non-Conventional Energy Sources.	**5%**	**3**

i. Text Book and Reference Book:

1. "Elements of Mechanical Engineering", By S.B. Mathur, S. Domkundwar, Dhanpat Rai & Sons Publications.

2. “Thermal Engineering, By R.K Rajput”, Laxmi Publications.
3. “Thermal Science and Engineering”, By Dr. D. S. Kumar, S. K. Kataria and sons Publishers.
4. “Basic Mechanical Engineering”, By T. S. Rajan, Wiley Eastern Ltd
5. “Fundamental of Mechanical Engineering”, By G. S. Sawhney, PHI Publication New Delhi.

a. Course Name: Mathematics-II
b. Course Code: 303191151
c. Prerequisite: Knowledge of Mathematics up to 12th science level
d. Rationale: The Mathematics I syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.
e. Course Learning Objective:

CLOBJ 1	Define and identify ordinary differential equations of higher order. Classify ODEs based on homogeneity and linearity. Solve homogeneous linear ODEs of higher order with constant coefficients, and variable coefficients.
CLOBJ 2	Solve homogeneous linear ODEs of higher order with constant coefficients, variable coefficients
CLOBJ 3	Apply the Method of Undetermined Coefficients to solve nonhomogeneous ODEs. Utilize the Solution by Variation of Parameters for solving nonhomogeneous ODEs. Explore applications of ODEs in real-world scenarios.
CLOBJ 4	Understand power series solutions for ordinary points and regular Singular points. Explore properties and applications of Legendre polynomials and Bessel functions.
CLOBJ 5	Define Laplace transform and its inverse. Understand the linearity property of Laplace transforms. Solve ordinary differential equations using Laplace transforms.
CLOBJ 6	Define Fourier Integral and its applications. Explore Fourier Cosine and Sine Integrals.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to translate physical or engineering problems into mathematical equations and solve them.
CLO 2	Develop analytical and critical thinking skills through the process of solving complex mathematical problems.
CLO 3	Understand and interpret mathematical solutions in the context of the given problems.

CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms.
CLO 5	Present mathematical arguments and solutions in a logical and organized manner.
CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**UNIT 1 Higher order ordinary differential equations:** Ordinary differential equations of higher orders, Homogeneous Linear ODEs of Higher Order, Homogeneous Linear ODEs with Constant Coefficients, Euler–Cauchy equations, Nonhomogeneous ODEs, Method of Undetermined Coefficients, Solution by Variation of Parameters, Applications	**8%**	**5**
2	**UNIT 2 Power Series:** Power series solutions at ordinary point and regular singular point;Legendre polynomials, Bessel functions of the first kind and their Property	**15%**	**9**
3	**UNIT 3 Laplace Transform:** Laplace Transform and inverse Laplace transform, Linearity, First Shifting Theorem (s-Shifting), Transforms of Derivatives and Integrals, ODEs, UNIT Step Function (Heaviside Function), Second Shifting Theorem (t-Shifting), Laplace transform of periodic functions, Short Impulses, Dirac's Delta Function, Convolution,Integral Equations, Differentiation and Integration of Transforms, Solution of ordinary differential equation by Laplace transform	**25%**	**15**
4	**UNIT 4 Fourier Integral:** Fourier Integral, Fourier Cosine Integral and Fourier Sine Integral	**17%**	**10**

5	**UNIT 5 Vector Calculus:** Gradient of scalar field, Directional Derivative, Divergence and curl of Vector field, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	**10%**	**6**
6	**UNIT 6 Multivariable Calculus (Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Triple integrals (Cartesian)	**25%**	**15**

i. Text Book and Reference Book:

1. Calculus and Analytic Geometry (Textbook) By G.B. Thomas and R.L. Finney | Addison Wesley
2. Calculus with early transcendental functions By James Stewart | Cengage Learning
3. Higher Engineering Mathematics By B. S. Grewal | Khanna Publications
4. Elementary Linear Algebra (Textbook) By Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
5. Advanced Engineering Mathematics (Textbook) By Erwin Kreyszig | Willey India Education

a. Course Name: Advanced Communication & Technical Writing
b. Course Code: 303193152
c. Prerequisite: Knowledge of English language studied till 12th standard
d. Rationale: Communication confidence laced with knowledge of English grammar is essential for all engineers**.**

e. Course Learning Objective:

CLOBJ 1	Demonstrate the ability to adapt writing style to different audiences and purposes.
CLOBJ 2	Create comprehensive technical documents such as reports, manuals, and proposals.
CLOBJ 3	Refine editing and proofreading skills for complex technical documents.
CLOBJ 4	Explore and apply technical communication through various mediums (video, web content, multimedia)
CLOBJ 5	Incorporate advanced document design principles for clarity and readability.
CLOBJ 6	Conduct in-depth research on technical topics.

f. Course Learning Outcomes:

CLO 1	Develop four basic skills
CLO 2	Construct grammatically correct sentences.
CLO 3	Develop and deliver professional presentation skills (
CLO 4	Develop the skills of critical thinking.
CLO 5	Compare different types of written communication.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	2	0	2	-	25	-	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Developing Effective Listening Skills**: To help students understand the meaning and importance of good listening skills, learning the traits of being a good listener through activity and listening audio tracks.	**10%**	**2**
2	**Error analysis**: To provide insights into the complicated processes of language development as well as a systematic way for identifying, describing and explaining errors. (Tenses, Voices, Reported speech)	**10%**	**4**
3	**Delivering different types of speeches:**: Students will understand and use the different patterns for structuring speeches • Welcome / Introductory speech • Vote of Thanks speeches • Farwell speeches	**10%**	**2**

4	**Professional Presentations**: Students will learn • Combating stage fright • Preparing power point presentation • Delivering PPT	**10%**	**5**
5	**Essay writing**: Students will overcome the common pitfalls in the task of essay writing by understanding • Basics of Paragraph development and paragraph jumble • Types of essays • Characteristic features of essays • Guiding Principles	**10%**	**4**
6	**Reading Comprehension**: • Employing Different Reading Skills • Activity • Practice	**10%**	**2**
7	**Project Proposal**: • To equip students with the various elements required to prepare a winning proposal.	**5%**	**2**
8	**Misplaced Modifiers**: Students will understand how to place the improperly separated word, phrase or clause from the word it describes.	**5%**	**1**
9	**Movie Review**: • A movie show followed by writing a review. • To provide an exposure to students how to express their opinions about some film or documentary with unbiased and objective approach.	**10%**	**2**
10	**Narrative Writing**: • Narrative writing helps them explore different characters and settings. • To help students clarify their thinking, and teach them to express that in writing in an organized way.	**5%**	**2**
11	**Writing Reports**: • Process of writing • Order of writing • Final draft & checklist for reports • Sample reports: 1. Memorandum 2. Letter report	**10%**	**2**
12	**Critical Thinking**: • Need, relevance and Significance of Critical Thinking • Logic in problem solving and decision making(activities) • Moral Reasoning (Case Studies)	**5%**	**1**

13	**Activity Session (Presentation)** • An activity where the scene of a press conference is created in the class. • Students are encouraged to ask sharp questions and in turn are invited to assume roles of famous personalities, thus answering the questions posed.	**0%**	**1**

i. Textbook and reference Books:

1. Business Correspondence and Report Writing HARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD On Writing Well
5. William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press
7. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press

Semester 3

a. **Course Name:** Electronic Devices
b. **Course Code:** 303107201
c. **Prerequisite:** Basic knowledge of electronic Devices, active components, passive components, Laws such as KVL, KCL, etc., low frequency circuit analysis techniques, etc.
d. **Rationale:** This course aims to familiarize students with high frequency analysis of BJT circuits, power amplifier circuits, and Feedback Amplifier circuits, various oscillators' circuits, etc.
e. **Course Learning Objective:**

CLOBJ 1	Learn about the crystal structure of semiconductors and how it influences their electronic properties. Understand the concept of the semiconductor lattice and its impact on electrical behaviour.
CLOBJ 2	Explore advancements in oscillator technologies, such as MEMS oscillators and frequency synthesizers. Understand the advantages and challenges of these technologies.
CLOBJ 3	Learn to model MOS transistors using simplified small-signal and large-signal models. Utilize MOS transistor models to analyse and design amplifiers, logic gates, and other MOS-based circuits.
CLOBJ 4	Define and understand the basic concepts of amplification, gain, and power in the context of electronic circuits. Explain the importance of power amplifiers in electronic systems. Differentiate between amplifier classes (Class A, Class B, Class AB, and Class C) and understand their operating principles.
CLOBJ 5	Define and describe what MOS transistors are. Differentiate between n-type and p-type MOS transistors. Understand the role of metal, oxide, and semiconductor layers in an MOS transistor.

f. **Course Learning Outcomes:**

CLO 1	Understand the principles of semiconductor Physics
CLO 2	Design sinusoidal and non-sinusoidal oscillators
CLO 3	Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems
CLO 4	Design power amplifier circuits
CLO 5	Understand the principles of MOS transistor

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**		
				Internal Evaluation	**ESE**	

L	T	P	C	MSE	CE	P	Theory	P	Total
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams, Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors, Poisson and continuity equation	20%	9
2	Introduction to BJT, I-V Characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation	20%	9
3	Current amplifier, trans-conductance amplifier and trans-resistance amplifier, Biasing schemes for FET amplifiers, bias stability, various configurations (such as CS, CG, CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.	20%	9
4	High frequency transistor models, frequency response of single stage and multistage amplifiers, cascade amplifier, Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues, Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin	20%	9
5	Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.	20%	9

i. Text Book and Reference Book:

1. Solid State Electronic Devices By G. Streetman, and S. K. Banerjee | Pearson
2. Semiconductor Physics and Devices By D. Neamen , D. Biswas | McGraw-Hill Education
3. Physics of Semiconductor Devices By S. M. Sze and K. N. Kwok | John Wiley & Sons
4. Fundamentals of solid state electronics By C.T. Sah | World Scientific Publishing Co. Inc

5. Operation and Modeling of the MOS Transistor By Y. Tsividis and M. Colin | Oxford Univ. Press
6. Introduction to Operational Amplifier theory and applications By J.V. Wait, L.P. Huelsman and GA Korn | McGraw Hill
7. Microelectronics by J. Millman and A. Grabel | McGraw Hill Education, Pub. Year 1988

a. **Course Name:** - Electronic Devices Lab
b. **Course Code:** 303107202
c. **Prerequisite:** Basic knowledge of electronic Devices, active components, passive components, Laws such as KVL, KCL, etc., low frequency circuit analysis techniques,etc.
d. **Rationale:** This course aims to familiarize students with high frequency analysis ofBJT circuits, power amplifier circuits, and Feedback Amplifier circuits, various oscillators' circuits, etc.
e. **Course Learning Objective:**

CLOBJ 1	Learn about the crystal structure of semiconductors and how it influences their electronic properties. Understand the concept of the semiconductor lattice and its impact on electrical behaviour.
CLOBJ 2	Explore advancements in oscillator technologies, such as MEMS oscillators and frequency synthesizers. Understand the advantages and challenges of these technologies.
CLOBJ 3	Learn to model MOS transistors using simplified small-signal and large-signal models. Utilize MOS transistor models to analyse and design amplifiers, logic gates, and other MOS-based circuits.
CLOBJ 4	Define and understand the basic concepts of amplification, gain, and power in the context of electronic circuits. Explain the importance of power amplifiers in electronic systems. Differentiate between amplifier classes (Class A, Class B, Class AB, and Class C) and understand their operating principles.
CLOBJ 5	Define and describe what MOS transistors are. Differentiate between n-type and p-type MOS transistors. Understand the role of metal, oxide, and semiconductor layers in an MOS transistor.

f. **Course Learning Outcomes:**

CLO 1	Understand the principles of semiconductor Physics
CLO 2	Design sinusoidal and non-sinusoidal oscillators
CLO 3	Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems

CLO 4	Design power amplifier circuits
CLO 5	Understand the principles of MOS transistor

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	To Plot & Verify drain and transfer characteristics of a JFET and measure the parameters To Plot & Verify drain and transfer characteristics of a JFET and measure the parameters.
2	To Plot & Verify characteristics of a MOSFET To Plot & Verify characteristics of a MOSFET
3	To verify the operation of CMOS as logic inverter. To verify the operation of CMOS as logic inverter
4	Design & Implement the Timer Base circuit Using JFET Design & Implement the Timer Base circuit Using JFET
5	Design & Implement MOSFET Relay Driver Circuits. Design & Implement MOSFET Relay Driver Circuits.
6	To verify FET Biasing circuits To verify FET Biasing circuits
7	To study the frequency response of FET Amplifier To study the frequency response of FET Amplifier.
8	To plot the frequency response Negative feedback Amplifier To plot the frequency response Negative feedback Amplifier
9	To verify the operation of Wein bridge oscillator To verify the operation of Wein bridge oscillator
10	To verify the operation of Hartly oscillator To verify the operation of Hartly oscillator
11	To verify the operation of colpits oscillator To verify the operation of colpits oscillator

12	To verify the operation of RC phase shift oscillator To verify the operation of RC phase shift oscillator
13	Verify the operation of Class B Push Pull Amplifier. Verify the operation of Class B Push Pull Amplifier.
14	Calculate Max input power, Max. Output power, Max. Circuit efficiency for class B power amplifier with VCC = 25V, driving load. Calculate Max input power, Max. Output power, Max. circuit efficiency for class B power amplifier with VCC = 25V, driving load

i. Text Book and Reference Book:

1. Solid State Electronic Devices By G. Streetman, and S. K. Banerjee | Pearson
2. Semiconductor Physics and Devices By D. Neamen , D. Biswas | McGraw-Hill Education
3. Physics of Semiconductor Devices By S. M. Sze and K. N. Kwok | John Wiley & Sons
4. Fundamentals of solid state electronics By C.T. Sah | World Scientific Publishing Co. Inc
5. Operation and Modeling of the MOS Transistor By Y. Tsividis and M. Colin | Oxford Univ. Press
6. Introduction to Operational Amplifier theory and applications By J.V. Wait, L.P. Huelsman and GA Korn | McGraw Hill
7. Microelectronics by J. Millman and A. Grabel | McGraw Hill Education, Pub. Year

a. Course Name: Digital System Design

b. Course Code: 303107203

c. Prerequisite: Knowledge of Number Systems and Basic Electronics.

d. Rationale: The main objective of this subject is to inculcate basic concepts of digital circuits and system, which leads to design of complex digital system such as microprocessors. The course aims to familiarize students with combinational and sequential circuits using digital logic fundamentals.

e. Course Learning Objective:

CLOBJ 1	Introduces the concept of Boolean algebra and the basic digital electronics.
CLOBJ 2	Solve problems related to conversion of number from any number systems and conversion of codes from different types.
CLOBJ 3	Acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
CLOBJ 4	To inculcate basic concepts of digital circuits and systems, which leads to design of complex digital system such as Microprocessors.
CLOBJ 5	Finite State Machine Design is introduced which is the basis of Digital Design up to the level of processors.

CLOBJ 6	VHDL is commonly used as a design-entry language for field-programmable gate arrays and application-specific integrated circuits in electronic design automation of digital circuits. The course aims to enable the student to design Digital Systems which have combinational and sequential circuits as a base and implement their design using VHDL programming.

f. Course Learning Outcomes:

CLO 1	Understand fundamental concepts and techniques used in Digital Electronics.
CLO 2	Design and analyse various combinational logic circuits and modular combinational circuits with MUX/DEMUX, Decoder, and Encoder.
CLO 3	Design & analyse synchronous sequential logic circuits.
CLO 4	Use HDL & appropriate EDA tools for digital logic design and simulation.
CLO 5	Identify basic requirements for a design application and proposed a cost-effective solution.
CLO 6	Develop skill to build, and troubleshoot digital circuits.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Logic Simplification and Combinational Logic Design:** Review of Boolean Algebra and De Morgaṅ s Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.	**20%**	**10**
2	**MSI devices** Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.	**25%**	**12**
3	**Sequential Logic Design** Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift	**25%**	**13**

	registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.		
4	**Logic Families and Semiconductor Memories** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.	**15%**	**5**
5	**VLSI Design flow: Design entry** Schematic, FSM & HDL, different modelling styles in VHDL, Data Types and objects, Dataflow, Behavioural and Structural Modelling, Synthesis and Simulation in VHDL :constructs and codes for combinational and sequential	**15%**	**5**

i. Text Book and Reference Book:

1. Modern Digital Electronics By R. P. Jain | Tata McGraw-Hill Education
2. Fundamentals of Logic Design By Charles H. Roth, Jr., & Larry L. Kinney | Cengage Learning

a. Course Name: Digital System Design Lab

b. Course Code: 303107204

c. Prerequisite: Knowledge of Number Systems and Basic Electronics.

d. Rationale: The main objective of this subject is to inculcate basic concepts of digital circuits and system, which leads to design of complex digital system such as microprocessors. The course aims to familiarize students with combinational and sequential circuits using digital logic fundamentals.

e. Course Learning Objective:

CLOBJ 1	Introduces the concept of Boolean algebra and the basic digital electronics.
CLOBJ 2	Solve problems related to conversion of number from any number systems and conversion of codes from different types.
CLOBJ 3	Acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
CLOBJ 4	To inculcate basic concepts of digital circuits and systems, which leads to design of complex digital system such as Microprocessors.
CLOBJ 5	Finite State Machine Design is introduced which is the basis of Digital Design up to the level of processors.

CLOBJ 6	VHDL is commonly used as a design-entry language for field-programmable gate arrays and application-specific integrated circuits in electronic design automation of digital circuits. The course aims to enable the student to design Digital Systems which have combinational and sequential circuits as a base and implement their design using VHDL programming.

f. Course Learning Outcomes:

CLO 1	Understand fundamental concepts and techniques used in Digital Electronics.
CLO 2	Design and analyse various combinational logic circuits and modular combinational circuits with MUX/DEMUX, Decoder and Encoder.
CLO 3	Design & analyse synchronous sequential logic circuits.
CLO 4	Use HDL & appropriate EDA tools for digital logic design and simulation.
CLO 5	Identify basic requirements for a design application and proposed a cost-effective solution.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	Binary to gray/gray to binary code convertor
2	Half-adder and full-adder combinational circuit.
3	Half substractor and full substractor combinational circuit.
4	Multiplexer.
5	Encoder and Decoder
6	SR flip flop
7	JK flip flop

8	4-bit ripple counter
9	Shift Register
10	Introduction to VHDL
11	Introduction of Xilinx ISE with examples of basic gates
12	Implementation of All Universal Gates using VHDL.
13	Implementation of Half Adder and Full Adder using VHDL.
14	Implementation of multiplexer using VHDL.
15	Implementation of D – Flip flop and T- Flip flop using VHDL.

i. Text Book and Reference Book:

1. Modern Digital Electronics By R. P. Jain | Tata McGraw-Hill Education
2. Fundamentals of Logic Design By Charles H. Roth, Jr., & Larry L. Kinney | Cengage Learning

a. Course Name: Network Theory

b. Course Code: 303107205

c. Prerequisite Fundamental knowledge of calculus (Integration, differentiation, etc.) and Linear Algebra (Determinant, Matrices) etc.

d. Rationale: The Students of EC Engineering are expected to be able to analyze and synthesize circuits using various laws and theorems. This is one of the foundation courses offering understanding of concepts and developing of skills required to analyze and synthesize real word problems circuits in the field of Electronics.

e. Course Learning Objective:

CLOBJ 1	Understand the basic circuits analysis techniques
CLOBJ 2	Use Network theorem for circuit analysis
CLOBJ 3	Understand Laplace transforms
CLOBJ 4	Understand the network functions.
CLOBJ 5	Use frequency domain techniques

f. Course Learning Outcomes:

CLO 1	Understand basics electrical circuits with nodal and mesh analysis
CLO 2	Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, Millman's Theorem, etc.
CLO 3	Apply Laplace Transform for steady state and transient analysis.

CLO 4	Determine different network functions.
CLO 5	Appreciate the frequency domain techniques

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Basic Concepts** Node and mesh analysis, matrix approach of network containing voltage and current sources, and reactance, source transformation and duality, coupled Circuit Analysis: dot convention	**15%**	**07**
2	**Graph Theory** Graph of a network, definitions, tree, Co-tree, link, basic loop and basic cut set, Incidence matrix, Cutset matrix, Tieset matrix, Duality, Loop and Nodal methods of Analyses	**10%**	**04**
3	**Network theorems Network theorems:** Superposition, reciprocity, Thevenin̓ s, Norton̓ s, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.	**15%**	**7**
4	**Laplace Transform and network analysis Laplace transforms and properties**: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.	**15%**	**7**
5	**The Frequency domain: Fourier analysis Trigonometric and exponential Fourier series:** Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation	**15%**	**7**

6	**Network Function Synthesis and Two port Networks** : Transient behaviour, concept of complex frequency, Driving points and transfer functions poles and zeros of admittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem, Characterization of LTI two port networks; Z, Y, ABCD, g and h parameters, Reciprocity and symmetry, Interrelationships between the parameters, Interconnections of two port networks	**20%**	**9**
7	**Filters** : Behaviours of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject Filters	**10%**	**4**

i. Text Book and Reference Book:

1. Circuit Theory (Text Book) By Chakrabarti | DhanpatRai& Co.
2. Network Analysis By M. E. Van Valkenburg | PHI Learning
3. Circuit and network By Sudhakar, A.; Shyammohan, S. Palli | McGraw Hill Education
4. Network Analysis and synthesis By F. F. Kuo | John Wiley and sons

a. Course Name: Network Theory Lab

b. Course Code: 303107206

c. Prerequisite Fundamental knowledge of calculus (Integration, differentiation, etc.) and Linear Algebra (Determinant, Matrices) etc.

d. Rationale: The Students of EC Engineering are expected to be able to analyse and synthesize circuits using various laws and theorems. This is one of the foundation courses offering understanding of concepts and developing of skills required to analyze and synthesize real word problems circuits in the field of Electronics.

e. Course Learning Objective:

CLOBJ 1	Understand the basic circuits analysis techniques
CLOBJ 2	Use Network theorem for circuit analysis
CLOBJ 3	Understand Laplace transforms
CLOBJ 4	Understand the network functions.
CLOBJ 5	Use frequency domain techniques

f. Course Learning Outcomes:

CLO 1	Understand basics electrical circuits with nodal and mesh analysis

CLO 2	Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, Millman's Theorem, etc.
CLO 3	Apply Laplace Transform for steady state and transient analysis.
CLO 4	Determine different network functions.
CLO 5	Appreciate the frequency domain techniques

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	To Verify Loop Analysis and Nodal Analysis using KVL and KCL
2	To verify superposition theorem
3	To verify Thevenins theorem
4	To verify maximum power transfer theorem
5	To verify reciprocity theorem
6	To measure and calculate RC and RL time constant for a given RC circuit
7	To measure and analyse step response of for a given series RLC circuit
8	To measure and calculate Z-parameters for a given two-port system
9	To measure and calculate Y-parameters for a given two-port system
10	To Design Passive Low Pass filter and verify the Frequency Response.
11	To Design Passive High Pass filter and verify the Frequency Response.
12	To Design Passive Band Pass filter and verify the Frequency Response.

i. **Text Book and Reference Book:**

1. Circuit Theory (TextBook) By Chakrabarti | DhanpatRai& Co.
2. Network Analysis By M. E. Van Valkenburg | PHI Learning
3. Circuit and network By Sudhakar, A.; Shyammohan, S. Palli | McGraw Hill Education
4. Network Analysis and synthesis By F. F. Kuo | John Wiley and sons

a. **Course Name:** Signals and Systems

b. **Course Code:** 303107207

c. **Prerequisite:** : Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks

d. **Rationale**: The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

e. **Course Learning Objective:**

CLOBJ 1	To get ability to analyse different types of signals with its mathematical and graphical representation.
CLOBJ 2	To represent different continuous and discrete system on time as well as on frequency domain using different mathematical transform
CLOBJ 3	Get knowledge about stable and unstable system and learn to find system is stable or not using mathematical process
CLOBJ 4	Conversion of signals from digital to analog form and learning about sampling process and reconstruct it.

f. **Course Learning Outcomes:**

CLO 1	Analyse different types of signals.
CLO 2	Represent continuous and discrete systems in time and frequency domain using different transforms.
CLO 3	Investigate whether the system is stable.
CLO 4	Sampling and reconstruction of a signal.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability.	15%	8
2	Continuous time Linear Time-Invariant System Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.	15%	8
3	Fourier Representation of Signals Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.	20%	8
4	Laplace Transform The Laplace Transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behaviour.	15%	8

5	Z-Transform The z-Transform for discrete time signals and systems- Eigen functions, region of convergence, z-domain analysis	**20%**	**8**
6	State-space analysis State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	**15%**	**5**

i. Text Book and Reference Book:

1. Signals and Systems by Alan V. Oppenheim | Pearson Education
2. Signals and Systems by Simon Haykin | Wiley Publication
3. Signals and Systems by K. Gopalan | Cengage Learning (India Edition)
4. Signals and Systems by Michal J. Roberts and Govind Sharma Tata Mc-Graw Hill Publications
5. Linear Systems and Signals by B.P.Lathi | Oxford University Press

a. Course Name: Signals and Systems Lab

b. Course Code: 303107208

c. Prerequisite: : Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks

d. Rationale: The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

e. Course Learning Objective:

CLOBJ 1	To get ability to analyse different types of signals with its mathematical and graphical representation.
CLOBJ 2	To represent different continuous and discrete system on time as well as on frequency domain using different mathematical transform

CLOBJ 3	Get knowledge about stable and unstable system and learn to find system is stable or not using mathematical process
CLOBJ 4	Conversion of signals from digital to analog form and learning about sampling process and reconstruct it.

f. Course Learning Outcomes:

CLO 1	Analyse different types of signals.
CLO 2	Represent continuous and discrete systems in time and frequency domain using different transforms.
CLO 3	Investigate whether the system is stable.
CLO 4	Sampling and reconstruction of a signal.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	Introduction to Matlab/Scilab Software.
2	Generation of basic CT and DT signals in MATLAB and perform basic signal operations i.e., time-shifting, time-scaling, time reversal
3	Generations and capturing various continuous time signals.
4	Observing the effects of lower sampling rate and higher sampling rate on CT signal.
5	Synthesize square wave signal from linear combination of complex exponentials.
6	Performing various operations on the signal using circuits.
7	Compute FT and DTFT of the CT signals and DT sequences, respectively

8	Compute DFT of the DT sequences
9	Matlab implementation of Convolution (linear and Circular) algorithm for discrete time signal
10	Simulation of continuous and discrete time LTI system.
11	Simulation of Z-Transform function using given poles and zeros

i. Text Book and Reference Book:

1. Signals And Systems By Alan V. Oppenheim | Pearson Education
2. Signals and Systems By Simon Haykin | Wiley Publication
3. Signals and Systems By K. Gopalan | Cengage Learning (India Edition)
4. Signals and Systems By Michal J. Roberts and Govind Sharma Tata Mc-Graw Hill Publications
5. Linear Systems and Signals By B.P.Lathi | Oxford University Press

a. Course Name: Mathematics-III
b. Course Code: 303191203
c. Prerequisite: Knowledge of Mathematics up to 12th science level
d. Rationale: The Mathematics I, Mathematics-II syllabus integrates fundamentalcalculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solvingskills.
e. Course Learning Objective:

CLOBJ 1	Understand the principles of Z-transform, including linearity, elementary functions transformation, shifting theorems, and the application of Z-transforms in solving difference equations.
CLOBJ 2	Develop the ability to solve and analyse first-order partial differential equations using methods such as Charpit's method, separation of variables, and apply these techniques to model and solve heat, wave, and Laplace equations.
CLOBJ 3	Acquire proficiency in solving systems of linear equations using iterative methods like Gauss-Jacobi and Gauss Seidel, and mastering techniques for finding roots of algebraic and transcendental equations through methods such as Bisection, Newton-Raphson, and Regula-Falsi.
CLOBJ 4	Develop a strong understanding of finite differences, interpolation, and related formulas, with a focus on applying Newton's forward and backward difference formulae, and Lagrange's interpolation to solve practical problems.
CLOBJ 5	Master numerical integration techniques, including the application of the Trapezoidal rule, Simpson's 1/3rd and 3/8th rules, and gain proficiency in solving ordinary differential equations using methods such as Taylor's series, Euler's method, Modified Euler's method, and the Runge-Kutta method.

CLOBJ 6	Develop the ability to analyse statistical relationships between variables using correlation and regression techniques. Gain proficiency in curve fitting through the method of least squares, including fitting straight lines, second-degree parabolas, and more general curves.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to translate physical or engineering problems into mathematical equations and solve them.
CLO 2	Develop analytical and critical thinking skills through the process of solving complex mathematical problems.
CLO 3	Understand and interpret mathematical solutions in the context of the given problems.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms.
CLO 5	Present mathematical arguments and solutions in a logical and organized manner.
CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**-**	**-**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**UNIT 1 Z- Transform:** Linearity, Z- transform of elementary functions, Shifting theorem, initial and final value theorem, Convolution theorem, inversion of Z- transform, solution of difference equations by Z- Transforms	**8%**	**5**
2	**UNIT 2 Partial Differential Equations:** First order partial differential equations, solutions of first order	**15%**	**9**

	linear and nonlinear PDEs, Charpit's Method Solution to homogeneous and nonhomogeneous linear partial differential equations second and higher order by complementary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, second-order linear equations and their classification, Initial and boundary conditions, Modelling and solution of the Heat, Wave and Laplace equations.		
3	**UNIT 3 Solution of a System of Linear Equations, Roots of Algebraic and Transcendental Equations:** Gauss-Jacobi and Gauss Seidel Methods, Solution of Polynomial and Transcendental Equations – Bisection Method, Newton-Raphson Method and Regula-Flasi Method	**25%**	**15**
4	**UNIT 4 Finite Differences and Interpolation:** Finite Differences, Relation between Operators, Interpolation using Newton's Forward and Backward Difference Formulae. Newton's Divided and Lagrange's Formulae for Unequal Intervals	**17%**	**10**
5	**UNIT 5 Numerical Integration:** Trapezoidal rule, Simpson's 1/3rd and 3/8th Rules. Numerical solution of Ordinary Differential Equations: Taylor's Series, Euler and Modified Euler's Methods, Runge Kutta Method of Fourth Order for Solving First Order Equations	**10%**	**6**
6	**UNIT 6 Correlation, Regression and Curve Fitting :** Correlation and Regression – Rank correlation Curve Fitting by The Method of Least Squares- Fitting of Straight Lines, Second Degree Parabolas and More General Curves	**25%**	**15**

i. Text Book and Reference Book:

1. E. Kreyszig, Advanced Engineering Mathematics, Willey India Edition.
2. L. Debnath, D. Bhatta, Integral Transforms and their applications, Chapman and Hall/CRC.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2010.
4. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
5. L.S. Andrews, Bhimsen K. Shivamoggi ,Integral Transforms for Engineers
6. M. Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
7. S.C. Chapra, R. P. Canale, Numerical Methods for Engineers, Tata McGraw Hill, 2003.

a. Course Name: Product Realization

b. Course Code: 303107209

c. Prerequisite: Design and analytical skill

d. Rationale: This course is helpful in to find the idea about the real-time project

e. Course Learning Objective:

CLOBJ 1	To identify the products related to proposed work
CLOBJ 2	To find the components

f. Course Learning Outcomes:

CLO 1	Demonstrate different types of value added products.
CLO 2	Propose the real-time project

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Module-1** Design Conceptualization and Philosophy, Original, Adaptive, Variant and Re-Design, Evolution of Concept, Need for Systematic design Past methods of and design.	**14%**	**4**
2	**Module-2** Product life cycle, Innovation, Types of innovation	**14%**	**4**
3	**Module-3** Needs and opportunities, Vision and Mission of a concept, Type of needs, Technology S - curve, Need analysis, market analysis and competitive analysis, Kano Diagrams, SWOT analysis	**15%**	**4**
4	**Module-4** Conceptualization techniques Idea generation ideation, brainstorming, Trigger session Brain writing, Mind maps, SCAMPER, TRIZ, Biomimicry, Shape mimicry, Familiarity Matrix.	**15%**	**4**

5	**Module-5** Concepts screening, Concept testing - exploratory tests, Assessment tests , Validation tests Comparison tests Case studies	**14%**	**4**
6	**Module-6** Organization of design concept and design methods, Engineering Design - Descriptive and prescriptive model, Design decisions and development of design.	**14%**	**4**
7	**Module-7** Group work and case studies	**14%**	**4**

a. **Course Name:** PROFESSIONAL COMMUNICATION SKILLS
b. **Course Code:** 303193203
c. **Prerequisite:** Knowledge of English language in practical life
d. **Rationale:** Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism
e. **Course Learning Objective:**

CLOBJ 1	Demonstrate the ability to communicate clearly and persuasively in oral presentations.
CLOBJ 2	Practice active listening techniques to enhance understanding in professional interactions.
CLOBJ 3	Write professional emails, memos, and reports with clarity and conciseness.
CLOBJ 4	Understand and practice professional etiquette in various business settings.
CLOBJ 5	Demonstrate skills in resolving conflicts and negotiating effectively.
CLOBJ 6	Use digital communication tools and platforms effectively.

f. **Course Learning Outcomes:**

CLO 1	To develop advanced communication skills
CLO 2	To become more proficient in formal writing
CLO 3	To apply interpersonal communication skills to be more productive at the workplace
CLO 4	To identity set and achieve the goals with the help of time management
CLO 5	To use with range of vocabulary to communicate effectively

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	2	0	2	-	100	-	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Technical Writing: Email etiquette & Email writing Letter Writing (Types of Letters & Layout)**: • Trains students on detailed email and letter writing etiquette. • Students will be able to write formal letters following certain stipulated formats. • They will learn different types of letters for different official purposes.	**10%**	**4**
2	**Interpersonal Communication at Workplace: Dynamics of communication**: • To develop the confidence to handle a wide range of demanding situation more effectively at the workplace • To enable the students to analyse their own interpersonal communication style.	**10%**	**2**
3	**Debate: The three minute debate planner**: • To enable the students to generate effective critical thinking into primary issues in the given topic. • Students will be able to resolve controversies and recognize strengths and weaknesses of arguments.	**10%**	**4**
4	**Goal setting & Tracking**: • To enable the students to define strategies or implementation steps to attain the identified goals and make progress every day.	**10%**	**2**
5	**Time Management & Task Planning (Case –study)**: • To enable the students to identify their own time wasters and adopt strategies to reduce them. • To enable students to clarify and priorities their objective and goals by creating more planning time	**5%**	**2**
6	**Reading Comprehension: Intermediate level**: • To enable the students develop the knowledge, skills, and strategies they must possess to become proficient and independent readers	**5%**	**2**

i. Textbook and reference book

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.

2. Communication Skills Kumar S And Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press
7. Quantitative Aptitude for Competitive Examinations Dr. R.S. Aggarwal

Semester 4

a. **Course Name:** Analog communication
b. **Course Code:** 303107251
c. **Prerequisite:** Fourier series, Fourier Transforms, Circuit Theory
d. **Rationale:** This course explores the fundamentals of electronic communication systems. The course has two primary focuses: (1) Understanding electronic communications systems in analog form from deterministic approach (2) Design and analysis of analog communications systems.
e. **Course Learning Objective:**

CLOBJ 1	Acquire knowledge of the fundamental aspects of a communication system.
CLOBJ 2	Evaluate different kinds of passive circuits, particularly those involving tuned circuits.
CLOBJ 3	Comprehend the functioning of transmitters that use AM/FM modulation.
CLOBJ 4	Cultivate knowledge about the technology associated with amateur radio.
CLOBJ 5	Learn about the variety of techniques applied in the modulation and demodulation processes related to frequency.

f. **Course Learning Outcomes:**

CLO 1	Understand the basics of communication system.
CLO 2	Analyse different type of passive circuits (Tuned circuits).
CLO 3	Learn working of AM/FM Transmitters
CLO 4	Become aware of amateur radio technology
CLO 5	Understand the different techniques for frequency modulation and demodulation

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Analog Communication:** Elements of communication system – Transmitters, Transmission channels & receivers, Concept of modulation, its needs.	8%	3
2	**Noise** Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise. Behaviour of Analog systems in presence of Noise.	15%	5
3	**Continuous Wave Linear Modulation** Amplitude modulation(AM-DSB/TC):Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal, Calculation of Transmitted power & sideband power & Efficiency; concept of under, over and critical modulation of AM-DSB-TC. Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. Single side band modulation (SSB) both TC & SC and only the basic concept of VSB, Spectra and band-width.	23%	11
4	**Generation & Detection of Amplitude Modulation** Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator. Generation of SSB: Filter method, Phase shift method and the Third method. Demodulation for Linear Modulation: Demodulation of AM signals: Detection of AM by envelope detector, Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency.	20%	11
5	**Angle Modulation :**	24%	11

	Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions and Fourier series, Phasor diagram. Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator. Demodulation of FM and PM: Concept of frequency discriminator, Phase Locked Loop		
6	**Multiplexing:** Frequency Division Multiplexing, Time Division Multiplexing, (FDM) Stereo – AM and FM: Basic concepts with block diagrams.	**10%**	**4**

i. Text Book and Reference Book:

1. Electronic Communications By Dennis Roddy & John Coolen | PHI
2. Electronic Communication systems By G. Kennedy | Tata McGraw-Hill Publishing Company Limited, 1996
3. Electronic Communications Systems By Wayne Tomasi | Pearson education India
4. Communication Systems By Simon Haykins | Wiley India
5. Electronic Communication Systems By Roy Blake | Cengage learning
6. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz | McGraw Hill Publication

a. Course Name: Analog communication Lab

b. Course Code: 303107252

c. Prerequisite: Fourier series, Fourier Transforms, Circuit Theory

d. Rationale: This course explores the fundamentals of electronic communication systems. The course has two primary focuses: (1) Understanding electronic communications systems in analog form from deterministic approach (2) Design and analysis of analog communications systems.

e. Course Learning Objective:

CLOBJ 1	Acquire knowledge of the fundamental aspects of a communication system.
CLOBJ 2	Evaluate different kinds of passive circuits, particularly those involving tuned circuits.
CLOBJ 3	Comprehend the functioning of transmitters that use AM/FM modulation.
CLOBJ 4	Cultivate knowledge about the technology associated with amateur radio.
CLOBJ 5	Learn about the variety of techniques applied in the modulation and demodulation processes related to frequency.

f. Course Learning Outcomes:

CLO 1	Understand the basics of communication system.
CLO 2	Analyse different type of passive circuits (Tuned circuits).
CLO 3	Learn working of AM/FM Transmitters
CLO 4	Become aware of amateur radio technology
CLO 5	Understand the different techniques for frequency modulation and demodulation

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	To observe amplitude modulation wave forms for different modulation index.
2	Observe frequency modulation waveform with VCO.
3	To observe frequency spectrum of AM and FM waveforms.
4	To generate amplitude modulation signal.
5	To extract information signal from AM signal using diode detector
6	To extract information signal from FM signal using ratio detector or PLL detector.
7	To obtain frequency response of pre-emphasis and de-emphasis circuits.
8	To obtain frequency response of RF amplifier.
9	To generate and detect SSB signal.
10	To understand working of AGC circuit. To measure output of amplifier circuit with and without AGC circuit.

i. Text Book and Reference Book:

1. Electronic Communications By Dennis Roddy & John Coolen | PHI
2. Electronic Communication systems By G. Kennedy | Tata McGraw-Hill Publishing Company Limited, 1996
3. Electronic Communications Systems By Wayne Tomasi | Pearson education India

4. Communication Systems By Simon Haykins | Wiley India
5. Electronic Communication Systems By Roy Blake | Cengage learning
6. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz | McGraw Hill Publication

a. **Course Name:** Analog Circuits
b. **Course Code:** 303107253
c. **Prerequisite:** Fundamental knowledge of Basic Electronics and Circuit Theory for Analysis of Operational Amplifier Based Circuit.
d. **Rationale:** The Students of EC Engineering are able to apply basic concepts of Operational Amplifier in various Application of real problems. This is one of the courses, which are required to understand the concepts of advance courses and developing skills in the field of Electronics.

e. Course Learning Objective:

CLOBJ 1	Help students develop Analog circuit designs by presenting a concise treatment of the wide array of knowledge
CLOBJ 2	To learn the linear and non-linear applications of operational amplifiers.
CLOBJ 3	To explain the principle of oscillations and design various oscillator circuits
CLOBJ 4	To familiarize the students with the analysis and design of basic transistor amplifier circuits, oscillators and wave shaping circuits.
CLOBJ 5	To recall the characteristics of an ideal op-amp comparing the practical op-amp circuit in real life.
CLOBJ 6	To know about various analog switches and different A/D and D/A converter.
CLOBJ 7	To provide an easier way to generate a clock signal with a wide variety of speed.

f. Course Learning Outcomes:

CLO 1	Design circuits using operational amplifiers for various applications.
CLO 2	Analyse and design amplifiers and active filters using Op-amp.
CLO 3	Diagnose and trouble-shoot linear electronic circuits.
CLO 4	Develop and ability to analyse the high frequency transistor model.
CLO 5	Use the Op-amp applications in higher level circuits.
CLO 6	Learn about various techniques to develop A/D and D/A convertors
CLO 7	To provide the signals to a digital system to change its state using 555 timers.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Operational Amplifier:** Introduction, Block diagram representation of a typical op-amp, its equivalent circuit, types of ICs, Manufacturers designations and package types for ICs, Power supplies for ICs , Interpreting datasheet, Ideal op-amp, Equivalent circuit of an op-amp, Ideal voltage transfer curve, Open-loop op-amp configurations	10%	5
2	**Analysis of Op-amp Circuit with Feedback:** Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Differential amplifier, Practical Characteristic of Op-amp i.e. Input offset voltage, Input bias current, Input offset current, Total output offset, Slew Rate, CMRR, Change in Change in Characteristic of Op-amp w.r.t time, temperature, power supply.	15%	8
3	**Linear Applications Op-Amp:** Peaking amplifier, Summing, Scaling and Averaging amplifier, Instrumentation amplifier, Voltage-to-current converter, Integrator, Differentiator	15%	6
4	**Op-Amp as Comparator & Converter:** Comparator, Zero Crossing Detector, Schmitt Trigger, Voltage limiters, Clipper and Clampers, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision Rectifier Half/Full Wave, Square, Triangular and Saw tooth Wave Generator, Log/ Antilog Amplifier	15%	6
5	**Active Filters & Oscillators:** Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien and quadrature type, waveform generators - triangular, saw tooth, square wave and VCO.	15%	8
6	**D-A and A-D Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive	15%	6

	approximation ADC and slope ADC. DAC and ADC specifications		
7	**555 Timer Integrated Circuit:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.	**15%**	**6**

i. Text Book and Reference Book:

1. Op-Amps & Linear ICs (Textbook) Ramakanth A. Gayakwad; PHI
2. Linear Integrated Circuits (Textbook) D. Roy Chowdhury; New Age International (p) Ltd
3. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications (Textbook)
   Denton J. Daibey; TMH
4. Design with Operational Amplifiers & Analog Integrated Circuits (Textbook) Sergio Franco; McGraw Hill
5. Digital Fundamentals (Textbook) Floyd and Jain, Pearson Education
6. Operational Amplifiers and Linear ICs (Textbook) David A. Bell; Oxford University Press; 3rd edition

a. **Course Name:** Analog Circuits Lab
b. **Course Code:** 303107254
c. **Prerequisite:** Fundamental knowledge of Basic Electronics and Circuit Theory for Analysis of Operational Amplifier Based Circuit.
d. **Rationale:** The Students of EC Engineering are able to apply basic concepts of Operational Amplifier in various Application of real problems. This is one of the courses, which are required to understand the concepts of advance courses and developing skills in the field of Electronics.

e. Course Learning Objective:

CLOBJ 1	Help students develop Analog circuit designs by presenting a concise treatment of the wide array of knowledge
CLOBJ 2	To learn the linear and non-linear applications of operational amplifiers.
CLOBJ 3	To explain the principle of oscillations and design various oscillator circuits
CLOBJ 4	To familiarize the students with the analysis and design of basic transistor amplifier circuits, oscillators and wave shaping circuits.
CLOBJ 5	To recall the characteristics of an ideal op-amp comparing the practical op-amp circuit in real life.
CLOBJ 6	To know about various analog switches and different A/D and D/A converter.
CLOBJ 7	To provide an easier way to generate a clock signal with a wide variety of speed.

f. Course Learning Outcomes:

CLO 1	Design circuits using operational amplifiers for various applications.
CLO 2	Analyse and design amplifiers and active filters using Op-amp.
CLO 3	Diagnose and trouble-shoot linear electronic circuits.
CLO 4	Develop and ability to analyse the high frequency transistor model.
CLO 5	Use the Op-amp applications in higher level circuits.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	Measurement of Input and Output Offset voltage of Op-Amp.
2	Op-amp in Voltage Follower Mode and measurement of Slew Rate.
3	Gain and Bandwidth measurement of Op-Amp in Inverting Configuration
4	Gain and Bandwidth measurement of Op-Amp in Non-Inverting Configuration
5	Op-Amp as a Full Wave Rectifier
6	Op-Amp as a Summing and Averaging amplifier in Inverting Configuration
7	Op-Amp as a Summing and Averaging amplifier in Non-Inverting Configuration
8	Op-Amp as an Integrator
9	Op-Amp as a Differentiator
10	Op-amp as a Schmitt Trigger
11	Op-Amp as a Butterworth low-pass Filter
12	Analog to Digital and convertor

13	Digital to Analog Convertor
14	Astable multi-vibrator using 555 timer IC
15	Monostable multi-vibrator using 555 timer IC

i. Text Book and Reference Book:

1. Op-Amps & Linear ICs (Textbook) Ramakanth A. Gayakwad; PHI
2. Linear Integrated Circuits (Textbook) D. Roy Chowdhury; New Age International (p) Ltd
3. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications (Textbook)
   Denton J. Daibey; TMH
4. Design with Operational Amplifiers & Analog Integrated Circuits (Textbook) Sergio Franco; McGraw Hill
5. Digital Fundamentals (Textbook) Floyd and Jain, Pearson Education
6. Operational Amplifiers and Linear ICs (Textbook) David A. Bell; Oxford University Press; 3rd edition

a. Course Name: Microcontroller

b. Course Code: 303107255

c. Prerequisite: Basic knowledge of Digital Electronics

d. Rationale: Obtaining efficient algorithms is very important in modern computer engineering as the world wants applications to be time and space and energy efficient. This course enables to understand and analyze efficient algorithms for various applications

e. Course Learning Objective:

CLOBJ 1	Able to learn assembly programing language
CLOBJ 2	Able to interface peripherals with microprocessor
CLOBJ 3	Able to propose digital system
CLOBJ 4	Able to understand the internal architecture of microcontroller

f. Course Learning Outcomes:

CLO 1	Do assembly language programming
CLO 2	Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
CLO 3	Develop systems using different microcontrollers.
CLO 4	Understand RSIC processors and design ARM microcontroller based systems

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 8086)	35%	18
2	**Interfacing with peripherals** Timer, serial I/O, parallel I/O, A/D and D/A converters, Arithmetic Coprocessors, System level interfacing design, Concepts of virtual memory, Cache memory	25%	15
3	**Advanced Microprocessor** Advanced coprocessor Architectures- 286, 486, Pentium	26%	6
4	**Introduction of Microcontroller Microcontrollers:** 8051 systems. Introduction to RISC processors; ARM microcontrollers interface designs	20%	7

i. Text Book and Reference Book:

1. Microprocessor Architecture, Programming and Applications with 8085 By Ramesh Gaonkar Penram International Publishing (India) Private LTD. 5th
2. Advanced Microprocessors and Peripherals By A. K. Ray and K.M. Bhurchandani Tata McGraw-Hill Education 3

a. Course Name: Microcontroller Lab

b. Course Code: 303107256

c. Prerequisite: Basic knowledge of Digital Electronics

d. Rationale: Obtaining efficient algorithms is very important in modern computer engineering as the world wants applications to be time and space and energy efficient. This course enables to understand and analyze efficient algorithms for various applications

e. Course Learning Objective:

CLOBJ 1	Able to learn assembly programing language
CLOBJ 2	Able to interface peripherals with microprocessor
CLOBJ 3	Able to propose digital system
CLOBJ 4	Able to understand the internal architecture of microcontroller

f. Course Learning Outcomes:

CLO 1	Do assembly language programming
CLO 2	Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
CLO 3	Develop systems using different microcontrollers.
CLO 4	Understand RSIC processors and design ARM microcontroller based systems

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	W.A.P to perform addition of 8 bit Numbers. W.A.P to perform subtraction of 8 bit Numbers
2	W.A.P to perform AND operation of two 8-bit Numbers. W.A.P to perform OR operation of two 8-bit Numbers
3	W.A.P to perform NOT operation of 8-bit Number. W.A.P to perform XOR operation of 8-bit Number
4	W.A.P to perform Multiplication of two 8-bit Numbers. W.A.P to perform Division of two 8-bit Numbers.
5	W.A.P to perform addition of block of data

6	W.A.P to find Maximum No. from given Numbers. W.A.P to find Minimum No. from given Numbers
7	W.A.P. to find out even number from given Numbers. W.A.P. to find out odd number from given Numbers
8	A program to perform addition of numbers given in series. (80x86)
9	A) A program to find maximum number from given series. (80x86) B) A program to find minimum number from given series.(80x86)
10	A program to find number of Even or Odd numbers from given series.(80x86)
11	To Design Microcontroller based project

i. **Text Book and Reference Book:**

3. Microprocessor Architecture, Programming and Applications with 8085 By Ramesh Gaonkar Penram International Publishing (India) Private LTD. 5th
4. Advanced Microprocessors and Peripherals By A. K. Ray and K.M. Bhurchandani Tata McGraw-Hill Education 3

a. **Course Name:** Control System
b. **Course Code:** 303107257
c. **Prerequisite:** Knowledge of Linear differential equations, Different equations and its solution and Laplace transform.
d. **Rationale:** The course explores the fundamentals of control systems, understanding and predicting system behaviour and design and analysis of closed loop control systems.
e. **Course Learning Objective:**

CLOBJ 1	Utilize systems theory to address intricate real-world challenges, aiming to derive models articulated through the differential equations, transfer functions, and state space equations.
CLOBJ 2	Anticipate the performance of a system by relying on its mathematical representation, expressed either in the time or frequency domain.
CLOBJ 3	Examine the performance of closed-loop systems by employing methodologies such as root locus, Routh-Hurwitz, Bode, Nyquist, and MATLAB tools.
CLOBJ 4	Create controllers through classical approaches including PID methods, root locus techniques, and frequency domain methods.
CLOBJ 5	Develop a secure and efficient approach for exploring a system identification issue in the laboratory.

f. Course Learning Outcomes:

CLO 1	Apply systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
CLO 2	Predict system behaviour based on the mathematical model of that system where the model may be expressed in time or frequency domain.
CLO 3	Analyse the behaviour of closed loop systems using tools such as root locus, Routh Hurwitz, Bode, NY Quist and MATLAB.
CLO 4	Design controllers using classical PID methods, root locus methods, and frequency domain methods.
CLO 5	Devise a safe and effective method of investigating a system identification problem in the laboratory.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Control Systems** Introduction, Examples of Control Systems, Closed-Loop Control versus Open-Loop Control, Digital Computer Control, The Control Problem.	10%	3
2	**Mathematical Modelling of Control Systems** Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Transformation of Mathematical Models with MATLAB. Mathematical Modelling of Mechanical Systems, Mathematical Modelling of Electrical Systems, and Block diagram Model, Signal flow graph.	20%	9
3	**State variable Analysis** Concept of State Variable, State equation, State-Space Representations of Transfer-Function Systems, Transformation of System Models with MATLAB, Solving the Time-Invariant State Equation, Some Useful Results in Vector-Matrix Analysis	10%	6
4	**Feedback & Time response analysis**	20%	9

	Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.		
5	**Frequency-response analysis** Relationship between time and frequency response, Polar plots, Bode plots. NY Quist stability criterion. Relative stability using NY Quist criterion – gain and phase margin. Closed-loop frequency response	**20%**	**9**
6	**Control Systems Analysis and Design** Introduction, Root-Locus Plots, Plotting Root Loci with MATLAB, Root-Locus Plots of Positive Feedback Systems, Root-Locus Approach to Control-Systems Design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers. Design of PID Controllers with Frequency-Response Approach, Modifications of PID Control Schemes, Two-Degrees-of-Freedom Control.	**20%**	**9**

i. Text Book and Reference Book:

1. Control Systems: Principles and Design by M. Gopal | McGraw Hill Education, Pub.Year1997.
2. Automatic Control Systems by B S Manke.
3. Modern Control Engineering by Katsuhiko Ogata | Prentice Hall of India.

a. Course Name: Control System Lab

b. Course Code: 303107258

c. Prerequisite: Knowledge of Linear differential equations, Different equations and its solution and Laplace transform.

d. Rationale: The course explores the fundamentals of control systems, understanding and predicting system behaviour and design and analysis of closed loop control systems.

e. Course Learning Objective:

CLOBJ 1	Utilize systems theory to address intricate real-world challenges, aiming to derive models articulated through the differential equations, transfer functions, and state space equations.
CLOBJ 2	Anticipate the performance of a system by relying on its mathematical representation, expressed either in the time or frequency domain.

CLOBJ 3	Examine the performance of closed-loop systems by employing methodologies such as root locus, Routh-Hurwitz, Bode, NY Quist, and MATLAB tools.
CLOBJ 4	Create controllers through classical approaches including PID methods, root locus techniques, and frequency domain methods.
CLOBJ 5	Develop a secure and efficient approach for exploring a system identification issue in the laboratory.

f. Course Learning Outcomes:

CLO 1	Apply systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
CLO 2	Predict system behaviour based on the mathematical model of that system where the model may be expressed in time or frequency domain.
CLO 3	Analyse the behaviour of closed loop systems using tools such as root locus, Routh Hurwitz, Bode, NY Quist and MATLAB.
CLO 4	Design controllers using classical PID methods, root locus methods, and frequency domain methods.
CLO 5	Devise a safe and effective method of investigating a system identification problem in the laboratory.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	Introduction to MATLAB Software.
2	To conversion poles-zeroes to Transfer function and vice-versa.
3	Generating standard test signals i.e. step, ramp, and unit impulse on a simulator.
4	To Perform Block Diagram Reduction rules in MATLAB.
5	Simulation of DC motor.
6	Simulation of RC circuit.

7	Simulation of Second order system.
8	To obtain the transfer function from the state model and state space from transfer function.
9	To Study about Root locus.
10	To Study about Bode plot

i. Text Book and Reference Book:

1. Control Systems: Principles and Design by M. Gopal | McGraw Hill Education, Pub. Year 1997.
2. Automatic Control Systems by B S Manke.
3. Modern Control Engineering by Katsuhiko Ogata | Prentice Hall of India.

a. Course Name: Probability Theory and Stochastic Processes

b. Course Code: 303107259

c. Prerequisite: Basic Knowledge of Arithmetical skill

d. Rationale: To provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probabilitytheory, as well as solve probabilistic problems in signal processing and Communication Engineering. To understand basic concepts of probability theory and random variables, probabilistic thinking, how to deal with multiple random variables, Conditional probability and conditional expectation, joint distribution and independence, mean square estimation. To understand the difference between time averages and statistical averages. Analysis of random process and application to the signal processing in the communication system.

e. Course Learning Objective:

CLOBJ 1	To provide the fundamentals and advanced concepts of probability theory and random process to support graduate coursework and research in electronic Engineering.
CLOBJ 2	The applications of the probability theory and random processes to engineering problems will be emphasized.
CLOBJ 3	Gain advanced and integrated understanding of the fundamentals of and interrelationship between discrete and continuous random signals.
CLOBJ 4	Understand how to process random signals with specific applications in estimation theory.

f. Course Learning Outcomes:

CLO 1	Understand representation of random signals

CLO 2	Investigate characteristics of random processes
CLO 3	Make use of theorems related to random signals
CLO 4	To understand propagation of random signals in LTI systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.	10%	5
2	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;	25%	10
3	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;	25%	10
4	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.	20%	10
5	Random process. Stationary processes. Mean and covariance functions. Ergodicity, Transmission of random process through LTI. Power spectral density.	20%	10

i. Text Book and Reference Book:

1. Probability and Random Processes with Applications to Signal Processing by H. Stark and J. Woods, Third Edition, Pearson Education
2. Probability, Random Variables and Stochastic Processes, by A. Papoulis and S. Unnikrishnan Pillai, Fourth Edition, McGraw Hill.
3. Introduction to Probability Theory with Stochastic Processes, by K. L. Chung, Springer International

4. Introduction to Probability, by P. G. Hoel, S. C. Port and C. J. Stone, UBS Publishers,
5. Introduction to Stochastic Processes, by P. G. Hoel, S. C. Port and C. J. Stone, UBS Publishers
6. Introduction to Stochastic Models by S. Ross, Harcourt Asia, Academic Press.

a. **Course Name:** Probability Theory and Stochastic Processes Lab
b. **Course Code:** 303107260
c. **Prerequisite:** MATLAB software skill
d. **Rationale:** To provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probabilitytheory, as well as solve probabilistic problems in signal processing and Communication Engineering. To understand basic concepts of probability theory and random variables, probabilistic thinking, how to deal with multiple random variables, Conditional probability and conditional expectation, joint distribution and independence, mean square estimation. To understand the difference between time averages and statistical averages. Analysis of random process and application to the signal processing in the communication system.
e. **Course Learning Objective:**

CLOBJ 1	To provide the fundamentals and advanced concepts of probability theory and random process to support graduate coursework and research in electronic Engineering.
CLOBJ 2	The applications of the probability theory and random processes to engineering problems will be emphasized.
CLOBJ 3	Gain advanced and integrated understanding of the fundamentals of and interrelationship between discrete and continuous random signals.
CLOBJ 4	Understand how to process random signals with specific applications in estimation theory.

f. **Course Learning Outcomes:**

CLO 1	Understand representation of random signals
CLO 2	Investigate characteristics of random processes
CLO 3	Make use of theorems related to random signals
CLO 4	To understand propagation of random signals in LTI systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Basic matlab program for probability.
2	Write a program for uniform distribution using matlab.
3	Simulation and analysis of white Gaussian noise in matlab.
4	Using matlab generate a random input signal with 1000 samples taken at 100hz and an amplitude of 0.02.
5	Write a program to generate normal distribution function using matlab.
6	Write a program to generate binomial distribution function using matlab.
7	Write a program to generate Rayleigh distribution function using matlab.
8	Write matlab code for generate central limit theorem and simulate.
9	Using matlab generate power spectral density .Analysis the power spectral density of random process
10	Using matlab generate random process. Do analysis of random process by seeing graph.

i. Text Book and Reference Book:

1. Probability and Random Processes with Applications to Signal Processing by H. Stark and J. Woods, Third Edition, Pearson Education
2. Probability, Random Variables and Stochastic Processes, by A. Papoulis and S. Unnikrishnan Pillai, Fourth Edition, McGraw Hill.
3. Introduction to Probability Theory with Stochastic Processes, by K. L. Chung, Springer International
4. Introduction to Probability, by P. G. Hoel, S. C. Port and C. J. Stone, UBS Publishers,
5. Introduction to Stochastic Processes, by P. G. Hoel, S. C. Port and C. J. Stone, UBS Publishers
6. Introduction to Stochastic Models by S. Ross, Harcourt Asia, Academic Press.

a. Course Name Professional Grooming & Personality Development
b. Course Code: 303193252
c. Prerequisite: Knowledge of English language in practical life
d. Rationale: Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism

e. Course Learning Objective:

CLOBJ 1	Gain familiarity with electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLOBJ 2	Solve problems related to Alternating current, alternating voltage, etc., Demonstrate a clear understanding of Pure R, L C circuit and combination of RLC, Series and Parallel combination of R, L and C, etc.
CLOBJ 3	Acquire knowledge of the resistor, capacitor, and inductor and their performance characteristics for series and parallel connections.
CLOBJ 4	Understand different single phase and three phase circuits.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of transformer, DC machines and AC machines.
CLOBJ 6	Study the use of LT Switch Gear, Fuse, MCB, ELCB etc.

f. Course Learning Outcomes:

CLO 1	Identity and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace
CLO 3	Speak and participate effectively in oral organizational communication
CLO 4	Improve comprehensive skills for reading.
CLO 5	Know how to be assertive in professional environment

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**1**	**0**	**1**	**-**	**100**	**-**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	**Topic**	**Weightage**	**Teaching Hrs.**
1	**Self-Development and Assessment**: Various self-assessments for personal and professional development skills that are relevant to career development: • Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Guess, Think, Communicate, Relate, and Dream	**25%**	**4**

2	**Corporate Etiquette**: Tips and guide to develop personality and gain various etiquettes manners, case studies and activities. • Telephone etiquette • Etiquette for foreign business trips • Etiquette for small talks • Respecting privacy • Learning to say 'No'	**25%**	**4**
3	**Public Speaking**: It's process of communicating information to an audience and is helpful in career advancement. Effective Public speaking skills includes: • Choosing appropriate pattern • Selecting appropriate method • Art of persuasion • Making speeches effective • Delivering different types of speeches	**20%**	**4**
4	**Reading Skills Activity & Reading Comprehension**: Aims to improve students' Comprehensive Skills in English Language by getting them involved in reading activity and providing practice for reading comprehension.	**15%**	**2**
5	**Listening Skills- Inquiry Based Listening Questions**: Aims to improve students' listening skills in English Language of various types of inquiry based listening tracks. Students will find out details from the conversations.	**15%**	**1**

i. Textbook and reference Books:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Pre

Semester-5

a. **Course Name:** Electromagnetics waves
b. **Course Code:** 3303107301
c. **Prerequisite:** Higher Engineering Mathematics, Basic knowledge of vector calculus, Electric and Magnetic fields and its laws, Basic knowledge of Wave propagation, Antennas and Semiconductor physics
d. **Rationale:** This course provides basic knowledge of designing of transmission lines and wave guides. The various modes of propagations through transmission line and wave guides are included. The students can also understand the transmission lines, antennas and waveguides theory.

e. **Course Learning Objective:**

CLOBJ 1	To introduce the basic mathematical concepts related to electromagnetic vector fields
CLOBJ 2	To give knowledge on the concepts of electrostatics, electric potential, energy density and their application
CLOBJ 3	To give knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications..
CLOBJ 4	To give knowledge on the concept of Maxwell's equations.
CLOBJ 5	To give knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

f. **Course Learning Outcomes:**

CLO 1	Understand characteristics and wave propagation on high frequency transmission lines.
CLO 2	Carryout impedance transformation on TL.
CLO 3	Use sections of transmission line sections for realizing circuit elements
CLO 4	Calculate reflection and transmission of waves at media interface.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Transmission Lines** Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Lossless and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.	**20%**	**8**
2	**Maxwell's Equations** Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface	**15%**	**7**
3	**Uniform Plane Wave** Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor	**15%**	**7**
4	**Plane Waves at a Media Interface** Plane wave in arbitrary direct ion, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.	**15%**	**7**
5	**Wave propagation in parallel plane waveguide** Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide ,Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide	**20%**	**8**
6	**Radiation** Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna	**15%**	**8**

i. Text Book and Reference Book:

1. Elements of Electromagnetics, By Matthew N. O. Sadiku, Oxford University Press
2. Engineering Electromagnetic, By W.H. Hayt and J A Buck, McGraw Hill
3. Electromagnetic Waves, By R.K. Shevgaonkar, Tata McGraw Hill India, Pub. Year 2005
4. Electromagnetic waves & Radiating Systems, By E.C. Jordan & K.G. Balmain, Prentice Hall
5. Engineering Electromagnetics, By Narayana Rao, Prentice Hall, Pub. Year, 1997

a. **Course Name:** Electromagnetics waves Lab
b. **Course Code:** 3303107302
c. **Prerequisite:** Higher Engineering Mathematics, Basic knowledge of vector calculus, Electric and Magnetic fields and its laws, Basic knowledge of Wave propagation, Antennas and Semiconductor physics
d. **Rationale:** This course provides basic knowledge of designing of transmission lines and wave guides. The various modes of propagations through transmission line and wave guides are included. The students can also understand the transmission lines, antennas and waveguides theory.

e. **Course Learning Objective:**

CLOBJ 1	To introduce the basic mathematical concepts related to electromagnetic vector fields
CLOBJ 2	To give knowledge on the concepts of electrostatics, electric potential, energy density and their application
CLOBJ 3	To give knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications..
CLOBJ 4	To give knowledge on the concept of Maxwell's equations.
CLOBJ 5	To give knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

f. **Course Learning Outcomes:**

CLO 1	Understand characteristics and wave propagation on high frequency transmission lines.
CLO 2	Carryout impedance transformation on TL.
CLO 3	Use sections of transmission line sections for realizing circuit elements
CLO 4	Calculate reflection and transmission of waves at media interface.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Vector addition		

2	Vector products		
3	Coordinate systems		
4	Position vector and distance vector.		
5	Curl of a vector field.		
6	Divergence of a vector field		
7	Electric flux density		
8	Gradient of a scalar field		
9	Variation of electrostatic fields.		
10	Electron moving in different regions.		
11	Magnetic vector potential		
12	Variation of time varying fields		

i. **Text Book and Reference Book:**
   1. Elements of Electromagnetics, By Matthew N. O. Sadiku, Oxford University Press
   2. Engineering Electromagnetic, By W.H. Hayt and J A Buck, McGraw Hill
   3. Electromagnetic Waves, By R.K. Shevgaonkar, Tata McGraw Hill India, Pub. Year 2005
   4. Electromagnetic waves & Radiating Systems, By E.C. Jordan & K.G. Balmain, Prentice Hall
   5. Engineering Electromagnetics, By Narayana Rao, Prentice Hall, Pub. Year, 1997

a. **Course Name:** Computer Architecture
b. **Course Code:** 303107303
c. **Prerequisite:** Basic understanding of computer system
d. **Rationale:** This course provides detail of computer system's functional components, their characteristics, performance and interactions including system bus, different types of memory and input/output organization and CPU. This course also covers the architectural issues such as instruction set program and data types. On top that, the students are also introduced to the increasingly important area of parallel organization.
e. **Course Learning Objective:**

CLOBJ 1	Gain knowledge of computer Functional units, software, and performance issues software, Multiprocessors.
CLOBJ 2	Understand the Assembly language, Stacks, Ques, and Subroutines.
CLOBJ 3	Acquiring informative knowledge in RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces
CLOBJ 4	Understand Arithmetic Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation.

f. Course Learning Outcomes:

CLO 1	learn how computers work
CLO 2	know basic principles of computer's working
CLO 3	analyze the performance of computers
CLO 4	know how computers are designed and built

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basic Structure of computer Functional units, software, and performance issues software, Multiprocessors and multicomputer.	10	6
2	Machine Instruction and Programme: Types of instructions, addressing mode, and Instruction sets: Instruction formats, Assembly language, Stacks, Ques, and Subroutines.	15	9
3	Memory and Input – output Organization Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces	25	10
4	Arithmetic Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Micro programmed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Micro programmed computers - CPU control unit	25	10
5	Basic processing unit and Pipeline Processor organization, Information representation, number formats., Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network	25	10

i. Text Book and Reference Book:

1. Computer System Architecture By M.M.Mano,
2. Computer Organisation By V.Carl Hammacher Fifth Edition
3. Structured Computer Organisation By A.S.Tanenbum Production, Characterization and antibiotic property of lipase by using thermophilic fungi from ma Third
4. Computer Organization and Micro programming By Y.Chu N.J., Prentice Hall Edition

5. Computer Organization and Programming By C.W.Gear McGraw Hill, | N.V. Edition

a. **Course Name:** Computer Architecture Lab
b. **Course Code:** 303107304
c. **Prerequisite:** Basic understanding of computer system
d. **Rationale:** This course provides detail of computer system's functional components, their characteristics, performance and interactions including system bus, different types of memory and input/output organization and CPU. This course also covers the architectural issues such as instruction set program and data types. On top that, the students are also introduced to the increasingly important area of parallel organization.
e. **Course Learning Objective:**

CLOBJ 1	Gain knowledge of computer Functional units, software, and performance issues software, Multiprocessors.
CLOBJ 2	Understand the Assembly language, Stacks, Ques, and Subroutines.
CLOBJ 3	Acquiring informative knowledge in RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces
CLOBJ 4	Understand Arithmetic Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation.

f. **Course Learning Outcomes:**

CLO 1	learn how computers work
CLO 2	know basic principles of computer's working
CLO 3	analyze the performance of computers
CLO 4	know how computers are designed and built

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	To write C program for sum of two binary numbers		
2	To write a C program for multiplication of two binary numbers		

3	To Write a c program to perform logical operation in KEIL software.		
4	To write c program to send values 00-ff to port 1.		
5	To write c program to toggle all the bits of port 1		
6	Design a C program to find operation of timer in KEIL		
7	Write program to perform delay using timer.		
8	Write program for door sensor		
9	Write program to turn the switch depending on frequency.		
10	Write program for blinking of led		

i. Text Book and Reference Book:

1. Computer System Architecture By M.M.Mano,
2. Computer Organisation By V.Carl Hammacher Fifth Edition
3. Structured Computer Organisation By A.S.Tanenbum Production, Characterization and antibiotic property of lipase by using thermophilic fungi from ma Third
4. Computer Organization and Micro programming By Y.Chu N.J., Prentice Hall Edition
5. Computer Organization and Programming By C.W.Gear McGraw Hill, | N.V. Edition

a. Course Name: - Digital Communication

b. Course Code: 303107305

c. Prerequisite: Knowledge of Signals & Systems and Analog Communication

d. Rationale: The main objective of this subject is to make students acquainted with provide fundamentals of digital communication system. EC Engineers are expected to be design a reliable, efficient and secured digital communication system. The course presents the detail theory of digital signals and systems. It aims to familiarize students, concept of probability theory, CDF, PDF and also includes error detection and error correction codes.

e. Course Learning Objective:

CLOBJ 1	Define and explain the basic concepts of digital communication, including signals, modulation, demodulation, and encoding.
CLOBJ 2	Explore and understand various digital communication technologies
CLOBJ 3	Describe various modulation techniques used in digital communication systems, such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM).
CLOBJ 4	Study channel coding techniques for reliable communication over noisy channels.
CLOBJ 5	Understand the design and operation of digital transmission systems.
CLOBJ 6	Explore error detection and correction methods in digital communication. Implement and to analyse error-correcting codes to improve system reliability.

f. Course Learning Outcomes:

CLO 1	Know probability, random variable and various statistical analysis methods.

CLO 2	Convert analog signal into digital signal using different techniques like PCM, DM, and ADM.
CLO 3	Understand behavior of various modulation-demodulation techniques in presence of noise.
CLO 4	Implement Source encoding for given source symbols.
CLO 5	Understand behavior of digital communication channel.
CLO 6	Analyze various error correcting codes and implement it reliable for communication system

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	T	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Probability Theory & Random Variables Information, Probability, Conditional Probability of independent events, Raleigh Probability Density, CDF, PDF, Random Variables and Variance, Statistical Averages (Means), Mean and Variance of sum of Random variables, Central limit theorem, Gaussian PDF, Threshold Detection, Statistical Average, Chebyshev inequality, Concept of correlation.	**15**	**7**
2	Base Band Modulation Base band system, Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system	**15**	**7**
3	Principal of Digital Data Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M-ary communication, Digital Carrier Systems.	**14**	**6**
4	Digital Modulation Techniques Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, QAM, MSK, GMSK.	**14**	**6**
5	Digital Carrier Demodulation Techniques Coherent and non coherent detection of ASK, QASK, FSK, PSK, QPSK, M-ary PSK, DPSK, Noise temperature, Noise bandwidth, Noise figure.	**12**	**5**
6	Introduction to Information Theory Measure of information, Entropy, Source encoding, Error free	**15**	**7**

	communication over noisy channel, channel capacity of discrete memory less channel, Channel capacity of continuous channel, Practical communication system in lights of Shannon theorem		
7	Error Correcting Codes Introduction, Linear Block Code, Cyclic Code, Burst error detecting and correcting codes, Interlace codes for burst and random error correction, Convolution Code, Comparison of coded and un coded system.	**15**	**7**

i. Text Book and Reference Book:

1. Modern Digital and Analog Communication Systems (TextBook) By B. P. Lathi, Zhi Ding | Oxford University Press | 4th Edition
2. Digital communication - Fundamentals and Applications By Bernard Sklar Pearson Education, India | 2nd Edition
3. Principles of Communication Systems By Taub & Schilling | Tata McGraw Hill Publication
4. Communication systems By S. Haykin | John Wiley
5. Digital Communication By Bhattacharya Amitabh | Tata McGraw-Hill

a. Course Name: - Digital Communication Lab

b. Course Code: 303107306

c. Prerequisite: Knowledge of Signals & Systems and Analog Communication

d. Rationale: The main objective of this subject is to make students acquainted with provide fundamentals of digital communication system. EC Engineers are expected to be design a reliable, efficient and secured digital communication system. The course presents the detail theory of digital signals and systems. It aims to familiarize students, concept of probability theory, CDF, PDF and also includes error detection and error correction codes.

e. Course Learning Objective:

CLOBJ 1	Define and explain the basic concepts of digital communication, including signals, modulation, demodulation, and encoding.
CLOBJ 2	Explore and understand various digital communication technologies
CLOBJ 3	Describe various modulation techniques used in digital communication systems, such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM).
CLOBJ 4	Study channel coding techniques for reliable communication over noisy channels.
CLOBJ 5	Understand the design and operation of digital transmission systems.
CLOBJ 6	Explore error detection and correction methods in digital communication. Implement and to analyse error-correcting codes to improve system reliability.

f. Course Learning Outcomes:

CLO 1	Know probability, random variable and various statistical analysis methods.
CLO 2	Convert analog signal into digital signal using different techniques like PCM, DM,

	and ADM.
CLO 3	Understand behavior of various modulation-demodulation techniques in presence of noise.
CLO 4	Implement Source encoding for given source symbols.
CLO 5	Understand behavior of digital communication channel.
CLO 6	Analyze various error correcting codes and implement it reliable for communication system

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	To perform sampling and reconstruction on analog signal		
2	To perform PCM data regeneration i.e. A/D quantization & A/D conversion with associated control signal		
3	To observe and study the control signal sequences and data framing necessary to generate TDM-PCM digital data to be transmitted.		
4	To perform TDM over PAM using 1 link, 2 link and 3 link		
5	To perform delta modulation & demodulation		
6	To perform Adaptive delta modulation & demodulation		
7	To study different data formats		
8	To perform Frequency Shift Keying		
9	To perform Phase Shift Keying		
10	To perform Amplitude Shift Keying.		
11	Simulation of Gaussian and Rayleigh distribution using MATLAB code.		
12	Simulation of Error correcting code using MATLAB.		
13	Simulation of Digital Modulation Techniques - QPSK, QAM in MATLAB		
14	Simulation of Entropy in MATLAB		
15	Simulation of Source Coding Technique in MATLAB		

i. **Text Book and Reference Book:**

1. Modern Digital and Analog Communication Systems (TextBook) By B. P. Lathi, Zhi Ding | Oxford University Press | 4th Edition
2. Digital communication - Fundamentals and Applications By Bernard Sklar Pearson Education, India | 2nd Edition
3. Principles of Communication Systems By Taub & Schilling | Tata McGraw Hill Publication
4. Communication systems By S. Haykin | John Wiley
5. Digital Communication By Bhattacharya Amitabh | Tata McGraw-Hill

a. **Course Name:** PLC & SCADA

b. **Course Code:** 303107337

c. **Prerequisite:** Digital electronics fundamentals, programming languages like C, C++, and Instrumentation.

d. **Rationale:** : In the era of automation, an engineering graduate, employed in automated process controls/power stations will be required to know the basic of programmable logic controllers, their working and their programming. Existence of abundant applications of PLC & SCADA in industrial and other domains justifies its usefulness in the present curriculum. This course aims to provide fundamental knowledge of PLC & SCADA. In addition, covers aspect of appropriate selection of PLC & SCADA for specific industry/applications as well as explores various programming languages used for PLC programming to make students readily available for industry use.

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with the Major Components of PLC.
CLOBJ 2	Selection of PLC for specific/general applications.
CLOBJ 3	Acquire knowledge of different sensors and Actuators.
CLOBJ 4	Get acquainted with 5 different PLC Programming Languages.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of timers and Counters.
CLOBJ 6	Study the use of SCADA.

f. **Course Learning Outcomes:**

CLO 1	Understand the generic architecture and constituent components of a Programmable Logic Controller.
CLO 2	Justify selection of appropriate PLC for a given application/industry.
CLO 3	Interface various industrial equipment's to PLC.
CLO 4	Write, compile, and debug PLC programs using different programming languages.
CLO 5	Understand the theoretical concept of SCADA and develop architecture of SCADA explaining each unit in detail.
CLO 6	Apply knowledge gained about PLCs and SCADA systems to design and control real time industrial applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Programmable logic controllers** Controllers, Hardware, Internal architecture, PLC systems. Input-output devices: Input devices, Output devices, Examples of applications	20%	7
2	**I/O processing** Input/output units, Signal conditioning, Remote connections, Networks Processing inputs, I/O addresses.	10%	5
3	**Ladder and functional block programming** Ladder diagrams, Logic functions, Latching, Multiple outputs, Entering programs, Function blocks.	10%	5
4	**IL, SFC and ST programming methods** Instruction lists, Sequential function charts, Structured text.	10%	5
5	**Internal relays** Internal relays, Ladder programs, Battery-backed relays, One-shot operation, Set and reset, Master control relay. Jump and call: Jump, Subroutines.	15%	7
6	**Timers & Counters** Timers: Types of timers, Programming timers, Off-delay timers, Pulse timers Counters: Forms of counter, Programming, Up and down counting, Timers with counters, Sequencer	15%	7
7	**SCADA** Definition of SCADA, Applicable Processes, Elements of SCADA System, A Limited Two-Way System. Real Time Systems: Communication Access and Master-Slave determining scan interval. Introduction to Remote Control, Communications- A/D Conversion, Long Distance Communication, Communication System components in brief-Protocol, Modems, Synchronous/Asynchronous telephone cable/radio, Half Duplex, Full Duplex System, Brief introduction to RTU and MTU, Applications- Automatic Control, Advisory Applications.	20%	9

i. Text Book and Reference Book:

1. Programmable Logic Controllers by (TextBook) By W. Bolton Newness (an imprint of

Elsevier) 5th
2. Programmable Logic Controllers by Frank D. Petruzella McGraw-Hill Book Company
3. Programmable Controllers, Theory and Implementation by L. A. Bryan, E. A. Bryan Industrial Text Company 2nd
4. Programmable Logic Controllers by John w. Webb and Ronald A. Reis | PH
5. Programmable Logic Controllers by Simpson, Colin | Englewood Cliffs NJ PHI
6. Introduction to Programmable Logic Controllers by Gray Dunning | Delmar Thompson Learning
7. Supervisors Control and Data Acquisition (TextBook) by Stuart A. Boyer | ISA

a. **Course Name:** PLC & SCADA Lab
b. **Course Code:** 303107338
c. **Prerequisite:** Digital electronics fundamentals, programming languages like C, C++, and Instrumentation.
d. **Rationale:** : In the era of automation, an engineering graduate, employed in automated process controls/power stations will be required to know the basic of programmable logic controllers, their working and their programming. Existence of abundant applications of PLC & SCADA in industrial and other domains justifies its usefulness in the present curriculum. This course aims to provide fundamental knowledge of PLC & SCADA. In addition, covers aspect of appropriate selection of PLC & SCADA for specific industry/applications as well as explores various programming languages used for PLC programming to make students readily available for industry use.
e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with the Major Components of PLC.
CLOBJ 2	Selection of PLC for specific/general applications.
CLOBJ 3	Acquire knowledge of different sensors and Actuators.
CLOBJ 4	Get acquainted with 5 different PLC Programming Languages.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of timers and Counters.
CLOBJ 6	Study the use of SCADA.

f. **Course Learning Outcomes:**

CLO 1	Understand the generic architecture and constituent components of a Programmable Logic Controller.
CLO 2	Justify selection of appropriate PLC for a given application/industry.
CLO 3	Interface various industrial equipment's to PLC.
CLO 4	Write, compile, and debug PLC programs using different programming languages.
CLO 5	Understand the theoretical concept of SCADA and develop architecture of SCADA explaining each unit in detail.
CLO 6	Apply knowledge gained about PLCs and SCADA systems to design and control

	real time industrial applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to Programmable logic controllers (PLC).		
2	PLC Program to implement various digital logic Gates using Ladder Logic Diagram.		
3	PLC Program to implement Various Boolean Functions without don't care condition using Ladder Logic Diagram.		
4	PLC Program to implement Various Boolean Functions with don't care condition using Ladder Logic Diagram.		
5	PLC Program to implement a Binary to Gray Code Conversion.		
6	PLC program to implement a 8:1 Multiplexer using Ladder Logic Diagram.		
7	PLC program to implement a 1:8 DE multiplexer using Ladder Logic Diagram.		
8	PLC program to maintain the Capacity of an Auditorium using Ladder Logic Diagram.		
9	PLC program to implement a Car Parking System using Ladder Logic Diagram.		
10	PLC program to implement a DOL Starter using Ladder Logic Diagram.		

i. Text Book and Reference Book:

1. Programmable Logic Controllers by (Text Book) By W. Bolton Newness (an imprint of Elsevier) 5th
2. Programmable Logic Controllers by Frank D. Petruzella McGraw-Hill Book Company
3. Programmable Controllers, Theory and Implementation by L. A. Bryan, E. A. Bryan Industrial Text Company 2nd
4. Programmable Logic Controllers by John w. Webb and Ronald A. Reis | PH
5. Programmable Logic Controllers by Simpson, Colin | Englewood Cliffs NJ PHI
6. Introduction to Programmable Logic Controllers by Gray Dunning | Delmar Thompson Learning
7. Supervisors Control and Data Acquisition (Text Book) by Stuart A. Boyer | ISA

Semester 6

a. **Course Name:** VLSI
b. **Course Code:** 303107351
c. **Prerequisite:** Basic knowledge of Analog & Digital Electronics circuits
d. **Rationale:** This course will provide an opportunity to the students to learn about various topics VLSI such as MOSFET fabrication, its physics, and analysis as well as design of digital circuits using MOSFET device.

e. **Course Learning Objective:**

CLOBJ 1	Gain a comprehensive understanding of the basic principles and concepts of Very Large Scale Integration (VLSI) design, transistor level operation, logic gates, and digital circuits.
CLOBJ 2	MOSFET basics, principles of MOSFET and structure, physics of charge carries of MOSFET, step by step process flow, layout design.
CLOBJ 3	MOS transistor structures, including the gates, source, and drain regions, understanding the principles of operation, including threshold voltage and inversion.
CLOBJ 4	Describe the structures of MOS inverters, including NMOS and PMOS transistors, DC characteristics, and noise margins.
CLOBJ 5	Combinational and sequential MOS logic circuits, SR latch circuit, CMOS D-Latch and Edge- triggered flip flop.
CLOBJ 6	Increment circuits, shift registers, simulation , Layout.

f. **Course Learning Outcomes:**

CLO 1	Explain fabrication of MOSFET based circuits.
CLO 2	Describe working of MOSFET and its mathematical model
CLO 3	Analyze, design, and simulate various MOSFET based inverter circuits.
CLO 4	Realize and size given logic function using MOSFETs
CLO 5	Analyze, design, and simulate Dynamic CMOS circuits
CLO 6	Draw and simulate various transient characteristics of MOS using Microwind software.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	

3	**0**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology. Introduction of GPGA and CPLD.	**10%**	**4**
2	**Fabrication of MOSFET:** Introduction, Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.	**8%**	**4**
3	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small- geometry effects, MOSFET capacitances.	**20%**	**9**
4	**MOS Inverters: Static Characteristics and Switching characteristics** Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement and Depletion type MOSFET load), Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters, CMOS Inverter.	**35%**	**15**
5	**Combinational and Sequential MOS Logic Circuit:** Introduction, MOS logic circuits with Depletion N-MOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs). Behaviour of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop.	**20%**	**9**
6	**Design example using CMOS:** Increment/decrement circuits, left/right shift serial/parallel register, comparator for two n-bit number, a two-phase non-overlapping clock generator with buffered output on both phases.	**7%**	**4**

i. Text Book and Reference Book:

6. CMOS Digital Integrated circuits -Analysis and Design By Sung -Mo Kang, Yusuf Leblebici TATA McGraw-Hill Pub. Company Ltd.
7. Introduction to VLSI Systems By Mead C and Conway Addison Wesley

8. Principles of CMOS VLSI Design By Neil H.E. Weste and Kamran Eshraghian Pearson
9. Basic VLSI Design By Pucknell and Eshraghian PHI 3

a. **Course Name:** VLSI Lab
b. **Course Code:** 303107352
c. **Prerequisite:** Basic knowledge of Analog & Digital Electronics circuits
d. **Rationale:** This course will provide an opportunity to the students to learn about various topics VLSI such as MOSFET fabrication, its physics, and analysis as well as design of digital circuits using MOSFET device.

e. **Course Learning Objective:**

CLOBJ 1	Gain a comprehensive understanding of the basic principles and concepts of Very Large Scale Integration (VLSI) design, transistor level operation, logic gates, and digital circuits.
CLOBJ 2	MOSFET basics, principles of MOSFET and structure, physics of charge carries of MOSFET, step by step process flow, layout design.
CLOBJ 3	MOS transistor structures, including the gates, source, and drain regions, understanding the principles of operation, including threshold voltage and inversion.
CLOBJ 4	Describe the structures of MOS inverters, including NMOS and PMOS transistors, DC characteristics, and noise margins.
CLOBJ 5	Combinational and sequential MOS logic circuits, SR latch circuit, CMOS D-Latch and Edge- triggered flip flop.
CLOBJ 6	Increment circuits, shift registers, simulation , Layout.

f. **Course Learning Outcomes:**

CLO 1	Explain fabrication of MOSFET based circuits.
CLO 2	Describe working of MOSFET and its mathematical model
CLO 3	Analyze, design, and simulate various MOSFET based inverter circuits.
CLO 4	Realize and size given logic function using MOSFETs
CLO 5	Analyze, design, and simulate Dynamic CMOS circuits
CLO 6	Draw and simulate various transient characteristics of MOS using Microwind software.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
-	0	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction of VHDL.		
2	Introduction of Xilinx ISE with examples of basic gates.		
3	Implementation of All Universal Gates using Xilinx ISE design suit		
4	Implementation of Half Adder and Half Subtractor using Xilinx ISE design suit.		
5	Implementation of Full Adder and Full Subtractor using Xilinx ISE design suit.		
6	Implementation of multiplexer using Xilinx ISE design suit.		
7	Implementation of demultiplexer using Xilinx ISE design suit**.**		
8	Implementation of D-Flipflop and T- Flip flop using Xilinx ISE design suit**.**		
9	Introduction to Back-end Design Tools – Microwind / Hspice.		
10	Draw a layout of Resistive Load Inverter & CMOS Inverter using CMOS 0.12um technology and simulate its transient characteristics**.**		

i. Text Book and Reference Book:

1. CMOS Digital Integrated circuits -Analysis and Design By Sung -Mo Kang, Yusuf Leblebici | TATA McGraw-Hill Pub. Company Ltd.
2. Introduction to VLSI Systems By Mead C and Conway | Addison Wesley
3. Principles of CMOS VLSI Design By Neil H.E. Weste and Kamran Eshraghian | Pearson
4. Basic VLSI Design By Pucknell and Eshraghian PHI 3

a. Course Name: Computer Network

b. Course Code: 303107353

c. Prerequisite: Basic knowledge of Computer languages.

d. Rationale: Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities.

e. Course Learning Objective:

CLOBJ 1	Gain a comprehensive understanding of networking principles and ideas.
CLOBJ 2	Create a network tailored to a specific application.
CLOBJ 3	Assess the network's operational efficiency and effectiveness.

f. Course Learning Outcomes:

CLO 1	Understand the concepts of networking thoroughly.
CLO 2	Design a network for a particular application
CLO 3	Analyze the performance of the network.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.	22%	10
2	**Switching in networks** Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Spacedivision switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing.	33%	15
3	**Transport layer** Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call	20%	9
4	**Congestion Control and Resource Allocation** Issues in Resource Allocation, Queuing Disciplines, TCP	15%	7

	congestion Control, Congestion Avoidance Mechanisms and Quality of Service.		
5	**Network layer** Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing, Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches	**10%**	**4**

i. Text Book and Reference Book:

1. "Computer Networking – A top down approach featuring the Internet" By J.F. Kurose and K. W. Ross | Pearson Education | 5th Edition.
2. "Computer Networks – A Systems Approach" By L. Peterson and B. Davie | Elsevier Morgan Kaufmann Publisher | 5th Edition
3. "Telecommunication Switching System and Networks", By T. Viswanathan | Prentice Hall
4. "An Engineering Approach to Computer Networking" By S. Keshav | Pearson Education
5. "Data Communications and Networking" By B. A. Forouzan | Tata McGraw Hill | 4th Edition.
6. "Computer networks" By Andrew Tanenbaum | Prentice Hall
7. "Computer Networks and Internet/TCP-IP" By D. Comer | Prentice Hall
8. "Data and computer communications", By William Stallings | Prentice Hall

a. Course Name: Computer Network Lab

b. Course Code: 303107354

c. Prerequisite: Basic knowledge of Computer languages.

d. Rationale: Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities.

e. Course Learning Objective:

CLOBJ 1	Gain a comprehensive understanding of networking principles and ideas.
CLOBJ 2	Create a network tailored to a specific application.
CLOBJ 3	Assess the network's operational efficiency and effectiveness.

f. Course Learning Outcomes:

CLO 1	Understand the concepts of networking thoroughly.
CLO 2	Design a network for a particular application
CLO 3	Analyze the performance of the network.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	

-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to WIRESHARK		
2	Generate DNS traffic and trace packets using wireshark.		
3	Generate HTTP traffic, trace packets using wireshark.		
4	Connect the computers in Local Area Network.		
5	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.		
6	Install and configure Network Devices: HUB, Switch and Routers.		
7	Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).		
8	To study and execute Network Commands.		
9	Create a network using CISCO packet tracer.		
10	Configure a Network using Distance Vector Routing protocol.		
11	Configure Network using Link State Vector Routing protocol.		
12	Implementation of Parity checker. Write a CRC code and verify it using C		
13	Implementation of Character stuffing and DE stuffing.		
14	Introduction to NS3.		
15	Creating point to point module using NS3.		

i. Text Book and Reference Book:

1. "Computer Networking – A top down approach featuring the Internet" By J.F. Kurose and K. W. Ross | Pearson Education | 5th Edition.
2. "Computer Networks – A Systems Approach" By L. Peterson and B. Davie | Elsevier Morgan Kaufmann Publisher | 5th Edition
3. "Telecommunication Switching System and Networks", By T. Viswanathan | Prentice Hall
4. "An Engineering Approach to Computer Networking" By S. Keshav | Pearson Education
5. "Data Communications and Networking" By B. A. Forouzan | Tata McGraw Hill | 4th Edition.
6. "Computer networks" By Andrew Tanenbaum | Prentice Hall
7. "Computer Networks and Internet/TCP-IP" By D. Comer | Prentice Hall
8. "Data and computer communications", By William Stallings | Prentice Hal

a. **Course Name:** Electronic Measurement Lab
b. **Course Code:** 203107358
c. **Prerequisite:** Basic knowledge of sensors and Transducers
d. **Rationale:** Explain basic concepts and definitions in measurement. Describe the bridge configurations and their applications. Elaborate discussion about the importance of signal generators and analyzers in Measurement.
e. **Course Learning Objective:**

CLOBJ 1	Learn to measure DC and AC voltages and currents accurately using multimeters and oscilloscopes. Understand the principles behind voltage and current measurements.
CLOBJ 2	Learn how to achieve accurate and precise measurements, considering factors such as instrument limitations, calibration, and error analysis.
CLOBJ 3	Explore the sources of measurement uncertainty and errors associated with different devices and learn techniques to minimize and quantify them. Identify and understand the limitations of measurement instruments, including factors such as environmental conditions, instrument drift, and measurement interference.
CLOBJ 4	Comprehend the basic principles and components of data acquisition systems, including sensors, transducers, signal conditioning, and data converters.

f. **Course Learning Outcomes:**

CLO 1	Design and validate DC and AC bridges.
CLO 2	Analyze the dynamic response and the calibration of few instruments.
CLO 3	Learn about various measurement devices, their characteristics, their operation and their limitations.
CLO 4	Understand computerized data acquisition.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**60**	**-**	**40**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

a. **Course Name:** Electronics Design Lab
b. **Course Code:** 203107360
c. **Prerequisite:** Basic design tasks involved in a particular role or project.

d. **Rationale:** the electronics design lab is a fundamental component of an engineering curriculum, providing a practical and immersive learning experience. It not only reinforces theoretical knowledge but also equips students with the skills and mindset needed for successful careers in electronics and engineering.

e. **Course Learning Objective:**

CLOBJ 1	Develop a basic understanding of microcontrollers, including architecture, input/output ports, and programming concepts.
CLOBJ 2	Develop a comprehensive understanding of advanced measurement instruments commonly used in the field, such as oscilloscopes, spectrum analyzers, network analyzers, and signal generators.
CLOBJ 3	Define and understand the basic principles of PCB design, including layer stackup, component placement, and routing.
CLOBJ 4	Gain a deep understanding of the specific application for which the electronics-based system is being designed, including the requirements, constraints, and user needs.

f. **Course Learning Outcomes:**

CLO 1	Interface various sensors to microcontroller
CLO 2	Use and understand the advance features of measurement instruments
CLO 3	Make the layout of PCB
CLO 4	Design the application oriented small electronics based systems

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**2**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

Semester - 7

a. **Course Name:** Antenna and Propagation/ Antenna and Propagation Lab
b. **Course Code:** 303107427/303107428
c. **Prerequisite:** Basic knowledge of Electromagnetic Theory, Engineering Mathematics
d. **Rationale:** UG Students of EC Engineering need to possess good understanding of the fundamentals and applications of Antenna and wave propagation, including radiation from point sources as applied to antenna, antenna types and their radiation patterns. They are expected to be able to design different antennas for specific given frequency and application. They will be practiced in study of antenna radiation patterns and in measurement of different antenna parameters. They will be able to design and analyze some basic antennas in hardware and application specific antenna in HFSS or CST.

e. **Course Learning Objective:**

CLOBJ 1	To gain knowledge about fundamental concepts and various parameters of the Antenna.
CLOBJ 2	To study the mathematics and functioning of antenna as a point source of radiation and method of multiplication to design an array of antennas
CLOBJ 3	To learn about different types of feeding mechanisms, geometry of antenna. To know about the field zones and radiation patterns of an antenna
CLOBJ 4	To study about different types of antennas like, horn, lens, microstrip patch, reflector antenna.
CLOBJ 5	To gain knowledge about radio wave propagation and characteristics of waves. To get familiar with different modes and factors affecting the propagation
CLOBJ 6	To design and simulate different types of antenna according to the application.

f. **Course Learning Outcomes:**

CLO 1	Understand the basic principles and radiation mechanism of antenna.
CLO 2	Able to understand important classes of antennas and their properties.
CLO 3	Provide an overview of the fundamental characteristics and parameters of antennas.
CLO 4	Design and analyze wire and aperture antennas, and antenna arrays.
CLO 5	Identify the characteristics of radio-wave propagation.
CLO 6	Able to design and simulate upcoming antenna

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	**Basic antenna concepts and radiation from dipole** Definition and functions of an antenna, comparison between an antenna & transmission line, radiation patterns of antennas-field and power patterns, all antenna types. Application to antennas, Radiation from quarter wave monopole and half wave dipoles, Derivation for radiation resistance, application of reciprocity theorem to antennas, equality of directional patterns and effective lengths of transmitting and receiving antennas, directional properties of dipole antennas, antenna feeding methods.	10	3
2	**Antenna parameters and definitions** Beam area, Beam width- Half-Power Beam width (HPBW) and First Null Beam width (FNBW), Polarization, Radiation Intensity, Beam Efficiency, Directivity and Directive Gain, Radiation resistance, Radiation Efficiency, Resolution, Antenna aperture-physical and effective apertures, effective height, Transmission formula, antenna field zones. Transmission loss as a function of frequency. Antenna temperature and signal to noise ratio.	13	6
3	**Arrays of point sources** Expression for electric fields from two, three and N element arrays- linear arrays: Broad-side array and End-Fire array-Method of pattern multiplication- Binomial array-Horizontal and Vertical Antennas above the ground plane, Effect of ground on ungrounded antenna, Schelkunoff theorems for linear arrays, Dolph-Tchebysheff distribution for linear arrays.	12	5
4	**Arrays of dipoles & apertures** 3 element dipole Array with parasitic elements, Yagi-Uda array-function and its design, Phased arrays, frequency scanning arrays, smart antennas, long wire antennas, location methods of feeding antennas, folded dipole antennas, matching arrangements.	11	4
5	**Loop Antenna:** Small loop short magnetic dipole, comparison of far field of small	8	4

	loop and short dipole loop antennas, field pattern of circular loop antenna & radiation resistance of loop antenna, directivity of circular loop antennas with uniform current.		
6	**Helical antenna** Helical geometry, transmission radiation modes, practical design considerations, wide band characteristics of helical antenna.	**5**	**2**
7	**Reflector antennas** Parabolic reflector, paraboloidal reflector, aperture Pattern of large circular apertures with uniform illumination, off axis operation of paraboloidal reflectors, Cassegrain feed system	**8**	**4**
8	**Lens Antenna** Non-metallic Dielectric lens and artificial dielectric lens antennas, reflector lens antennas	**6**	**3**
9	**Micro-strip (patch) antennas** Rectangular and circular types-function, features analysis, design considerations and applications	**6**	**3**
10	**Slot patch & Horn antennas** Slot antenna, its pattern, Babinet's principle and complementary antennas, impedance of slot antennas, and horn antenna-function and types	**6**	**3**
11	**Broadband & Freq. Independent antennas** Broadband antenna, Frequency independent antenna, log periodic antennas	**5**	**3**
12	**Radio wave propagation** Modes of propagation, Ground Wave Propagation, Structure of troposphere and ionosphere, Characteristic of ionosphere layers, Sky wave propagation, Definitions for Virtual height, MUF and Skip distance, OWF, Fading, ionospheric absorptions, Multi-hop propagation, Space wave propagation and Super refraction	**10**	**5**

j. Text Book and Reference Book:

1. Antennas for all applications (Text Book); By J.D. Krauss | (TMH) | 3rd
2. Antenna & Wave Propagation (Text Book); By K.D. Prasad | Satyaprakash Publications
3. Antenna Theory, Analysis and design; By Balanis C A | Willey
4. Antenna & Wave Propagation; By G.S.N. Raju | Pearson Education

a. **Course Name:** Mobile Communication Networks/ Mobile Communication Networks Lab
b. **Course Code:**303107421/303107422
c. **Prerequisite:** It is desirable that student is familiar with following domains: Digital and analog Communication, Signals & Systems, Electromagnetic Theory, Probability & Random Processes.
d. **Rationale:** The course will provide fundamental about many theoretical & practical concepts that form the basis for wireless communication systems and Networks. Also, the emphasis is given for creating foundation of cellular concepts which will be useful for understanding the fundamentals of cellular mobile communication systems design. The students will learn Mobile Radio Propagation models and various wireless channel effects. Student will understand Multiple Access techniques. Students will also be exposed to recent emerging trends in wireless communication like Software Defined Radio as well. The course also covers overview of recent

trends like wireless communication like Wi-Fi, Wi-MAX, bee, UWB Radio and Wireless Adhoc Networks.

e. **Course Learning Objective:**

CLOBJ 1	To know the evolution of Mobile communication and cell concept to improve capacity of the system.
CLOBJ 2	To know the fading mechanism and types of fading and effect of fading on Mobile communication.
CLOBJ 3	To know the types of channel coding techniques, data transmission modes and services of GSM.
CLOBJ 4	To know the types of channel coding techniques, data transmission modes and services of CDMA.

f. **Course Learning Outcomes:**

CLO 1	Understand the working principles of the mobile communication systems
CLO 2	Understand the relation between the user features and underlying technology.
CLO 3	Analyze mobile communication systems for improved performance
CLO 4	Gain knowledge of underlying mobile standards and the future mobile technologies such as W-CDMA, Wi-Max, and also the upcoming 4G and 5G mobile standards.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Cellular concepts** Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control;	10%	5

	Wireless Standards: Overview of 2G and 3G cellular standards.		
2	**Signal propagation-Propagation mechanism** Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.	25%	12
3	**Channel Capacity** Capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal monopole antennas, PIFA, base Weightage Teaching station antennas and arrays.	15 %	8
4	**Multiple access schemes** FDMA, TDMA, CDMA and SDMA. Modulation schemes-BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.	15%	5
5	**Mobile Transmitter and Receiver** Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme	20%	10
6	**MIMO and space time signal processing** Spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average SNR, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.	15%	5

i. **Text Book and Reference Book:**

1. Wireless Communication By T.S.Rappaport, Pearson Edu.
2. MIMO Wireless Communications By Ezio Biglieri, Cambridge University Press
3. OFDM for Multimedia Communications By Richard Van Nee & Ramjee Prasad Artech House Publication

a. Course Name: Embedded system

b. Course Code: 203107429

c. Prerequisite: Basic knowledge of Microcontroller, microprocessor and memories.

d. Rationale: To provide an overview of Design Principles of Embedded System and clear understanding about the role of firmware, operating systems in correlation with hardware systems.

e. Course Learning Objective:

CLOBJ 1	To design approach using advanced controllers to real-life situations
CLOBJ 2	To do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
CLOBJ 3	To design interfacing of the systems with other data handling / processing systems

CLOBJ 4	To understand Real time operating systems and design real time applications.

f. Course Learning Outcomes:

CLO 1	Able to Suggest design approach using advanced controllers to real-life situations
CLO 2	Able to Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
CLO 3	Able to Design interfacing of the systems with other data handling / processing systems
CLO 4	Able to Understand Real time operating systems and design real time applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
0	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topic	Weightage	Teaching Hrs.
1.	**Introduction:** Embedded system, embedded hardware units and devices in asystem, Introduction to embedded system design and architecture, embedded memories	15%	5
2.	**Technological aspects of embedded systems:** A/D and D/A converters, accuracy, resolution, precision and reproducibility or repeatability transducers, DAS Design, analysis of thermal noise.	25%	12

3.	**Real Time Operating Systems:** Multiple process in an application, multiple threads in an application, tasks and thread states, Task and Data, concept of semaphores, disabling and enabling functions, pipe and socket functions introduction of RTOS, basic design using RTOS.	**30%**	**14**
4.	**Basic function of Operating system:** Operating system services, Process management, timer and event functions, memory management, device, file and I/O subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, OS security issues, RTOS interrupt latency and response times of the tasks as performance metrics.	**30%**	**14**

i. Text Book and Reference Book:

1. J. W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000
2. Rajkamal, “Embedded Systems architecture, programming and design” Third edition, Mc Graw Hill eduction,2015
3. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.

Semester 8

a. **Course Name:** Internet of Things/ Internet of Things Lab
b. **Course Code:** 303107463/303107464
c. **Prerequisite:** Fundamentals of computer network, Wireless Communication, communication & internet technology, web technology, information security.
d. **Rationale:** The explosive growth of the "Internet of Things" is changing our world. IoT components are allowing people to innovate new designs and products at home. In this course students will learn the importance of IoT in society, the current components of typical IoT devices and trends for the future. This course will make students understand Hardware and software component for IoT. This course is also cover components of the networking and how to connect devices with internet.
e. **Course Learning Objective:**

CLOBJ 1	Understand the term "Internet of Things".
CLOBJ 2	Gain the knowledge of the technological trends which have led to IoT
CLOBJ 3	study the impact of IoT on society
CLOBJ 4	understanding the interactions of Things with the physical world
CLOBJ 5	Gain the knowledge of software and hardware in an IoT device.
CLOBJ 6	Study an application of IoT.

f. **Course Learning Outcomes:**

CLO 1	Define the term "Internet of Things".
CLO 2	State the technological trends which have led to IoT
CLO 3	Describe the impact of IoT on society
CLO 4	Describe the interactions of Things with the physical world
CLO 5	Describe the interaction between software and hardware in an IoT device.
CLO 6	Understand the application of IoT.

g. **Teaching & Examination Scheme:**

1. 203107463 **-** Internet of Things

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

2. 203107464 **-** Internet of Things Lab

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
	-	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Internet of Things (IoT)** Introduction to IoT, The Internet of Things Today, Internet of Things Vision, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technology- Embedded System, Wireless Sensor Networks, Communication Protocols , Big Data analysis, Cloud Computing, Case Study of Refrigerator, IoT Devices, IoT Devices.	**15%**	**7**
2	**IoT and M2M (Machine-to-Machine)** Introduction, Machine-to-Machine communication, Difference between IoT and MNetworking and Network Function Virtualization, Mstructure for IoT, The international driven global value chain and global information monopolies. MArchitectural Overview.	**15%**	**7**
3	**IoT Architecture** Introduction, Architecture Reference Model, IoT Design Methodology- Purpose and Requirement Specification, Process Specification, Domain Model Specification, Functional View, Information View, Deployment and Operational View, Device and Component Integration, Other Relevant architectural views, Application Development.	**15%**	**7**
4	**Hardware and Software** **Arduino Board :** Arduino Platform, Arduino IDE, Compiling Code, Arduino Shields, Arduino Basic Setup & Interface, **Sensor Technology:** Light Sensor, Temperature Sensor, Sound Sensor, Touch Sensor, Smoke/ Gas Sensor, Smart Relay, Motion Sensor, IR Sensor, Flex Sensor. **Raspberry Pi:** About the board, Raspberry Pi Interfaces, Serial, SPI, Programming Raspberry Pi, Controlling LED with Raspberry Pi, Interfacing Switch, Light sensor (LDR) with Raspberry Pi.	**20%**	**9**
5	**IoT Applications** Introduction, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Opinions on IoT Application and Value for Industry, Home Automation, Environment, Energy, Health and Lifestyle, Retail & Logistics, Agriculture, Case Studies : Smart Cities	**20%**	**8**
6	**Internet of Things Privacy, Security and Governance** **Introduction,** Overview of Governance, Privacy and Security Issues, Contribution from FPand Trust in IoTData- Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	**15%**	**7**

i. Text Book and Reference Book:

1. "Internet of Things (A Hands-on-Approach) By Vijay Madisetti and Arshdeep Bahga, | VPT

2. Arduino Cookbook By Michael Margolis | Shroff/O'Reilly
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting EverythingBy Francis daCosta, | Apress Publications
4. Getting Started with the Internet of Things By Cuno Pfister, | O"Reilly Media

a. Course Name: Spread Spectrum Techniques
b. Course Code: 303107485
c. Prerequisite: Basic Concepts of Wireless Communications
d. Rationale: Recent Trends in Modern Wireless Communication Engineering subject deals with the latest technology in wireless communication and the goal of subject is to inspire them for further research for current and next generation wireless communication technology.
e. Course Learning Objective:

CLOBJ 1	Understand the different spread-spectrum techniques and application of various techniques
CLOBJ 2	Familiar with PN sequences and generation of pseudo random sequences
CLOBJ 3	Demonstrate a Broadband Spread Spectrum
CLOBJ 4	Study about different multiple access techniques and its application.
CLOBJ 5	Apply the knowledge of the modulation techniques in real environment.

f. Course Learning Outcomes:

CLO 1	Demonstrate their understanding on functioning of a spread-spectrum system and minimize the design challenges.
CLO 2	Have an ability to demonstrate several pseudo random sequences and its applications.
CLO 3	To design a broadband spread –spectrum under in Jamming Environments.
CLO 4	Demonstrate an ability to explain various multiple access techniques.
CLO 5	Have an ability to provide practical solutions and apply the subject expertise for the welfare of the society.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	0	3	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**INTRODUCTION** Spread Spectrum Modulation (SSM) Concepts, Advantages- Disadvantages, Averaging And Avoidance Type Systems, Concept of SSM Bandwidth From Shanon's Theorem And SNR	7%	3
2	**PSUEDO RANDOM CODES** Direct Sequence(DS) Or Pseudo Noise(PN) Codes And Generation, Aperiodic And Periodic Sequences, Maximum Length(ML) Sequences, Walsh-Hadamard Sequences, Gold Codes/Gold Sequences, Quadratic Residue Sequences (Q-R) Sequences, Hall Sequences, Twin Prime Sequences, Criteria To Select Code/Sequence	14%	6
3	**DIRECT SEQUENCE SPREAD SPECTRUM SYSTEM** General Block Diagram Of DSSS Transmitter And Receiver, Biphase And Quadriphase Modulation, Mathematics Associated With The System, PN Signal Characteristics, Spectral Density, Bandwidth And Processing Gain, Direct Sequence Spread Spectrum Receiver Considerations(Rake Receiver), Partial Correlation Of PN Sequences At The Rake Receiver, Cyclic Prefix In DSSS Frames, Signal Processing At The Rake Receiver, Characteristics Of DSSS Systems, Interference Rejection, Antijam Characteristics, Energy And Bandwidth Efficiency, Near-Far Problem And Power Control..	21%	10
4	**OTHER SPREAD SPECTRUM SYSTEMS** Frequency Hopping Spread Spectrum, Fast And Slow Frequency Hopping, Associated Mathematics, Time Hopping Spread Spectrum System, Hybrid Spread Spectrum System And Chirped Spread Spectrum.	12%	5
5	**BASIC PRINCIPLES OF OFDM** Orthogonality And Subcarrier Setting In The Spectrum, FDM Vs Orthogonal FDM, Single Carrier Systems, Data Transmission In A Multipath Enviroment By Single And Multicarrier Systems.	7%	3
6	**OFDM BLOCK DIAGRAM AND EXPLANATION** Scrambling Or Energy Dispersal, Convolutional Encoding, Puncturing, Interleaver, Serial To Parallel Conversion And Symbol Mapping, Modulation Of Data, Pilot Insertion, IFFT, Cyclic Prefix Insertion, Transmission Of OFDM Signal Over The Channel, RF Modulation, OFDM Signal Reception And Demodulation.	18%	8
7	**OFDM SIGNAL MATHEMATICAL REPRESENTATION** OFDM Frequency Domain Representation, OFDM Time Domain Representation, OFDM System Spectral Settings According to Lattice, Selection Parameters For Modulation, Pulse Shaping In OFDM Signal And Spectral Efficiency, Windowing In OFDM Signal And Spectral Efficiency.	14%	6
8	**VARIOUS ISSUES IN OFDM**	7%	4

	Timing Errors And Symbol Synchronization, Sampling Frequency Synchronization, Carrier Frequency, Synchronization, Pilot Insertion In OFDM Transmission And Channel Insertion, Channel Impulse Response Estimation Basics, Amplitude Limitations In OFDM, Peak To Average Power Ratio, Approaches To Remove The Amplitude Limitations, OFDM Vs CDMA, Flash OFDM, Vector OFDM, Wideband OFDM, Adaptive OFDM		

i. Text Book and Reference Book:

1. "Wireless Communication" By Dalal Upena | Oxford Press, 1st Ed., 2009
2. "Wideband Wireless Digital Communication" By Molisch Andreas, | Pearson LPE, | 1st Ed., 2001.
3. "Wireless Communications" By Muthu Chidambara Nathan P | PHI | 1st Ed., 2008.
4. "Theory And Applications Of OFDM and CDMA", By Schulze Henrik and Luders Christian, | Wiley | 1st Ed., 2005.
5. " Spread Spectrum Communication Handbook" By Simon M. K | McGraw-Hill | 1st Ed. 2001.

a. Course Name: Python for Hardware Programming

b. Course Code: 30310748

c. Prerequisite: Basic knowledge of programming languages

d. Rationale: Obtaining efficient algorithms is very important in modern computer engineering as the world wants applications to be time and space and energy efficient. This course enables to understand and analyze efficient algorithms for various applications.

e. Course Learning Objective: (Paraphrase)

CLOBJ 1	Acquire expertise in building applications utilizing the Python programming language.
CLOBJ 2	Gain knowledge of the diverse data structures offered by the Python programming language and employ them to address computational challenges.
CLOBJ 3	Connect an Arduino to a computer using the Firmata protocol with the assistance of Python
CLOBJ 4	Apply Python for different hardware implementations

f. Course Learning Outcomes:

CLO 1	Develop proficiency in creating applications using the Python Programming Language.
CLO 2	Understand the various data structures available in Python programming language and apply them in solving computational problems
CLO 3	Interface Arduino to a computer using the Firmata protocol and Python
CLO 4	Use python for various hardwires.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	0	3	20	20		60		100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction of python programming:** Why we use Python, Installing Python and Setup tools, Installing Python packages, The fundamentals of Python programming, Python operators and built-in types, Tuples, Sets, Dictionaries, Controlling the flow of program, Built-in functions (Conversions, Math operations, String operations,)	20%	9
2	**Working with the Firmata Protocol and the py Serial Library:** Introduction to Arduino (Why Arduino?, Arduino variants, The Arduino Uno board) , Getting started with the Arduino IDE, working with library, Connecting the Arduino board, Introducing the Firmata protocol, Uploading a Firmata sketch to the Arduino board, Testing the Firmata protocol, Installing pySerial, Playingwith a pySerial example, Bridging pySerial and Firmata	20%	9
3	**Programming the pi with python:** Introduction and installation of Pi, Linux, Desktop, internet resources for pi, command prompts, py programming for pi	20%	9
4	**Graphical Programming Multimedia:** Graphical User Interface (GUI) Programming, Adding Controls, Creating a Web Browser, Adding Window Menus, Using PyAudio to Get Sound into Your Computer, Recording the Sound, Using USB Webcams, Adding Computer Vision Features with OpenCV, Using the Raspberry Pi Camera Module	20%	9
5	**Project:** The First Project–Motion triggered LEDs , The software flow design, The hardware system design, The Python code, The second Project – controlling LED brightness using PWM, The software flow design, The hardware system design, The Python code	20%	9

i. Text Book and Reference Book:

1. Pratik Desai, python programming for Arduino, Kindle Edition, Packt Publishing (2015)
2. Simon Monk, Programming the raspberry Pi getting started with python, McGraw-Hill (2013)
3. Nicholas Ayden, Python programming, Kindle Edition, Packt Publishing

a. Course Name: Artificial Intelligence

b. Course Code: 303107471/303107472

c. Prerequisite: Strong Knowledge of Mathematics, Good knowledge of Programming knowledge, Strong Analytical skills, Ability to understand complex algorithms, Basic knowledge of Statistics and modelling

d. Rationale: Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution. This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defense, healthcare, agriculture and many other areas. This course will give the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence.

e. Course Learning Objective:

CLOBJ 1	Study the concepts of Artificial Intelligence
CLOBJ 2	Help the AI agents to attain the goal state through the assessment of scenarios and alternatives.
CLOBJ 3	Learn the knowledge representation techniques, reasoning techniques and planning.
CLOBJ 4	Learn the methods of solving problems using Artificial Intelligence
CLOBJ 5	Introduce the concepts of Machine Learning and Data Science
CLOBJ 6	Focus on evaluation of various algorithms and approaches for the given task, dataset, stage of the NLP product.

f. Course Learning Outcomes:

CLO 1	Understand the fundamentals: Gain a solid understanding of the fundamental concepts, techniques, and algorithms in AI.
CLO 2	Examine the useful search techniques, knowledge representation techniques, Inference methods; learn their advantages, disadvantages and comparison.
CLO 3	Familiar with Artificial Intelligence, its foundation and principles.
CLO 4	Solve AI problems through programming with Python
CLO 5	Learning optimization and inference algorithms for model learning

CLO 6	Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	0	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Definition of an AI, Major Areas of Artificial Intelligence, AI Techniques, History, AI problems, Production Systems, Problem characteristics, Intelligent Agents, Agent Architecture, AI Application (E-Commerce, & Medicine), AI Representation, Properties of internal representation, Future scope of AI, Issues in the design of search algorithms. Introduction to AI Problems and Applications, Defining Problems as a State Space Search, Problem Characteristics, Production Systems.	15%	6
2	**Search Algorithms** Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. Heuristic search, Hill Climbing, Best first search, mean and end analysis, Constraint Satisfaction, A* and AO* Algorithm, Knowledge Representation: Basic concepts, Knowledge representation Paradigms, Propositional Logic, Inference Rules in Propositional Logic, Knowledge representation using Predicate logic, Predicate Calculus, Predicate and arguments, ISA hierarchy, Frame notation, Resolution, Natural Deduction	15%	6
3	**Knowledge Representation** Knowledge Representation - Representation and Mappings, Different Approaches, Issues in knowledge representation. Predicate Logic - Representation Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution. Propositional Logic - Representation, Inference, Reasoning Patterns, Resolution, First-order Logic: Representation, Inference, Reasoning Patterns, Resolution	10%	5
4	**Markov Decision Process** MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs. Fuzzy Sets and Fuzzy Logic Fuzzy Set Operations, Membership Functions, Fuzzy Logic, Hedges, Fuzzy Proposition and Inference Rules, Fuzzy Systems.	25%	12

5	**Machine Learning and Data Science** Supervised & Unsupervised Machine Learning, Regression, Classification, Clustering approach, Pandas data manipulation, Exploratory Data Analytics, Feature Engineering, Evaluation mechanisms, Role of visualization in AI, Basics visualization types, Matplotlib &Seaborn in Python, Visual analytics in PowerBI & Excel.	**20%**	**9**
6	**Natural Language Processing** Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking, Stop words removal, Bag of words technique, TF-IDF analysis, spacy library	**15%**	**7**

i. Text Book and Reference Book:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig | Pearson Education | 3
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F Luger
3. A Classical Approach to Artifical Intelligence By Trivedi, M.C. | Khanna Publishing House, Delhi
4. Artificial Intelligence: A Systems Approach by Michael Negnevitsky.
5. Artificial Intelligence: By Elaine Rich and Kevin Knight | TMH
6. Artificial Intelligence: Foundations for Computational Agents By David Poole and Alan Mackworth | Cambridge University Press | 2010