G. PULLA REDDY ENGINEERING COLLEGE (Autonomous): KURNOOL

Accredited by NBA of AICTE and NAAC of UGC with A Grade

Affiliated to JNTUA, Anantapuramu

SCHEME – 2023

Scheme and Syllabus for V, VI, VII, VIII Semesters of

Four-year B. Tech. Degree Programme in

Electronics and Communication Engineering

FOUR YEAR B.TECH. DEGREE COURSE
Scheme of Instruction and Examination
(Effective for the students admitted from the academic year 2023-2024 onwards)

V Semester ECE **Scheme-2023**

S.No	Category	Title	L/D	T	P	Credits	CIA	End Exam Marks	Total Marks
1	PC	Analog and Digital IC Applications	3	0	0	3	30	70	100
2	PC	Antennas & Wave Propagation	3	0	0	3	30	70	100
3	PC	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
4	ES	Introduction to Quantum Technologies and Applications	3	0	0	3	30	70	100
5	PE	**Professional Elective-I** 1. Computer Architecture & organization 2. Information theory and coding 3 .Detection and Estimation Theory	3	0	0	3	30	70	100
6	OE	**Open Elective-I**	3	0	0	3	30	70	100
7	PC	Analog & Digital IC Applications Lab	0	0	3	1.5	30	70	100
8	PC	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	SEC	**Skill Enhancement Course -III** PCB Design and Prototype Development.	0	1	2	2	30	70	100
10	MC	Tinkering Lab	0	0	2	1	30	70	100
11		Evaluation of Community Service Internship	**0**	**0**	**0**	2	100	-	100
	Total		**18**	**1**	**10**	**26**			

VI Semester ECE **Scheme-2023**

S.No	Category	Title	L/D	T	P	Credits	CIA	End Exam Marks	Total Marks
1	PC	Digital Signal Processing	3	0	0	3	30	70	100
2	PC	Microwave and Optical Communications	3	0	0	3	30	70	100
3	PC	VLSI Design	3	0	0	3	30	70	100
4	PE	**Professional Elective-II** 1. Digital Image Processing 2. Artificial Intelligence & Machine learning 3. Wireless Communications	3	0	0	3	30	70	100
5	PE	**Professional Elective-III** 1. Electronic Measurements and instrumentation 2. Embedded Systems & IOT 3. Speech Processing	3	0	0	3	30	70	100
6	OE	**Open Elective-II**	3	0	0	3	30	70	100
7	PC	Microwave and Optical Communications Lab	0	0	3	1.5	30	70	100
8	PC	VLSI Design Lab	0	0	3	1.5	30	70	100
9	SEC	**Skill Enhancement course -IV** Machine Learning and DSP	0	1	2	2	30	70	100
10	AC	Technical Paper Writing & IPR	2	0	0	-	-	-	-
	Total		**20**	**1**	**08**	**23**			
Mandatory Industry Internship of 08 weeks duration during summer vacation									

FOUR YEAR B.TECH. DEGREE COURSE

Scheme of Instruction and Examination

(Effective for the students admitted from the academic year 2023-2024 onwards)

VII Semester ECE — Scheme-2023

S.No	Category	Title	L/D	T	P	Credits	CIA	End Exam Marks	Total Marks
1	PC	Data Communications and Networking	3	0	0	3	30	70	100
2	BS&H	**Management Course-II** 1. Entrepreneurship and Incubation 2. Management Science 3. Human Resource Management	2	0	0	2	30	70	100
3	PE	**Professional Elective-IV** 1. Low Power VLSI Design 2. Wireless Sensor Networks 3. Cellular & Mobile Communications	3	0	0	3	30	70	100
4	PE	**Professional Elective-V** 1. VLSI Signal Processing 2. DSP Processors & Architectures 3. 5G Communications	3	0	0	3	30	70	100
5	OE	**Open Elective-III**	3	0	0	3	30	70	100
6	OE	**Open Elective-IV**	3	0	0	3	30	70	100
7	SEC	**Skill Enhancement course - V** RF System Design tools / Industrial IoT & Automation	0	1	2	2	30	70	100
8	AC	**Audit Course** Gender Sensitization / Constitution of India	2	0	0	-	-	-	-
9		Evaluation of Industry Internship	0	0	0	2	100	-	100
	Total		**19**	**1**	**02**	**21**			

VIII Semester ECE — Scheme-2023

S.No	Category	Title	Credits	Scheme of instruction periods/week			Scheme of Examination Maximum Marks		
				L	T	P/D	End Exam Marks	CIA Marks	Total marks
1	PR	Project	8	-	-	16	70	30	100
2		Internship	4	-	-	8	-	100	100
	Total		**12**			**24**			

G. PULLA REDDY ENGINEERING COLLEGE (Autonomous): KURNOOL OPEN ELECTIVE COURSES

Open Elective – I

V- Semester **Scheme-23**

S.No.	Title	Offering Department	Eligible Branches
1	Green Buildings	CE	All Branches
2	Construction Technology and Management	CE	All Branches Except CE
3	Electrical Safety Practices and Standards	EEE	All Branches Except EEE
4	Sustainable Energy Technologies	ME	All Branches Except ME
5	Electronic Circuits	ECE	All Branches Except ECE
6	Java Programming	CSE	CE, EEE, ME and ECE
7	Foundations of Artificial Intelligence	CSE	CE, EEE and ECE
8	Ethical Hacking	CSE	All Branches
9	Mathematics for Machine Learning and AI	HBS	All Branches
10	Materials Characterization Techniques		
11	Chemistry of Energy Systems		
12	English for Competitive Examinations		
13	Entrepreneurship and New Venture Creation		

Open Elective-II

VI Semester **Scheme 2023**

S.No.	Title	Offering Department	Eligible Branches
1	Disaster Management	CE	All Branches
2	Sustainability In Engineering Practices	CE	All Branches
3	Renewable Energy Sources	EEE	All Branches Except EEE
4	Automation and Robotics	ME	All Branches Except ME
5	Product Life cycle Management	ME	All Branches Except CE
6	Digital Electronics	ECE	All Branches Except ECE
7	Foundations of Operating Systems	CSE	CE, EEE, ME and ECE
8	Foundations of Machine Learning	CSE	CE, EEE and ECE
9	Web Technologies	CSE	CE, EEE, ME and ECE
10	Introduction to Information Systems	CSE	CE, EEE, ME and ECE
11	Optimization Techniques	HBS	All Branches Except ME
12	Physics Of Electronic Materials And Devices	HBS	All Branches
13	Chemistry Of Polymers And Applications		
14	Academic Writing and Public Speaking		
15	Mathematical Foundation of Quantum Technologies		

Open Elective-III

VII Semester **Scheme 2023**

S.No.	Title	Offering Department	Eligible Branches
1	Building Materials and Services	CE	All Branches Except CE
2	Environmental Impact Assessment	CE	All Branches
3	Smart Grid Technologies	EEE	All Branches Except EEE
4	3DPrintingTechnologies	ME	All Branches Except ME
5	Composite Materials	ME	All Branches
6	Applications of Microprocessors and Microcontrollers	ECE	All Branches Except EEE and ECE
7	Introduction to Database Systems	CSE	CE, EEE, ME and ECE
8	Cyber Security	CSE	CE, EEE, ME and ECE
9	Modern C++	CSE	All Branches
10	Wavelet transforms and its Applications	HBS HBS HBS HBS HBS	All Branches
11	Smart Materials And Devices		
12	Green Chemistry And Catalysis For Sustainable		
13	Employability Skills		
14	Introduction to Quantum Mechanics		

Open Elective-IV

VII Semester **Scheme 2023**

S.No.	Title	Offering Department	Eligible Branches
1	Geo-Spatial Technologies	CE	All Branches Except CE
2	Solid Waste Management	CE	All Branches
3	Electric Vehicles	EEE	All Branches Except EEE
4	Total Quality Management	ME	All Branches Except ME
5	Safety in Engineering Industry	ME	All Branches
6	Transducers and Sensors	ECE	All Branches Except ECE
7	Drone Technology	ECE	All Branches
8	Introduction to Computer Networks	CSE	CE, EEE, ME and ECE
9	Internet of Things	CSE	CE, EEE, ME and ECE
10	Multimedia & Animation	CSE	All Branches
11	Advanced Information Systems	CSE	CE, EEE, ME and ECE
12	Quantum Computing	CSE	All Branches
13	Financial Mathematics	HBS HBS HBS HBS	All Branches
14	Sensors and Actuators for Engineering Applications		
15	Chemistry of Nano materials and Applications		
16	Literary Vibes		

Note: MOOC courses from SWAYAM portal shall be offered as Open Electives

Note:

1. A student is permitted to register for Honors or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester Pertaining to their Minor from V Semester onwards.

2. A student shall not be permitted to take courses as Open Electives/Minor/Honors with content substantially equivalent to the courses pursued in the student's primary major.

3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

ANALOG AND DIGITAL IC APPLICATIONS (ADICA)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC301	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the classification of Integrated Circuits, internal blocks and characteristics of Op-Amp.

CO2: Analyze linear and non-linear applications of Op-Amp.

CO3: Gain knowledge on active filters, timers and phased locked loops.

CO4: Evaluate the operation of Voltage Regulators and Converters.

CO5: Design various application based digital circuits using Digital ICs.

UNIT – I

Integrated Circuits and Operational Amplifier: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Features of 741 Op-Amp.

UNIT – II

Linear Applications of Op-Amp: Inverting, non-inverting, Differential amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

Non-Linear Applications of Op-Amp: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multi vibrators, Triangular and Square waveform generators, Oscillators

UNIT – III

Active Filters: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

Timer and Phase Locked Loops: Introduction to IC 555 timer, description of functional diagram, monostable and a stable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

UNIT – IV

Voltage Regulator: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

D to A and A to D Converters: Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT – V

CMOS Logic: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

Combinational Logic IC's: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers,

Parallel Binary Adder/ Subtractor, Magnitude Comparators.

Sequential Logic IC's: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Textbooks:

1. D. Roy Choudhury, Shail B. Jain, ―Linear Integrated Circuit‖, 4th edition (2012), New Age international Pvt.Ltd., New Delhi, India.
2. Floyd, Jain, ―Digital Fundamentals‖, 8th edition (2009), Pearson Education, New Delhi.

References:

1. Ramakant A. Gayakwad, ―OP-AMP and Linear Integrated Circuits‖, 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
2. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
3. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.
4. R.P.Jain, Modern Digital Electronics, TMH, 3/e, 2003.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ANTENNAS AND WAVE PROPAGATION (AWP)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC302	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the fundamental principles of antenna radiation mechanisms for single wire, two-wire, and dipole configurations.

CO2: Analyze HF, VHF & UHF antennas, their operation and applications.

CO3: Analyze the working and applications of Microwave antennas.

CO4: Apply different techniques involved in the design of antenna arrays and antenna parameter measurements..

CO5: Analyze the various types of radio wave propagation methods.

UNIT – I

Antenna Basics & Dipole antennas: Definition of antenna, Radiation Mechanism – single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Antenna Theorems. Radiation – Basic Maxwell's equations, Retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.

UNIT – II

HF, VHF and UHF Antennas: Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics. Log periodic Antenna, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Illustrative Problems.

UNIT – III

Microwave Antennas : Microstrip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameters on characteristics, reflector antennas - Introduction, Flat sheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types - Related Features, Lens Antennas - Geometry of Non-metallic Dielectric Lenses, Zoning , Tolerances, Applications, Illustrative Problems.

UNIT – IV

Antenna Arrays: Point sources - Definition, Patterns, arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSAa with Non-uniform Amplitude Distributions - General considerations and Bionomial Arrays, Illustrative problems. Antenna Measurements: Introduction, Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT – V
Wave Propagation: Introduction, Definitions, Characterizations and general classifications, different modes of wave propagation, Ray/Mode concepts, Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections, Space wave propagation - Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations, Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges, Illustrative problems
Textbooks:
1. John D. Kraus, Ronald J. Marhefka and Ahmad S.Khan, ―Antennas and wave propagation‖, TMH, New Delhi, 4th Ed., 2010.
2. C.A. Balanis, ―Antenna Theory- Analysis and Design‖, John Wiley & Sons, 2nd Edn., 2001.
3. K.D. Prasad and SatyaPrakashan, ―Antennas and Wave Propagation‖, New Delhi, Tech. India Publications, 2001.
References:
1. E.C. Jordan and K.G. Balmain, ―Electromagnetic Waves and Radiating Systems‖, 2nd Edition, PHI, 2000.
2. G.S.N Raju, ―Antenna and Wave Propagation‖, Pearson Education India, 3rd Edition 2009.
R K Shevgaonkar,‖ Electromagnetic Waves‖. Tata McGraw-Hill, 2006
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MICROPROCESSORS AND MICROCONTROLLERS (MPMC)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC303	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Analyze the architectural concepts of 8086 microprocessor.

CO2: Apply the programming model of 8086 in assembly language programming.

CO3: Analyze the architectural concepts the 8051 microcontroller.

CO4: Apply the programming model of 8051 in interfacing with peripherals

CO5: Analyze the architecture and operations of ARM processors

UNIT – I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, memory segmentation, minimum mode and maximum mode configuration

UNIT – II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, assembly language programs on arithmetic, logical, sorting, searching and conversion operations. 8086 Interfacing- 8255 PPI, architecture, Control Word Register, and interfacing peripherals- DAC, ADC with 8255.

UNIT – III

8051 Microcontroller: Comparison of Microprocessor, Microcontroller Architecture of 8051– Special Function Registers, I/O Pins Ports and Circuits, Memory Organization, Interrupts - Timers - Serial Port – Assembly language programming model.

UNIT – IV

Microcontroller Interfacing: Programming 8051 Addressing modes, Instruction set & Directives, Debugging the microcontroller programs, Programming Switches, LEDs with Delay operations, Seven Segment Display, LCD, Sensors, DC Motor, Stepper Motor and DAC interface Waveform generation.

UNIT – V

ARM Microcontrollers: ARM family, Nomenclature, RISC vs CISC Architecture, Register Set & Modes, CPSR, SPSR, Privileged modes, Pipelining 3 stage, 5 stage, I/O System, programming model of ARM embedded platform.

Textbooks:

A. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.

B. Mazidi Muhammad Ali, Mazidi Janice Gillespie & amp; Mc Kinlay Rolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.

C. Steve Furber, ARM system on chip Architecture, Pearson Publications Design, 2000, Second Edition.

References:

1. John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, 3rdEdition, Pearson Ed, 2006.

2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publication Ltd, 2006.

Web References:

1. www.nptel.onlinecourseac.in/.microprocessorsandmicrocontrollers
2. https://onlinecourses.nptel.ac.in/noc18_ec03/

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (IQTA)								
V Semester: Common for all Branches						**Scheme:2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
ESCM03	**ES**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
SessionalExamDuration:2Hrs						**EndExamDuration:3Hrs**		

Course Outcomes:
At the end of the course the student will be able to
CO1: Explain core quantum principles in a non-mathematical manner
CO2: Compare classical and quantum information systems.
CO3: Identify theoretical issues in building quantum computers.
CO4: Discuss quantum communication and computing concepts.
CO5: Recognize applications, industry trends, and career paths in quantum technology
UNIT–I
Introduction to Quantum Theory and Technologies: The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India's Quantum Mission, EU, USA, China
UNIT–II
Theoretical Structure of Quantum Information Systems: What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role
UNIT–III
Building a Quantum Computer – Theoretical Challenges and Requirements: What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

UNIT–IV
Quantum Communication and Computing – Theoretical Perspective: Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential
UNIT–V
Applications, Use Cases, and the Quantum Future: Real-world application domains: Healthcare(drugdiscovery),Materialscience,Logisticsandoptimization,Quantumsensing and precision timing, Industrial case studies: IBM, Google, Microsoft, Psi Quantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skill sets, and preparation pathways, Educational and research landscape–India's opportunity in the global quantum race.
Text Books:
1. Michael A Nielsen and Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, Cambridge.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, Cambridge.
Reference Books:
1. David Mc Mahon, Quantum Computing Explained, Wiley.
2. Pillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press.
4. Alastair I M Rae, Quantum Physics: A Beginner's Guide, One world Publications.
5. Eleanor G Rieffel and Wolfgang H Polak, Quantum Computing: A Gentle introduction, MIT Press.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books.
7. Bruce Rosenblum and Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press.
8. Giuliano Benenti, Giulio Casati and Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing
9. K.B.Whaley et al., Quantum Technologies and Industrial Applications: European Road map and Strategy Document, Quantum Flagship, European Commission.
10. Department of Science& Technology (DST), Government of India, National Mission on Quantum Technologies& Applications – Official Reports and Whitepapers, MeitY/DST Publications.
Online Learning Resources:
1. https://www.coursera.org/learn/quantum-mechanics
2. https://nptel.ac.in/courses/106106232

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1shallcontainTencompulsory short answer questions for a total of Twenty marks(with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

COMPUTER ARCHITECTURE & ORGANIZATION (CAO)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC311	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the concepts of Register transfer and Micro-operations.

CO2: Analyze the concepts of Computer organization and its design.

CO3: Analyze the concepts of processor organization and various computer arithmetic algorithms used in the design of a basic computer.

CO4: Analyze the fundamental concepts of I/O and Memory organization.

CO5: Analyze the importance of Pipeline and Vector Processing.

UNIT – I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture**.**

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input &Output and Interrupt.

UNIT – II

Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control

UNIT – III

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT – IV

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access**.**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

UNIT – V

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor. Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.

Textbooks:

1. Computer System Architecture–M. Moris Mano, Third Edition, Pearson/PHI.
2. Computer Organization–CarHamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.

References:

1. Computer Organization and Architecture–William Stallings Sixth Edition, Pearson/PHI.

2.Structured Computer Organization–AndrewS.Tanenbaum,4thEdition,PHI/Pearson.

3. JohnP. Hayes,*ComputerArchitectureandOrganization,*McGrawHill,3/e,1998

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

INFORMATION THEORY AND CODING (ITC)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC312	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the concepts of information in the context of communication theory and communication receivers.

CO2: Implement various source coding algorithms and analyze their performance.

CO3:Apply the knowledge about techniques for error detection and error correction

CO4: Design linear block codes and cyclic codes.

CO5: Understand various convolutional codes

UNIT – I

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.

Block to Variable length Coding: Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Code length, Coding a Single Random Variable, Rooted Tree with Probabilities, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.

UNIT – II

Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equi-partition Property, Problem solving.

Universal Source Coding: Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.

Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.

UNIT – III

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding**.**

UNIT – IV

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code**.**

UNIT – V

Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

Textbooks:

1. Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons,2nd Edition,2006.
2. Herbert Taub, DonaldL Shilling, Goutam Saha, Principles of Communication Systems,4th Edition, McGraw Hill, 2017.

References:

1. ShuLin,DanielJ. CostelloJr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems,JohnWiley,4th Edition,2010.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

DETECTION AND ESTIMATION THEORY (DET)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC313	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1:Understand the impact of White Gaussian noise on the detection of signals

CO2: Analyze the detection of deterministic signals and random signals.

CO3: Understand the nonparametric detections.

CO4: Analyze estimation signal parameter and apply suitable estimation techniques.

CO5: Understand the signal estimation in Discrete-Time techniques

UNIT – I

Statistical Decision Theory: Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain. Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

UNIT – II

Detection of Deterministic Signals: Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

Detection of Random Signals: Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection.

UNIT – III

Nonparametric Detection: Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.

UNIT – IV

Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

UNIT – V

Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

Textbooks:

1.H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY.

2.H.V.Poor,"AnIntroductiontoSignalDetectionandEstimation",Springer, 2/e,1998.

References:

1.S. M.Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR.

2.S. M.Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ANALOG AND DIGITAL IC APPLICATIONS LAB (ADICA (P))

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC304	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	30	70	100
Sessional Exam Duration:2Hrs					End Exam Duration:3Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: To design an Inverting and Non-inverting Amplifier using an Op Amp.

CO2: To demonstrate the Linear and Non-Linear Applications using IC 741.

CO3: To design A stable and Monostable Multi vibrator using timer ICs.

CO4: To analyze the DAC and ADC converter.

CO5: To design Counters and Registers using digital ICs.

LIST OF EXPERIMENTS

Note: At least 12 experiments shall be performed. At least 8 Linear and 4 Digital IC experiments shall be performed.

1.Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.

2.Design Adder and Subtractor using Op Amp and verify addition and subtraction process.

3. Design a Comparator using Op Amp and draw the comparison results of A=B, A>B, A<B

4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically

5. Design a Active LPF, HPF cutoff frequency of 2 KHZ and find the roll off of it.

6 Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1KHZ and draw the output waveform.

7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.

8. Construct A stable Multivibrator using IC555 and draw its output waveform and also find its duty cycle.

9. Design a Schmitt Trigger Circuit and find its LTP and UTP.

10. Design Voltage Regulator usingIC723, IC 7805/7809/7912 and find its load regulation factor.

11. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages

12. Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.

13. Design a 8x1 multiplexer using digital ICs.

14. Design a 4-bit Adder/Subtractor using digital ICs

15. Design a Decade counter and verify its truth table and draw respective waveforms.

16. Design a Up/down counter usingIC74163 and draw read/write waveforms.

17. Design a Universal shift register using IC 74194/195 and verify its shifting operation.

18. Design a 8x3 encoder/3x8 decoder and verify its truth table.

MICROPROCESSORS AND MICROCONTROLLERS LAB (MPMC (P))

V- Semester : ECE
Scheme: 2023

Course Code	Category	Hours/Week		Credits	Maximum Marks		
		L/D	T/P	C	Continuous Internal Assessment	End Exam	Total
EC305	PC	0	3	1.5	30	70	100

Sessional Exam Duration: 2Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes:

At the end of the course the student will be able to

CO1: Execute 8086 Microprocessor programs using addressing modes and instruction set

CO2: Utilize 8086 Microprocessor programming model to interface peripherals using IDE tools

CO3: Compile programs of 8051 Microcontroller using Keil software

CO4: Interface peripherals with 8051 Microcontroller using assembly programming approach

CO5: Implement 8051 Microcontroller interfacing applications for solving real-world problems.

LIST OF EXPERIMENTS

(Any TEN of the experiments are to be conducted)

1.Execute the 8086 assembly language programs on arithmetic operations.
2.Execute the 8086 assembly language programs on series of data operations.
3.Execute the 8086 assembly language programs on Factorial of a number & Fibonacci series generation
4.Execute the 8086 assembly language programs on data conversions
5. Execute the 8086 assembly language programs on TASM environment.
6. Interface and execute LCD functioning using 8086 Microprocessor
7 Execute peripheral interface through AT89S52 microcontroller through Keil software
8. Interface and execute Dancing LEDs pattern usingAT89S52Microcontroller
9 Interface and execute LCD operation usingAT89S52Microcontroller
10.Interface and execute Delay controlling usingAT89S52Microcontroller
11Interface and execute Sensor operations usingAT89S52Microcontroller
12.Interface and execute the 7 segment Display usingAT89S52Microcontroller
13.Using AT89S52 microcontroller operate delay programming using Keil Software.
14.Using AT89S52 interface a switches & LEDs & display the count of LEDs ON.
15.Using AT89S52 board interfaces a temperature sensor and display the value on LCD.

PCB DESIGN AND PROTOTYPE DEVELOPMENT (PCBDPD)

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
SCEC01	SEC	0	1	2	2	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the basic Concepts of PCB Design.

CO2: Apply the EDA tool for PCB Schematic and PCB Layout Design.

CO3: Design the Schematic and PCB layout of Analog and Digital Electronic Circuits.

CO4: Design an 8051 Development board for various Applications.

CO5: Fabricate a Single Sided PCB, Mount the Components and assemble them in a cabinet.

UNIT – I

Introduction to PCB Components and Symbols: Component identification, Component symbols & their footprints, understand schematic, creating new PCB, browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT – II

Fundamentals of PCB Design: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA)tools: EAGLE, OrCAD, Altium, Ki-CAD, Easy EDA and comparison.

UNIT – III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards

Practice Exercises: Any twelve experiments are to be done
Software's: EAGLE/Ki-CAD, CopperCAM, Mach3Mill (CNC control software)

1. Practice following PCB Design steps
   - Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Netlist generation.
   - Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic.
   - Create new schematic components.
   - Create new component footprints.
2. Regulator circuit using 7805.
3. Inverting Amplifier or Summing Amplifier using op-amp .
4. Full-wave Rectifier
5. Astable multivibrator using IC555.
6. Monostable multivibrator using IC555.
7. RCPhase-shifter oscillator using transistor.
8. Wein-bridge Oscillator using op- amp .
9. Full-Adder using half-adders.
10. 4-bit binary /MOD N counter using D-Flip flops.

11.One open-ended (analog/ digital/mixed circuit) experiments of similar nature and magnitude to the above are to be assigned by the teacher (Student is expected to solve and execute/simulate independently).
12.Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor, headers, LED.
13.Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector,Jumper, LEDs .
14.Design an 8051 Development board having Reset & Input/output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors.
15.Fabricate a single-sided PCB, mount the components and assemble them in a cabinet for any one of the circuits mentioned in the above exercises.

References:
5. Jon Varteresian, Fabricating Printed Circuit Boards, z, 2002 .
6. R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001.
7. C. Robertson. PCB Designer´s Reference. Prentice Hall, 2003.
8. Open-source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/13.PCB Fabrication user guide page:
Web References:
1.http://www.wikihow.com/Create-Printed-Circuit-Boards
2.http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/
3.http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself
4.PCB Fabrication at home(video):https://www.youtube.com/watch?v=mv7Y0A9YeUc, https://www.youtube.com/watch?v=imQTCW1yWkg.

Tinkering Lab (TLP (P))

V Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
ESCM02	MC	0	0	2	1	30	70	100
						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to experiment, innovate, and solve Real-world challenges.

LIST OF EXPERIMENTS

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit-using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture-monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.

References:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2. https://atl.aim.gov.in/ATL-Equipment-Manual/
3. https://aim.gov.in/pdf/Level-1.pdf
4. https://aim.gov.in/pdf/Level-2.pdf
5. https://aim.gov.in/pdf/Level-3.pdf

DIGITAL SIGNAL PROCESSING (DSP)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC308	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Familiar with the properties of discrete time signals, systems and z-transform.

CO2:Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations

CO3:Design IIR digital filters with the given specifications. .

CO4: Design FIR digital filters with the given specifications.

CO5:Gain the knowledge on Programmable DSP Devices.

UNIT – I

Introduction to discrete time signals and systems: Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems.

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z- Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

UNIT – II

Discrete Fourier Transform : Introduction, Discrete Fourier Series, properties of DFS,Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

UNIT – III

IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

UNIT – IV

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations

UNIT – V

Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Textbooks:
1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

References:
1.S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3.Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MICROWAVE AND OPTICAL COMMUNICATIONS (MWOC)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC309	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Analyze different modes of operation in rectangular wave guides, circular wave guides and resonators.

CO2: Understand and analyze various microwave components and microwave sources.

CO3: Gain knowledge on different microwave semiconductor devices and microwave measurements procedures.

CO4: Analyze different optical fiber modes and to study different types of distortions and losses in optical communication.

CO5: Understand study various optical sources, optical detectors and to analyze various optical links.

UNIT – I

Waveguides: Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Waveguide current and mode excitation, Circular waveguide – TE and TM modes(Qualitative treatment only), Wave propagation, Cavity resonators (Qualitative treatment only).

UNIT – II

Passive Microwave Devices: Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator and Circulator.

Microwave Amplifiers and Oscillators: Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (Qualitative treatment only).Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.

UNIT – III

Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

Microwave Measurements: Description of Microwave bench-different blocks and their features, errors and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of Q of a cavity, Impedance measurements.

UNIT – IV

Introduction to Optical Fibers and Transmission Characteristics - The propagation of light in optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD

UNIT – V

Optical Transmitters and Receivers: Optical Sources: - Light source materials – LED homo and hetero structures –surface and edge emitters–Quantum efficiency– Injection Laser Diode – Modes and threshold
condition – Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes
– Photo detector noise
Optical Link Design: Point-to-point links–System considerations –Link Power budget –Rise time budget.

Textbooks:

1. DavidM.Pozar, Microwave Engineering JohnWiley &Sons,Inc.4thedition,2012
2. SamuelY.Liao,—MicrowaveDevicesandCircuits‖,PHIpublications,ThirdEdition, 1997.
3. GerdKeiser,—OpticalFiberCommunications‖,McGrawHill,ThirdEdition,2000.

References:

1. R.E.Collin,—FoundationsforMicrowaveEngineering‖,WileyStudentEdition,Second Edition, 2009.
2. Om.P.Gandhi,—Microwave:EngineeringandApplications‖,KaiFaBookCompany, 1981.
3. ReichH.J.,etal,—MicrowavePrinciples‖,MITPress,1972.
4. FETerman,—ElectronicandRadioEngineering‖,McGrawHill,4thEdition,1984

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

VLSI DESIGN (VLSID)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC310	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Explain the fabrication process of ICs using MOS transistor technology.

CO2: Interpret and construct stick diagrams and layout designs based on design rules.

CO3: Apply gate-level design concepts to implement basic digital circuits using MOS transistors.

CO4: Design subsystems such as ALUs, shifters, and adders using various VLSI design styles like full-custom and semi-custom.

CO5: Analyze and implement CMOS testing methodologies including scan design and built-in self-test (BIST) techniques.

UNIT – I

Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS & BiCMOS Technologies.BasicElectricalPropertiesofMOSandBiCMOSCircuits:I_{DS}-V_{DS}relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT – II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT – III

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out.

UNIT – IV

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters**.**

VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design.

UNIT – V

CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Textbooks:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Dougles, A. Pucknell, 2005, PHI.
2. Modern VLSI Design –Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan

Banerjee, 3rd Edn, Pearson, 2009.
2. BehzadRazavi,—DesignofAnalogCMOSIntegratedCircuits‖,McGrawHill,2003.
3. JanM.Rabaey,—DigitalIntegratedCircuits‖,AnanthaChandrakasanandBorivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

DIGITAL IMAGE PROCESSING (DIP)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC316	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the concepts of image processing system and image transforms.

CO2: Apply the intensity transformations, histograms, spatial and frequency domain filters on images.

CO3: Apply various models of Restoration and Reconstruction of images from filtering projections.

CO4: Analyze various image compression, wavelet and multi resolution techniques.

CO5: Design the image processing systems using Segmentation, Morphological techniques and Color images.

UNIT – I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT – II

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, Combining spatial enhancement methods.

Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

UNIT – III

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position -Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter, image reconstruction from projections.

UNIT – IV

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding

Wavelets and Multi resolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions& two dimensions, Wavelet coding.

UNIT – V

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region -based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression**.**

Textbooks:

1. R.C. Gonzalezand R.E.Woods, Digital Image Processing,3rd edition, Prentice Hall, 2008.
2. Jayaraman, S.Esakkirajan, and T.Veerakumar, "Digital Image Processing" ,Tata McGraw-Hill Education, 2011.

References:

1. AnilK.Jain,"FundamentalsofDigitalImageProcessing",PrenticeHallofIndia, 9th Edition, Indian Reprint, 2002
2. B.Chanda,D.DuttaMajumder,"DigitalImageProcessingandAnalysis",PHI,2009

Online Learning Resources:

https://nptel.ac.in/courses/117105079
https://nptel.ac.in/courses/117105135

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING(AI & ML)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC317	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the basics and problems of Artificial Intelligence with rationality and structure of agents.

CO2: Describe the search for solutions using various search strategies & algorithms for optimization.

CO3: Apply various supervised machine learning techniques, including linear, multiple, polynomial, and logistic regression, understanding their principles, and practical applications.

CO4: Implement and differentiate various unsupervised clustering methods, including K-Means, PCA

CO5: Comprehend the fundamental computations of deep learning and construct Convolutional Neural Networks using their core building blocks.

UNIT – I

Introduction: What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT – II

Problem Solving: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT – III

Supervised Machine Learning: Introduction to Machine Learning, Basics of linear regression, its assumptions, limitations and industry applications. Least square based and Gradient Descent Based Regression, Multiple linear regression, Polynomial regression, Logistic regression

UNIT – IV

Unsupervised Machine Learning: Different clustering methods (Distance, Density, Hierarchical), Iterative distance-based clustering; K-Means Clustering Algorithm and Image Quantization, basics of Principal Component Analysis.

UNIT – V

Introduction to Deep learning: Analyze the key computations underlying deep learning, Convolution Neural Network, Building blocks of CNN- Convolutional layers, Pooling layers Dense layers.

Textbooks:

1) Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Pearson

2) Tom M. Mitchell, Machine Learning, McGraw Hill Edition, 2013

References:

1) Saroj Kaushik, ―Artificial Intelligence‖, Cengage Learning India, 2011

2) Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill

3) David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010.

4) Trivedi, M.C., ―A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.

5) Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.

6) ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

WIRELESS COMMUNICATIONS (WC)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC318	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand various multiple access techniques.

CO2: Understand the characteristics of mobile radio propagation.

CO3: Analyze factors influencing small scale multipath propagation.

CO4: Understand the necessity of equalization and diversity.

CO5: Analyze the concepts of multicarrier modulation and technical challenges involved.

UNIT – I

Multiple Access Techniques: TDMA, FDMA, Spread Spectrum Modulation: Introduction, Pseudo-noise sequence, Direct Sequence spread spectrum, Processing gain, Frequency Hopping spread spectrum, Spread Spectrum Multiple Access.

UNIT – II

Mobile Radio Propagation: Introduction to Radio Wave Propagation, Basic Propagation Mechanisms, Types of fading.

Large scale fading: Free Space Propagation Model, Relating Power to Electric Field, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge diffraction, Scattering.

UNIT – III

Small Scale Fading in Mobile Radio Propagation: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small- Scale Fading Fading effects due to Multipath Time Delay Spread, Fading effects due to Doppler Spread.

UNIT – IV

Equalization : Introduction, Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-Linear Equalizers-DFE, MLSE, Algorithms for adaptive equalization-Zero Forcing, LMS, RLS.

UNIT – V

Multicarrier Modulation : Data transmission using multiple carriers, Multi carrier modulation with overlapping sub-channels, Discrete implementation of multicarrier modulation, The cyclic prefix, Orthogonal Frequency division multiplexing (OFDM), Matrix representation of OFDM, Challenges in Multicarrier systems- Peak- to-Average power ratio, Frequency and timing offsets, Introduction to MIMO systems.

Textbooks:

1.T.S.Rappaport, —Wireless Communications – Principles & Practice", 2ndEdition, PHI.

2. Andrea Goldsmith, —Wireless Communications", 2nd Edition, Cambridge University Press, 2009.

References:

1.William Stallings, —Wireless communications & Networks",2ndEdition, Pearson Education.

2.William C.Y. Lee, —Mobile Cellular Telecommunications", 2nd Edition, McGraw-Hill.

3. Simon Haykin, —Modern wireless communications‖, 1st edition, Pearson, 2004.

Web References :

1. https://nptel.ac.in/courses/117102062/
2. https://www.youtube.com/watch?v=XUXmfrbNJns
3. https://www.youtube.com/watch?v=XUXmfrbNJns

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (EMI)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC319	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Learn about the performance characteristics of instruments and measurement of electrical quantities.

CO2:Understand the construction, working and applications of different types of CRO's.

CO3: Compare the working of different types of bridges.

CO4: Know the working of signal & function generators and analyzers.

CO5: Grasp the working of sensors and transducers in measuring physical parameters.

UNIT – I

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT – II

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT – III

Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.

UNIT – IV

Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

UNIT – V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Textbooks:

1. A.D. Helfrick and W.D. Cooper, ―Modern Electronic Instrumentation and Measurement Techniques‖, 5th Edition, PHI, 2002.
2. H.S.Kalsi, ―Electronic Instrumentation‖, 2nd edition, Tata McGraw Hill, 2004.

References:

1. David A. Bell, ―Electronic Instrumentation & Measurements‖, 2nd Edition, PHI, 2003.
2. K. Lal Kishore, ―Electronic Measurements & Instrumentations‖, Pearson Education, 2009.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

EMBEDDED SYSTEMS AND IoT (ESIoT)

VI- Semester : ECE							Scheme: 2023
Course Code	Category	Hours/Week		Credits	Maximum Marks		
		L/D	T/P	C	Continuous Internal Assessment	End Exam	Total
EC320	PE	3	0	3	30	70	100
Sessional Exam Duration: 2Hrs					End Exam Duration: 3 Hrs		

Course Outcomes :

At the end of the course the student will be able to

CO1: Analyze the architecture and characteristics of Embedded Systems

CO2: Analyze the operational blocks and characteristics in IoT

CO3: Apply the IoT tools in Communication Technologies

CO4: Analyze the cloud computing platforms in IoT

CO5: Analyze the python programming levels and raspberry pi features

UNIT-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Embedded Processor-MSP430 features and operations

UNIT-II

Essentials of Internet of Things: Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry

UNIT-III

IoT Technologies and Tools: Communication Technologies & Protocols of IoT- BLE, Wi-Fi, LoRA , 3G/4G Technologies and HTTP, MQTT, CoAP protocols. Introduction to Arduino, Connecting LED, Buzzer, Sensors- Light sensor, temperature sensor, IR sensor, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Bluetooth Sensors, Distance Measurement with ultrasonic sensor.

UNIT-IV

IoT Cloud Computing Platforms: IOT Platform Architecture (IBM Internet of Things & Watson Platforms); API Endpoints for Platform Services; Devices Creation and Data Transmission; Introduction to NODE-RED and Application deployment.

UNIT-V

Fundamentals of Python Programming & Raspberry Pi: Introduction to python programming, Data Types & Control Structures, working with functions, Modules & Packages, Introduction & programming Raspberry Pi3, Interfaces, Integrating Input Output devices with Raspberry Pi3.

Text Books:

1. Shibu K.V, Introduction to Embedded Systems ,Mc Graw Hill ,1st Edition,2009.
2. Frank Vahid, Embedded System Design, 2nd Edition Wiley Publications,2009
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
5. Adrian McEwen, Hakim Cassimally, —Designing the Internet of Things‖, Wiley Publications, 2013

Reference Books:

1. Jonathan W Valvano, —Embedded Microcomputer Systems: Real-Time Interfacing‖, 3rd Edition, Thomson Engineering, 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things: Key applications

and Protocols‖, 2nd Edition, Wiley Publications, 2012.

3. Rene Beuchat , Andrea Guerrieri & Sahand Kashani ―Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers‖ Paperback, 2 August 2021.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs93/preview
2. https://www.coursera.org/courses?query=embedded%20systems

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a Total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a Total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SPEECH PROCESSING (SP)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC321	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the anatomy and physiology of speech organs and the process of Speech Production.

CO2: Apply the methods for extracting of speech using Time domain parameters.

CO3: Apply the Frequency Domain Methods for Speech Processing.

CO4: Analyze LPC Parameters for Speech Processing.:

CO5: Analyze the concepts of homomorphic Speech Processing.

UNIT – I

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract and radiation at lips, Digital models for speech signals.

UNIT – II

Time Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation.

UNIT – III

Frequency Domain Methods for Speech Processing: Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.

UNIT – IV

Linear predictive Coding (LPC) for Speech: Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT – V

Homomorphic Speech Processing: Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.

Textbooks:

1. L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education, 2008.
2. Human & Machine, Douglas O'Shaughnessy, Speech Communications, 2nd Edition., Wiley India, 2000.

References:

1. Thomas F. Quateri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Edition, PE, 2001.
2. Ben Gold & Nelson Morgan, Speech & Audio Signal Processing, 1st Edition, Wiley, 2011.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MICROWAVE AND OPTICAL COMMUNICATIONS LAB (MWOC (P))

VI Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC314	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	30	70	100
						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the working of microwave bench setup and characteristics of microwave sources.

CO2: Verify the characteristics of various microwave components and to draw the radiation pattern of antennas.

CO3: Verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

List of Experiments

PART-A: Microwave Lab - Any Seven (7) Experiments

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Attenuation Measurement
4. Directional Coupler Characteristics
5. VSWR Measurement
6. Impedance Measurements
7. Frequency and Wavelength measurement
8. Scattering Parameters of Directional coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of a Antenna
11. Antenna gain measurement

Part B: Optical Fiber Lab - Any five (5) Experiments

1. Characterization of LED
2. Characterization of Laser Diode
3. Intensity Modulation of Laser output through Optical fiber
4. Measurement of data rate for digital Optical link
5. Measurement of Numerical Aperture.
6. Measurement of Losses for Analog optical link

VLSI DESIGN LAB (VLSID (P))

VI Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC315	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	30	70	100
								End Exam Duration:3 Hrs

Course Outcomes:

After the completion of the course students will be able to

CO1: Design CMOS logic circuits using 180 nm technology, including schematic creation, symbol generation, and test bench development for digital gates.

CO2: Simulate and analyze CMOS circuits (Inverter, AOI, etc.) using DC, AC, and parametric sweep techniques on EDA tools.

CO3: Design complex digital and analog blocks (e.g., AOI logic, full adders, amplifiers) using full-custom and semi-custom IC design approaches.

CO4: Develop layout diagrams for CMOS circuits, perform DRC, LVS checks, and extract parasitics using industry-standard EDA tools.

List of Experiments: (Any **TEN** of the experiments are to be conducted)

Note: Software Required:

i. Mentor Graphics/ Synopsis/ Cadence / Equivalent Industry Standard Software.

ii. Personal computer system with necessary software to run the programs and to implement.

1. **Design and analysis of CMOS Inverter**

a) Implement CMOS inverter schematic using 180 nm technology and design its symbol.
b) Implement test bench for CMOS Inverter and check its output response.
c) Perform DC and AC analysis for CMOS inverter.
d) Check the performance of CMOS inverter using parametric sweep.

2. **Design and analysis of NAND and NOR Logic gates**

a) Implement NAND/NOR schematic using 180 nm technology and design its symbol.
b) Implement test bench for NAND/NOR and check its output response.
c) Perform DC and AC analysis for NAND/NOR.
d) Check the performance of NAND/NOR using parametric sweep.

3. **Design and analysis of XOR and XNOR Logic gates**

a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol.
b) Implement test bench for XOR/XNOR and check its output response.
c) Perform DC and AC analysis for XOR/XNOR.
d) Check the performance of XOR/XNOR using parametric sweep.

4. **Design of AOI logic**

a) Design Schematic for AB+C_D and check its output response.
b) Design Schematic for AB_+C_D and check its output response.
c) Design Schematic for (A+B_)(C+D) and check its output response.
d) Design Schematic for (A+B_)(C_+D) and check its output response.

5. **Design and analysis of Full adder**

a) Design full adder using Full custom IC design.
b) Design full adder using Semi custom IC design.

6. Analysis of NMOS and PMOS characteristics

a) Implement test bench for NMOS/PMOS transistor.

b) Perform DC and AC analysis for NMOS/PMOS transistor

c) Check the performance of NMOS/PMOS transistor using parametric sweep.

7. Design and analysis of Common source amplifier

a) Implement CS amplifier schematic using 180 nm technology and design its symbol.

b) Implement test bench for CS amplifier and check its output response.

c) Perform DC and AC analysis for CS amplifier.

d) Check the performance of CS amplifier using parametric sweep.

8. Design and analysis of Common drain amplifier

a) Implement CD amplifier schematic using 180 nm technology and design its symbol.

b) Implement test bench for CD amplifier and check its output response.

c) Perform DC and AC analysis for CD amplifier.

d) Check the performance of CD amplifier using parametric sweep.

9. Design of MOS differential amplifier

a) Design differential amplifier schematic using 180 nm technology and its symbol.

b) Implement test bench for differential amplifier and check its output response.

c) Perform DC and AC analysis for differential amplifier.

d) Check the performance of differential amplifier using parametric sweep.

10. Design of differential amplifier using FET/BJT

a) Design differential amplifier using FET/BJT schematic using 180 nm technology and its symbol.

b) Implement test bench for two stage differential amplifier and check its output response.

c) Perform DC and AC analysis for differential amplifier.

d) Check the performance of differential amplifier using parametric sweep.

11. Design of Inverter Layout

a) Design and implement inverter schematic.

b) Design the layout for inverter using 180 nm tech file.

c) Perform LVS for schematic and layout

d) Check and remove all DRC violations.

e) Extract parasitic R and C in layout.

12. Design of NAND/NOR Layout

a) Design and implement NAND/NOR schematic.

b) Design the layout for inverter using 180 nm tech file.

c) Perform LVS for schematic and layout

d) Check and remove all DRC violations.

e) Extract parasitic R and C in layout

MACHINE LEARNING AND DSP (ML&DSP)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
SCEC02	SEC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	1	2	2	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the modules and dependencies for machine learning corresponding to Different applications.

CO2: Learn arrange of machine learning regression techniques & clustering along with their datasets.

CO3: Write the programs and implement k-Nearest Neighbour algorithm to classify the iris data sets, images & CNN.

CO4: Simulate the basic signal processing operations like convolution and correlation.

CO5: Simulate the DSP operations like DFT, FFT & implement Rand FIR filters using simulation software and verify their frequency responses.

UNIT – I

Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python.

UNIT – II

Linear regression*:* Predict the profit of a company/House price from a dataset using the concept of linear regression. Implement the speech recognition model (NLP) from a speech/audio dataset using the concept of linear regression

Logistic regression*:*

a. Identify whether the patient has diabetes or not from diabetes dataset using Logistic regression

b. Implement the speech to text model(NLP-Speech recognitions system)from a speech dataset using the concept of linear regression

K-means clustering*:* Apply the concept of K-means clustering for image segmentation problem (Brain tumor and Lung images)/Color quantization.

UNIT – III

k-Nearest Neighbour algorithm : Write a program to implement the k-Nearest Neighbour algorithm for image classification and distance metric learning for large margin with image classification applications using k- nearest neighbour.

Digit recognition using CNN: Identify the digits 0-9 from MNIST data and CIFR10 set using CNN.

UNIT – IV

a. Generate the following standard discrete time signals.

i)Unit Impulse ii) Unit step iii)Ramp iv) Exponentia lv) Sawtooth

b. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase)

c. Implementandverifylinearandcircularconvolutionbetweentwogivensignals.

d. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.

UNIT – V

a. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).

b. Implement and verify N-point IFFT of a given sequence.

c. Design IIR Butter worth filter and compare their performances with different orders(Low Pass Filter /High Pass Filter)
d. Design FIR filter(Low Pass Filter/High Pass Filter) using windowing technique.
Using rectangular window, ii. Using hamming window, iii. Using Kaiser window

Textbooks:

1.SimonHaykin,Neural Networks and Learning Machines,PHI,2008

2. Digital Signal Processing: AlonV.Oppenhelm,PHI

3. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI, 2009.

References:

1.Signals, Systems & Communications - B.P. Lathi, 2013, BSP

2. S.N.Sivanandamand S.N.Deepa, Introduction to neural networks using Matlab,2006.

3. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, Wiley, 2005.

4. Digital Signal processing(II-Edition):S.K.Mitra,TMH

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

TECHNICAL PAPER WRITING AND IPR (TP&IPR)

VI Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
AC301	AC	2	0	0	0	-	-	-

Course Outcomes:

After the completion of the course students will be able to

CO1: Develop precise and ethical technical writing with logical structure and critical analysis.

CO2: Formulate and present structured research content and synopsis.

CO3: Understand and apply the principles of publishing, journal types, indexing with proper citation and plagiarism standards

CO4: Understand fundamental knowledge of intellectual property rights, international frameworks and registration of trademarks.

CO5: Understand the fundamentals of laws of copyrights and patents, intellectual property audits.

UNIT – I

Principles of Technical Writing: Styles in technical writing; clarity, precision, coherence and logical sequence in writing, avoiding ambiguity, repetition, and vague language, highlighting your findings, discussing your limitations, hedging and criticizing, plagiarism and paraphrasing.

UNIT – II

Technical Research Paper Writing: Abstract, Objectives, Limitations, Review of Literature, Problems and Framing Research Questions, Synopsis.

UNIT – III

Process of research: publication mechanism: Types of journals, indexing, seminars, conferences, proof reading, plagiarism style; seminar & conference paper writing; Methodology, discussion, results and citation rules.

UNIT – IV

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – V

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Textbooks:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013

2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices. Oxford.

References:
1. R. Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001
3. Adrian Wallwork. English for Writing Research Papers, Second Edition. Springer Cham Heidelberg New York ,2016

Online Resources:	
1.	https://theconceptwriters.com.pk/principles-of-technical-writing/
2.	https://lawbhoomi.com/intellectual-property-rights-notes/
3.	https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

DATA COMMUNICATIONS AND NETWORKING (DCN)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC401	PC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand of the fundamentals of data communications and computer networks.

CO2: Analyze the characteristics and functionalities of various network architectures, models, and transmission media

CO3: Analyze error detection and correction methods, data link protocols, and medium access techniques.

CO4: Analyze the Process-to-Process Delivery using TCP, UDP in transport layer and the cryptography algorithms like DES and RSA in session layer.

CO5: Analyze the functionalities of application layer protocols such as DNS, SMTP, SNMP, FTP, HTTP, and WWW.

UNIT – I

Overview of Data Communication and Networking: Introduction; Data communications: components, direction of data flow; network criteria, physical structure, categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

UNIT – II

Physical Layer: Overview of data (analog & digital), signal (analog& digital), transmission (analog & digital) & transmission media (guided & unguided), queuing theory, its applications in data communication, Data Encoding Techniques, Circuit switching, time division & space division switching.

UNIT – III

Data link Layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC

Medium Access sub layer: Point to Point Protocol, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet.

UNIT – IV

Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing: techniques, static vs. dynamic routing, Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6

Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

UNIT – V

Application Layer: Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Textbooks:
1. B. A. Forouzan – Data Communications and Networking (3rd Ed.)-TMH
2. A.S. Tanenbaum –Computer Networks (4th Ed.) – Pearson Education/PHI

References:
1. W. Stallings – Data and Computer Communications (5th Ed.) – PHI/ Pearson Education
2. Kurose and Rose – Computer Networking -A top-down approach featuring the internet – Pearson Education
3. Leon, Garica, Widjaja – Communication Networks – TMH

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

ENTREPRENEURSHIP AND INCUBATION (E&I)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
HSM405	BS&H	2	0	0	2	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the concept of Entrepreneurship and challenges in the world of competition.

CO2: Apply the Knowledge in generating ideas for New Ventures.

CO3: Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.

CO4: Evaluate the role of central government and state government in promoting Entrepreneurship.

CO5: Create and design business plan structure through incubations.

UNIT – I

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

UNIT – II

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

UNIT – III

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

UNIT – IV

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

UNIT – V

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

Textbooks:

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

References:

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2nd Edition, Oxford, 2012.
3. B.Janakiramand M.Rizwana‖ “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

MANAGEMENT SCIENCE (MS)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
HSM403	BS&H	2	0	0	2	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand core management concepts, theories, organizational structures, and the role of social responsibility for effective management.

CO2: Understand the essential operations management principles and apply marketing mix strategies in the industry.

CO3: Understand key HRM concepts and functions and apply these practices to effectively manage the complete employee lifecycle within an organization.

CO4: Apply SWOT analysis, PERT, and CPM techniques to strengthen project strategy formulation

CO5: Apply the advanced management systems to enhance organizational quality, efficiency, innovation, and social responsibility.

UNIT – I

INTRODUCTION TO MANAGEMENT: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor‘s Scientific Theory-Henry Fayols’ principles - Elton Mayo‘s Human relations –

Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT – II

OPERATIONS MANAGEMENT: Principles and Types of Plant Layout -Methods of Production (Job, batch, and Mass Production), Work Study - Statistical Quality Control-

Material Management: Objectives - Inventory- Functions - Types, Inventory Techniques - EOQ-ABC Analysis.

Marketing Management: Concept-Meaning-Nature-Functions of Marketing-Marketing Mix-channels of Distribution

Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

UNIT – III

HUMAN RESOURCES MANAGEMENT (HRM):HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection -Process -Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT – IV

STRATEGIC& PROJECT MANAGEMENT: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process – EnvironmentalScanning-StepsinStrategyFormulationandImplementation –SWOT Analysis- Project Management - Network Analysis - Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM)Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT – V
CONTEMPORARY ISSUES IN MANAGEMENT: Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re- engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.

Textbooks:
1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

References:
1. Stoner, Freeman, Gilbert. *Management, Pearson* Education, New Delhi, 2019.
2. Koontz &Weihrich, *Essentials ofManagement*,6/e, TMH, 2005.
3. Thomas N.Duening & JohnM.Ivancevich, *Management Principles and Guidelines*, Biztantra
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.

Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

HUMAN RESOURCE MANAGEMENT (HRM)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HSM406	BS&H	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	2	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the value of human resource management and the executive's role in using it for organizational success.

CO2: Understand the purpose and processes of procurement and development functions.

CO3: Understand training and development and differentiate executive development from employee training.

CO4: Understand the essentials and methods of job evaluation, performance appraisal, and compensation management.

CO5: Understands the fundamentals, processes, and objectives of industrial relations—covering disputes, grievance handling, and collective bargaining.

UNIT – I

INTRODUCTION: Importance of Human Resource Management – Meaning, Nature and Scope, Functions and Role of HR Manager – Advisory and service function to other department – HRM function planning – objectives and policies, organizing the HRM Department.

UNIT – II

PROCUREMENT AND DEVELOPMENT FUNCTIONS: Job Analysis, Job description, job specification, recruitment, selection, placement and induction and socialization.

UNIT – III

TRAINING AND DEVELOPMENT: Significance and Importance of Training, Designing of a Training Program, Methods of Training, Evaluation of Training effectiveness. Executive Development: Concept, Techniques, Employee Training Vs. Executive Development.

UNIT – IV

JOBEVALUATION: Essentials of Job Evaluation, Methods of Job Evaluation. Performance Appraisal: Importance, Process of Performance Appraisal and Methods of Performance Appraisal, Compensation: Introduction to Compensation Management, Objectives and components of Compensation.

UNIT – V

INDUSTRIALRELATIONS: Definition of Industrial Relation, Objectives of Industrial Relations, Industrial Disputes- Types of Industrial Disputes, grievance Redressal Procedure, Collective Bargaining- Objectives of Collective bargaining, Process of Collective bargaining, types of Collective bargaining.

Textbooks:

1. A Textbook of Human Resource Management–C.B.Mamoria & S.V.Gankar. Publication - Himalaya Publishing House.
2. Personnel and human Resource management - Text & cases, P Subba Rao, Publication - Himalaya Publishing House.

References:

1. Venkata Ratnam C. S. & Srivatsava B. K.,PERSONNEL MANAGEMENT AND HUMAN RESOURCES, Tata Mc-Graw Hill, NewDelhi,,
2. Aswathappa, HUMAN RESOURCE MANGEMENT, Tata McGraw Hill, NewDelhi, 2010
3. Garry Dessler &Varkkey, HUMAN RESOURCE MANAGEMENT, Pearson, New Delhi, 2009
4. Alan Price, HUMAN RESOURCE MANAGEMENT, Cengage Learning, NewDelhi, 2007

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

LOW POWER VLSI DESIGN (LPVLSID)

VII Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC402	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course, students will be able to

CO1: Analyze different power dissipation mechanisms in VLSI circuits.

CO2: Apply the concepts to a practical scenario, selecting and justifying appropriate techniques..

CO3: Evaluate the trade-offs (power, delay, area) of various low-power adder architectures for use in an embedded system, and recommend the optimal solution.

CO4: Examine different low-power multiplier architectures and their impact on digital design..

CO5: Acquire knowledge of low-power memory technologies and their future developments

UNIT – I

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Static and Dynamic Power Dissipation, Short Circuit Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT – II

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT – III

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques – Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT – IV

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT – V

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Textbooks:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

References:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Low Power CMOS Design – Anantha Chandrakasan, IEEE Press/Wiley International, 1998.
3. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons,2000.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions(Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

WIRELESS SENSOR NETWORKS (WSN)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC403	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Learn the fundamental concepts and architecture of wireless sensor networks.

CO2: Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.

CO3: Acquire knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.

CO4:Understandtheinfrastructureestablishmentofsensornetworks,includingtopology control and synchronization

CO5: Analyze the knowledge on sensor network platforms, programming challenges, and simulation tools.

UNIT – I

Overview of Wireless Sensor Networks: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

UNIT – II

Architectures: Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT – III

Networking Sensors: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

UNIT – IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT – V

Sensor Network Platforms and Tools : Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Textbooks:

1.Holger Kar l& Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks‖, John Wiley, 2005.

2.FengZhao&LeonidasJ.Guibas,—WirelessSensorNetworks-An Information Processing Approach", Elsevier, 2007

References:

1.Waltenegus Dargie, Christian Poellabauer—Fundamentals Of Wireless Sensor Networks Theory And Practice‖, By John Wiley & Sons Publications, 2011

2. Kazem Sohraby, Daniel Minoli,&Taieb Znati,—Wireless Sensor Networks-Technology, Protocols, and Applications‖, John Wiley, 2007.

3.AnnaHac,—WirelessSensorNetworkDesigns‖,JohnWiley,2003

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

CELLULAR & MOBILE COMMUNICATIONS (CMC)

VII Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC404	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the basic cellular system and its working..

CO2: Explain the impairments caused by multipath fading and methods to mitigate fading effects in mobile communication.

CO3: Apply concepts of cellular communication to solve problems related to mobile antennas and system design

CO4: Analyze co-channel and non-co-channel interferences, different types of handoffs, and dropped call rates.

CO5: Evaluate the performance of cellular systems, including signal reception, handoff efficiency, and spectrum utilization

UNIT – I

Cellular Mobile Radio Systems: Introduction to Cellular Mobile system, basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.

UNIT – II

Elements of Cellular Radio System Design: General description of the problem, concept of frequencychannels,Co-channelInterferenceReductionFactor,desiredC/Ifromanormalcasein a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

Interference: Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types

UNIT – III

Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation antenna height gain, form of a point-to-point model.

UNIT – IV

Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

Frequency Management and Channel Assignment: Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

UNIT – V

Handoff: Handoff, dropped calls and cell splitting, types of handoffs, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

System Evaluations: Performance evaluation, Signal evaluation, Measurement of average received level and level crossings, Spectrum efficiency evaluation.

Textbooks:

1. W.C.Y.Lee,—Mobile cellular telecommunications, Tata Mc-Graw Hill,2nd Edition,2006.
2. Theodore.S.Rapport,—Wireless communications, Pearson Education,2nd Edn.,2002.

References:

1. GordonL.Stuber,—Principles of Mobile communications, Springer International2nd Edition, 2007.
2. Lee,—Wireless and Mobile Communications, McGraw Hills, 3rdEdition,2006.
3. Jon W.Markand Weihua Zhqung,—Wireless communications and Networking,PHI,2005.
4. R.Blake,—Wireless communication Technology, Thompson Asia Pvt.Ltd.,2004.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

VLSI SIGNAL PROCESSING (VSP)

VII- Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC405	PE	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration:2Hrs						End Exam Duration:3Hrs		

Course Outcomes:

At the end of the course the student will be able to

CO1: Analyze the role of DSP algorithms in VLSI.

CO2: Apply the principles of DFG, SFG for DSP architectures and Compute iteration, loop bound

CO3: Apply pipelining and parallel processing for FIR and IIR systems to achieve high speed and Low power.

CO4: Analyze critical path constraints and evaluate the impact of unfolding and retiming on system Through put and latency.

CO5: Understand the overview of FIR filter Systolic architecture design

UNIT-I

Introduction to Digital Processing System:
Introduction, Typical DSP Algorithms, DSP Application demands and scaled CMOS technologies, Representation of DSP Algorithms.

UNIT-II

Iteration Bound:
Introduction, Data Flow Graph Representations, Loop Bound and Iteration Bound, Algorithms for computing iteration bound, Iteration bound of multirate data flow graphs.

UNIT-III

Pipelining and Parallel Processing:
Introduction, Pipelining of FIR Digital Filters, Parallel Processing, Pipelining and Parallel Processing for low power

UNIT–IV

Folding and Unfolding:
Introduction, Definitions and properties, Retiming Techniques, An algorithm for unfolding, Critical path, Unfolding and retiming, Applications of unfolding, Folding techniques. Register minimization techniques, Register minimization in folded architecture, Folding of multirate systems.

UNIT–V

Systolic Architecture Design: Introduction, System array design methodology, FIR systolic arrays, selection of scheduling vector, Matrix-matrix multiplication and 2-D systolic array design, Systolic Design for space representations containing delays.

Text Books:

1. Keshab K. Parthi, VLSI Digital Signal Processing-System Design and Implementation, Wiley Inter Science. 1998.
2. Kung S.Y. H. J. White House, T. Kailath, VLSI and Modern Signal Processing, Prentice Hall,1985

Reference Books:

1. France, Yannis Tsividis, Design of Analog, Digital VLSI Circuits for Telecommunications and Signal Processing, Prentice Hall,1994.
2. Medisetti V. K, VLSI Digital Signal Processing, IEEE Press(NY),USA,1995.

Web References:

1.https://nptel.ac.in/courses/117106093/

2.https://nptel.ac.in/courses/117102060/

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions(Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

DSP PROCESSORS & ARCHITECTURES (DSPA)

VII Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC406	PE	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration:3 Hrs		

Course Outcomes:

After the completion of the course students will be able to

CO1: Summarize the fundamental features and role of Digital Signal Processing in real world applications.

CO2: Evaluate dynamic range, precision, and error sources in DSP implementations.

CO3: Explain the architectural features of DSP processors and their computational efficiency.

CO4: Analyze the performance of DSP algorithms on programmable DSP platforms for specific applications

CO5: Select and implement DSP processors for real-time applications, including memory and peripheral interfacing.

UNIT – I

Introduction to Digital Signal Processing: Introduction, a Digital signal-processing system, the sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT – II

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

UNIT – III

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On- Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT – IV

Implementations of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

Implementation of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT – V
Interfacing Memory and I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example**.**

Textbooks:
1. Avtar Singh and S. Srinivasan, ―Digital Signal Processing Implementation‖, 1st Edition, Cengage learning, 2004.
2. Lapsley et al. S. Chand and Co, ―DSP Processor Fundamentals, Architectures & Features‖, 2000.

References:
1. B. Venkata Ramani and M. Bhaskar, ―Digital Signal Processors, Architecture, Programming and Applications‖, TMH, 2004.
2. Jonatham Stein, ―Digital Signal Processing: A Computer Science Perspective‖, John Wiley, 2000.

Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

5G COMMUNICATIONS (5G)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
EC407	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the 5G radio spectrum and channel models, including spectrum sharing and propagation challenges.

CO2: Analyze the 5G network architecture, including the core network, RAN, and physical layer procedures.

CO3: Evaluate different 5G radio-access technologies, including new waveforms and non-orthogonal multiple access schemes.

CO4: Apply network slicing concepts and vehicular communication techniques for efficient 5G network deployment.

CO5: Develop strategies for mobility and handoff management to optimize network performance and minimize interference.

UNIT – I

5G Radio Spectrum: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.

5G Channel Model: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling.

UNIT – II

Radio Interface Architecture: 5G architecture options, core network architecture, RAN architecture. 5G PHYSICAL LAYER: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming

UNIT – III

Radio-Access Technologies: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple

UNIT – IV

Introduction to 5G Network Slicing: Network Slicing, E2E Slicing, SDN and NFV Slicing Vehicular Communications: From V2V to AV2X, key standards, VC architectures, V2X Use cases

UNIT – V

Mobility and Handoff Management in 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

Textbooks:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, ―5G Mobile and Wireless Communications Technology‖, Cambridge University Press, 2016

2. Saad Z. Asif, ―5G Mobile Communications Concepts and Technologies‖, CRC Press, Taylor &Francis Group, First Edition, 2018

3. HarriHolma, Antti Toskala, Takehiro Nakamura, ―5G Technology 3GPP NEW RADIO‖, John Wiley & Sons First Edition, HarriHolma, Antti Toskala, Takehiro Nakamura, ―5G Technology 3GPP NEW RADIO‖, John Wiley & Sons First Edition.

References:

1. Gordon L. Stuber, ―Principles of Mobile Communication‖, KLUWER ACADEMIC PUBLISHERS, 2nd Edition, 2002

2. Joseph C. Liberti, Theodore S. Rappaport, ―Smart Antennas for Wireless Communications‖, Prentice Hall PTR, 1999 3. Ying Zhang, ―Network Function Virtualization Concepts and Applicability in 5G Networks‖, John Wiley & Sons, 2018

Ying Zhang, ―Network Function Virtualization Concepts and Applicability in 5G Networks‖, John Wiley & Sons, 2018.

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

RF SYSTEM DESIGN TOOLS (RFSD)

VII Semester: ECE								Scheme:2023
Course Code	Category	Hours/Week			Credits	Maximum Marks		
SCEC03	SEC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	1	2	2	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1: Utilize RF design software and tools to simulate and analyze RF circuits and components..

CO2: Design and implement impedance matching networks such as L-match, Pi-match, and Tmatch circuits.

CO3: Develop and evaluate RF amplifiers, filters, oscillators, and mixers for high-frequency applications.

CO4: Analyze microstrip transmission lines and measure their characteristics using S-parameters and Smith charts.

CO5: Design and simulate various types of antennas, including microstrip patch antennas, YagiUda antennas, and horn antennas

UNIT-I

Basic Concepts in RF Design: Introduce any RF design software and orient students with the tools of the laboratory. Practice the tool to use it for significant design. Introduction to RF Design, Time Variance and Nonlinearity, Effects of nonlinearity, Passive impedance transformation, Scattering parameters, impedance matching, L match, Pi match, T match, Passive IC Components Resistors, capacitors Inductors, Schottky Diode, RF Switch.

List of Experiments:

1. Design and simulate Impedance matching circuits like L-Matching, Pi Matching and TMatching.
2. Design and Simulate a Schottky Diode and RF Switch.

UNIT-II

RF Power Amplifiers and Filters: RF Power amplifier design examples, Gain equalizers, Voltage controlled oscillators, Phase locked loops, Linearized PLL models, PLL design examples, High frequency oscillators, Loop filters, lumped filter. LPF, HPF and BPF.

List of Experiments:

3. Design and simulate a Power Amplifier and Gain Equalizer.
4. Analyse and measure the gain of a Power Amplifier and equalize its gain using an Equalizer.
5. Design and simulate a High Frequency Oscillator and Lumped Filter.
6. Measurement of insertion loss, -3dB Cut of frequency of LPF,HPF and BPF.

UNIT-III

LNA, VCO and Mixers: General considerations, Problem of input matching, Low Noise Amplifiers design in various topologies, Gain Switching, Band Switching, Voltage Controlled Oscillators, Mixers-General considerations, Passive down conversion mixers, Active down conversion mixers, Up conversion mixers.

List of Experiments:

7. Design and simulate a RF BJT Amplifier and LNA.
8. Design and Simulate a VCO and RF Mixer.

UNIT-IV

Microstrip transmission lines and discontinuities: S parameters of a Microstrip Transmission Line, Smith Chart, Analysis of Microstrip Transmission Line standing wave patterns at various frequencies, Different types of Transmission lines like CPW, Microstrip and Co-axial cable. Different types of Microstrip discontinuities like Bend, T, Via, Gap etc., Microstrip Ring Resonator.

List of Experiments:

9. Measure the S parameters of a Microstrip Transmission Line and plot the normalized impedance on a smith chart.
10. Analysis of Microstrip Transmission Line standing wave pattern at various frequencies.
11. Study of different types of Transmission lines like CPW, Microstrip and Co-axial and find/measure its Insertion Loss (S21 and S12).
12. Study of different types of Microstrip discontinuities like Bend, T, Via, Gap etc and find/measure its Insertion loss.
13. Determine the Bandwidth and Quality Factor of a Microstrip Ring Resonator.

UNIT-V

Antennas and Microwave Integrated Circuits: Radiation Pattern, Gain, S Parameters, Return loss and VSWR. Design considerations of Microstrip Patch Antenna and Microstrip Array, Yagi Uda Antenna and Horn Antenna. Hybrid Microwave Integrated Circuits, Monolithic Microwave Integrated Circuits, Microwave Integrated Circuits: MMIC Amplifier.-

List of Experiments:

14. Design and simulate the Radiation Pattern, gain, S11and VSWR of a Microstrip Patch Antenna and Microstrip Array.
15. Design and simulate the Radiation Pattern, gain, S11and VSWR of a Yagi Uda Antenna and Horn Antenna.
16. Design and Simulate a MMIC Amplifier.

Any twelve experiments are to be done:

1. Design and simulate Impedance matching circuits like L-Matching, Pi Matching and TMatching.
2. Design and Simulate a Schottky Diode and RF Switch.
3. Design and simulate a RF BJT Amplifier and LNA.
4. Design and simulate a Power Amplifier and Gain Equalizer.
5. Analyse and measure the gain of a Power Amplifier and equalize its gain using an Equalizer.
6. Design and simulate a High Frequency Oscillator and Lumped Filter.
7. Measurement of insertion loss, -3dB Cut of frequency of LPF,HPF and BPF.
8. Design and Simulate a VCO and RF Mixer.
9. Measure the S parameters of a Micro strip Transmission Line and plot the normalized impedance on a smith chart
10. Analysis of Microstrip Transmission Line standing wave pattern at various frequencies.
11. Study of different types of Transmission lines like CPW, Microstrip and Co-axial and find/measure its Insertion Loss (S21 and S12)
12. Study of different types of Microstrip discontinuities like Bend, T, Via , Gap etc and find/measure its Insertion loss.
13. Determine the Bandwidth and Quality Factor of a Microstrip Ring Resonator.
14. Design and simulate the Radiation Pattern, gain, S11and VSWR of a Microstrip Patch Antenna and Microstrip Array.
15. Design and simulate the Radiation Pattern, gain, S11and VSWR of a Yagi Uda Antenna and Horn Antenna
16. Design and Simulate a MMIC Amplifier.

Textbooks:
1. Razavi, B. (2012). *RF Microelectronics* (2nd ed.). Pearson.
2. Pozar, D. M. (2012). *Microwave Engineering* (4th ed.). John Wiley & Sons.
3. Streetman, B. G., & Banerjee, S. K. (2016). *Solid State Electronic Devices* (7th ed.). Pearson.

References:
1. Edwards, T. C., & Steer, M. B. (2016). *Foundations for Microstrip Circuit Design* (5th ed.). John Wiley & Sons.
2. Balanis, C. A. (2016). *Antenna Theory: Analysis and Design* (4th ed.). John Wiley & Sons.
3. Egan, W. F. (2003). *Practical RF System Design* (1st ed.). John Wiley & Sons.
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 contains Five short answer questions (2 marks each) for a Total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten short answer questions (2 marks each) for a Total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

INDUSTRIAL IOT & AUTOMATION (IIOT &A)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
SCEC04	SEC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	1	2	2	30	70	100
Sessional Exam Duration:2Hrs					EndExamDuration:3 Hrs			

Course Outcomes:

At the end of the course the student will be able to

CO1: Explain the fundamental concepts of IIoT, its architecture, and the challenges associated with industrial automation.

CO2: Demonstrate the integration of sensors and actuators with Raspberry Pi / NodeMCU for real-time monitoring and control.

CO3: Implement communication protocols such as MQTT, ZigBee, and Bluetooth to enable seamless IIoT connectivity.

CO4: Develop web-based dashboards for real-time visualization and remote monitoring of IIoT devices.

CO5: Retrieve,analyze,andtransmitindustrialdatausingweb-basedinteractionsandM2M communication by implementing PLC-based automation, ladder logic programming, and SCADA for supervisory control in industrial environments

UNIT-I

Introduction & Architecture

What is IIoT and connected world? The difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Practice

1. Introduction to Arduino, Introduction to raspberry Pi.

UNIT-II

IIOT Components

Fundamentals of Control System, introductions, components, closed loop & open loop system. Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.

Practice

1. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.

UNIT-III

Communication Technologies of IIoT

Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFID Industry standards communication technology (MQTT), wireless network communication.

Practice

Demonstration of MQTT communication

UNIT-IV

Visualization and Data Types of IIoT

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

Practice

Visualization of diverse sensor data using dashboard (part of IoT's _control panel')
Sending alert message to the user. ways to control and interact with your environment)

UNIT-V

Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice

1. Device control using mobile Apps or through Web pages.
2. Machine to Machine communication.

Control & Supervisory Level of Automation

Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

Practice

1. Digital logic gates programming using ladder diagram.
2. Implementation of Boolean expression using ladder diagram.
3. Simulation of PLC to understand the process control concept.

Textbooks:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham(Ed.) (Springer Publication)
2. IndustrialInternetofThings:CybermanufacturingSystem**,**SabinaJeschke,Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun(editor)

Question Paper Pattern:

Sessional Exam:

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a Total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination:

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a Total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall answer any one of them. Each of these questions may contain sub-questions**.**

GENDER SENSITIZATION (GS)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC401	AC	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	0	-	-	-

Course Outcomes:

After the completion of the course students will be able to

CO1: Understand the basic concepts of gender and its related terminology.

CO2: Identify the biological, sociological, psychological and legal aspects of gender.

CO3: Use the knowledge in understanding how gender discrimination works in our society and how to counter it.

CO4:Analyze the gendered division of labour and its relation to politics and economics.

CO5:Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups

CO6:Develop students' sensibility with regard to issues of gender in contemporary India

UNIT – I

UNDERSTANDING GENDER Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II

GENDER ROLES AND RELATIONS: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum.

UNIT – III

GENDER AND LABOUR: Division and Valuation of Labor-Housework: The Invisible Labor- -My Mother doesn't Work.‖-Share the Load.‖-Work: Its Politics and Economics -Fact and Fiction-Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

UNIT – IV

GENDER-BASED VIOLENCE: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

UNIT – V

GENDER AND CULTURE: Gender and Film-Gender and Electronic Media-Gender and Advertisement- Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships.

Textbooks:

1. A. Suneetha, Uma Bhrugubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn. March 1990.

References:

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India,* London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment,* London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A. Revathy & Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

CONSTITUTION OF INDIA (COI)

VII Semester: ECE						Scheme:2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
AC402	AC	2	0	0	0	-	-	-

Course Outcomes:

At the end of the course the student will be able to

CO1: Identify and explore the basic features and modalities about Indian Constitution.

CO2: Measure the powers and functions of Union government and State executive. Duties of President, Vice President, Prime Minister, Governor, Chief Minister cabinet and State Legislature.

CO3: Learn the constitutionalamendmentsof42,44,74,76,86and91.Central-Staterelations, President rule.

CO4: To know about Indian social structure and languages in India. Rights of women, SC, ST and then weaker Section.

CO5: Differentiate different aspects of Indian legal system and its related bodies

UNIT-I

Historical back ground, Significance of Constitution, Making of the constitution, Role of the constituent Assembly, Salient features, the Preamble, Citizenship, procedure for amendment of Constitution Fundamental rights-Derivative principles of state policy-Elections in India.

UNIT-II

Union Executive: Structures of Union Government & Functions, President, Vice President, Prime Minister, Cabinet, Parliament- State Executive: Structures and Functions, Governor, Chief Minister, Cabinet, State Legislature

UNIT-III

Central, State Relations, President's Rule, Constitutional Amendments [42, 44, 74, 76, 86 & 91]-Constitutional functionaries, Working of Parliamentary system in India

UNIT-IV

Indian Social Structure, Languages in India- Political Parties & Pressure groups, Rights of Women S.C's, S.T's &other weaker sections.

UNIT-V

Judiciary: Structure, Organisation of Judiciary, independence of the Judiciary, role and functions of Supreme Court, High Courts & Subordinate courts, Judicial Review.

Text Books:

1.DurgaDasBasu,*"IntroductiontotheConstitutionofIndia"*,Wedwe&Company

2.Macivel,Page,"AnIntroductionAnalysis", Society

3.M.V.Pylee,*"IndianConstitution"*,S.ChandPublications

4.Subhash C Kashyao:*"Our Constitution"*, National Bank, Trust, India.

5.ConstitutionalLawofIndiabyDr.S.M.Rajan

Reference Books:

1. The Constitution of India. By the Ministry of Law and Justice, The Govt.of India.

2. Constitutional Law of India by kashyap subhasah

3.IndianconstitutionLawbyM.P.Jain

4.ConstitutionalLawofIndiabyH.MSeervai

Web References:

1.https://www.india.gov.in/my-government/constitution-india

GREEN BUILDINGS (GB)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE501	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the importance of green buildings, their necessity, and sustainable features
CO2:	Analyze various green building practices, rating systems, and their impact on environmental sustainability.
CO3:	Apply principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
CO4:	Evaluate HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
CO5:	Assess material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

UNIT – I

Introduction to Green Building: Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable Features for Green Buildings.

UNIT – II

Green Building Concepts and Practices: Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Green Building Rating Systems, Residential Sector, Market Transformation

Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT – III

Green Building Design: Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – IV

Air Conditioning: Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – V

Material Conservation: Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture.

Indoor Environment Quality and Occupational Health: Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference Books:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code–ECBC-2020, published by BEE
4. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S NanjundaRao – New Age International Publishers
5. Non-conventional Energy Resources – By D S Chauhan and S K Sreevasthava – New Age International Publishers

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102195/
2. https://igbc.in/resources
3. https://www.grihaindia.org/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CONSTRUCTION TECHNOLOGY AND MANAGEMENT (CTM)

V Semester: All Branches Except CE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE502	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand project management fundamentals, organizational structures, and leadership principles in construction.
CO2:	Solve and formulate network analysis in CPM and PERT networks.
CO3:	Understand the structure of organization and resource allocation
CO4:	Evaluate various contract types, contract formation, and legal aspects in construction management
CO5:	Assess safety management practices, accident prevention strategies, and quality management systems in construction

UNIT – I

Introduction: Management Objectives and Functions; Stages of Project Management - Types of Organization, Organizational Chart of a Construction Company – Team of Construction Unit - Manager's Duties and Responsibilities.

Construction Planning and Scheduling: Objectives and importance of planning and scheduling – Methods of Planning and Scheduling.

UNIT – II

Network Techniques in Construction management: Elements of network – Network techniques – Breakdown structures – Representation and specifying of activities and events – Rules for Network.

Critical Path Method (CPM): Introduction – Difference between CPM and PERT – Time estimates – Float – Critical path – Network analysis and computation problems.

UNIT – III

Program Evaluation and Review Technique (PERT): Introduction, time estimates, slack, critical path – Network analysis and computation problems.

Cost–Time Analysis in Net Work Planning: Importance of time – Project cost analysis innetwork planning – Updating – Resources allocation.

UNIT – IV

Tenders and Contracts: Type of tenders – Principles of tendering – Notice inviting tender – Contracts definition – Essentials – Types – Documents – Conditions of contracts.

Arbitration: Definition – Arbitrator – Arbitration agreement – Qualification of arbitrator – Advantages of arbitration.

UNIT – V

Safety Management: Implementation and Application of QMS, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety.

Text Books:

1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019
3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

Reference Books:

1. Brien, J.O. andPlotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010.
2. Punmia, B.C., andKhandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management andOrganisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104161/
2. https://archive.nptel.ac.in/courses/105/103/105103093/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRICAL SAFETY PRACTICES AND STANDARDS (ESPS)

V Semester: All Branches Except EEE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE503	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understanding the Fundamentals of Electrical Safety
CO2:	Identifying and Applying Safety Components
CO3:	Analyzing Grounding Practices and Electrical Bonding
CO4:	Applying Safety Practices in Electrical Installations and Environments
CO5:	Evaluating Electrical Safety Standards and Regulatory Compliance

UNIT – I

Introduction To Electrical Safety: Fundamentals of Electrical Safety-Electric Shock-physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT – II

Safety Components: Introduction to conductors and insulators- voltage classification - safety against over voltages- safety against static electricity-Electrical safety equipment‘s - Fire extinguishers for electrical safety.

UNIT – III

Grounding: General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.

UNIT – IV

Safety Practices: General first aid- Safety in handling hand held electrical appliances tools-Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.

UNIT – V

Standards For Electrical Safety: Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate

Text Books:

1. Massimo A.G.Mitolo, “Electrical Safety of Low-Voltage Systems”, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, “Electric Safety - Practice and Standards”, CRC Press, USA, 2014.

Reference Books:

1. Kenneth G.Mastrullo, Ray A. Jones, “The Electrical Safety Program Book”, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, “Electrical Safety-Related Work Practices”, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., “Electrical Safety Engineering”, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, “Electrical Safety Hand book”, McGraw-Hill, New York, USA, 4th edition, 2012.

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/nou25_ec08/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SUSTAINABLE ENERGY TECHNOLOGIES (SET)

V Semester: All Branches Except ME					Scheme: 2023			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE504	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the importance of solar radiation and solar PV modules.
CO2:	Describe the storage methods in PV systems
CO3:	Explain the solar energy storage for different applications
CO4:	Illustrate the principles of wind energy, and bio-mass energy.
CO5:	Attain knowledge in geothermal energy, ocean energy and fuel cells.

UNIT – I

Solar Radiation: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

Solar PV Modules and PV Systems: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT – II

Storage in PV Systems: Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT – III

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – IV

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

Bio-Mass: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – V

Geothermal Energy: Origin, Applications, Types of Geothermal Resources, Relative Merits. **Ocean Energy**: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges.

Fuel Cells: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text Books:

1. Sukhatme S.P. and J.K.Nayak , Solar Energy – Principles of Thermal Collection and Storage, TMH, 2009

2. Khan B.H , Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi,2006

3. Twidell & Weir, Renewable Energy Sources , Taylor and Francis / 2nd Special Indian Edition,2006

4. G.N Tiwari and M.K.Ghosal , Fundamentals of Renewable Energy Sources, Alpha Science International Limited, 2007

Reference Books:

1. D.Yogi Goswami, Frank Krieth& John F Kreider , Principles of Solar Engineering , Taylor & Francis,2015

2. Ashok V Desai ,Non-Conventional Energy , New Age International (P) Ltd,1990

3. R. Ramesh & K. Uday Kumar,Renewable Energy Technologies, Narosa Publishing,1997

4. G.D Roy , Non-conventional Energy Source, Standard Publishers,2004

5. Anjaneyulu & Francis , Energy Resources Utilization and Technologies , BS Publications/2012.

6. Frank Krieth & John F Kreider, Principles of Solar Energy, Hemisphere Publications.2000

Online Learning Resources:

1. https://nptel.ac.in/courses/112106318

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRONIC CIRCUITS (EC)								
V Semester: All Branches Except ECE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE505	**OE-I**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to

CO1:	Illustrate the VI Characteristics of Diode and special purpose diodes, Design rectifiers, wave shaping circuits and describe the behavior of special purpose diodes.
CO2:	Explore the operation, configurations, and biasing of BJTs.
CO3:	Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
CO4:	Understand the operation, applications and uses of feedback amplifiers and oscillators
CO5:	Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT – I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode

UNIT – II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT – III

Single Stage Amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage Amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT – IV

Feedback Amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT – V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential. **Applications of Op-amp:** Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

Text Books:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

Reference Books:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LousisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

JAVA PROGRAMMING (JP)

V Semester: CE, EEE, ME and ECE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE506	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2:	Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
CO3:	Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
CO4:	Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5:	Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX
CO6:	Choose appropriate data structure of Java to solve a problem

UNIT – I

Object Oriented Programming: Basic concepts, Features of Java , Principles

Program Structure in Java: Introduction, Writing Simple Java Programs, Java Statements

Data Types, **Variables, and Operators:** Introduction, Data Types in Java, Declaration of Variables, Type Casting, Scope of Variable Identifier, Variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting

Introduction to Operators: Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (--) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bit-wise Logical Operators.

Control Statements: Introduction, Control Statements- If Nested loops, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop

UNIT – II

Classes and Objects: Introduction to Classes: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Constructor Methods for Class, , Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this, finalize and Wrapper classes

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, , Attributes Final and Static.

UNIT – III

Arrays: Introduction, Declaration and Initialization of Arrays, Memory Storage & Access, Array Operations, Arrays as Vectors. Two dimensional Arrays, Arrays of Varying Lengths, Three dimensional Arrays.

Inheritance: Introduction, Access Control and Types of Inheritance, Multilevel and Hierarchical Inheritance, Final and Super keywords, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, , Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT – IV

Packages and Java Library :Packages:

Introduction, Defining Package, Importing Packages and Classes into Programs, Access Control, Packages in Java SE, Class Object, Enumeration, class Math, Wrapper Classes, Java util Classes and Interfaces, Formatter Class, Random Class, Formatting for Date/Time in Java

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throw able, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams.

UNIT – V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Java thread model, Creating a thread-Extending Thread class and Implementing Runnable interface, Thread life cycle, Thread class methods, Thread priorities, Deadlocks in Threads, Thread Synchronization and Inter Thread Communication

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0128804645476 18816347 _shared/overview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (FAI)

V Semester: CE, EEE and ECE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE507	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes : At the end of the course, students will be able to

CO1:	Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
CO2:	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO3:	Learn different knowledge representation techniques.
CO4:	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
CO5:	Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
CO6:	Analyze Supervised Learning Vs. Learning Decision Trees.

UNIT – I

Introduction to AI: Intelligent Agents, Problem-Solving Agents.

Searching for Solutions: Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT – II

Games: Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic- Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT – III

First-Order Logic: Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. **Knowledge Representation:** Ontological Engineering, Categories and Objects, Events.

UNIT – IV

Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT – V

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Text Books:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

Reference Books:

1. Artificial Intelligence, 3rd Edition, E. Rich and K. Knight (TMH).
2. Artificial Intelligence, 3rd Edition, Patrick Henny Winston, Pearson Education.

3.	Artificial Intelligence, Shivani Goel, Pearson Education.
4.	Artificial Intelligence and Expert systems – Patterson, Pearson Education.
Online Learning Resources:	
1.	https://swayam.gov.in/nd1_noc19_me71/preview
2.	https://ai.google/
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ETHICAL HACKING (EH)

V Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE508	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the basics of security and ethical hacking.
CO2:	Understand about foot printing and types of attacks in social engineering.
CO3:	Understand about sniffers, hijacking and DoS attacks.
CO4:	Understand the importance of web server hacking, database hacking and SQL Injection.
CO5:	Understand about Wireless technologies, intrusion detection and firewalls.

UNIT – I

Introduction to Ethical Hacking: Introduction, Security fundamentals, Security testing, Hackers and crackers description, Ethical Hackers.

Technical Foundations of Hacking: The Hacking process, Information Security Systems and the Stack.

UNIT – II

Foot printing: Information Gathering Methodology , OS Fingerprinting, Fingerprinting Services, Enumeration, System Hacking.

Social Engineering: Social Engineering, Malware threats, Vulnerability analysis.

UNIT – III

Sniffers: Passive sniffing, Active sniffing, ARP,ARP poisoning and MAC flooding, tools for sniffing, wire shark, sniffing and spoofing countermeasures.

Session Hijacking: Transport layer Hijacking, Application layer Hijacking, Session Hijacking **Tools. Denial of Service:** DoS attack techniques, Distributed DoS, DDoS tools.

UNIT – IV

Web Server Hacking: HTTP protocol, scanning web servers, Banner grabbing and Enumeration, Web server, DoS/ DDoS and DNS attacks.

Database Hacking: Introduction to SQL and SQL injection and categories, Finger printing, UNION Exploitation technique, Boolean in SQL injection attacks, Out-of band exploitation, exploring the time-delay SQL injection technique, Stored procedure SQL injection and mitigations, SQL injection hacking tools.

UNIT – V

Wireless Technologies, Mobile Security: Mobile device operation and security, Wireless LAN's- Basics, Wireless LAN frequencies and signalling, Wireless LAN security.

IDS: Intrusion Detection and Prevention Systems. Firewalls and Honey pots.

Text Books:

1. Micheal Gregg, "Certified Ethical Hacker (CEH) Cert Guide", Pearson education, 2020.

Reference Books:

1. EC-Council, "Ethical Hacking and Counter measures (CEH)",CENGAGE Learning, 2020
2. Sai Satish, "Hacking Secrets Part-1", Indian Servers, 2018.
3. David Litchfield, Chris Anley "The Database Hackers Handbook: Defending Database Servers", Wiley.

Online Learning Resources:

1. https://www.coursera.org/courses?query=ethical%20hacking

2. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

3. https://www.geeksforgeeks.org/ethical-hacking-tutorial/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MATHEMATICS FOR MACHINE LEARNING AND AI (MMLA)								
V Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE509	**OE-I**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to

CO1:	Apply linear algebra concepts to ML techniques like PCA and regression
CO2:	Analyze probabilistic models and statistical methods for AI applications.
CO3:	Implement optimization techniques for machine learning algorithms.
CO4:	Utilize vector calculus and transformations in AI-based models.
CO5:	Develop graph-based AI models using mathematical representations.

UNIT – I

Linear Algebra for Machine Learning: Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigen values, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT – II

Probability and Statistics for AI: Probability distributions: Gaussian, Binomial, Poisson. Bayes‘ Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT – III

Optimization Techniques for ML: Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton‘s method, BFGS method.

UNIT – IV

Vector Calculus & Transformations: Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications

UNIT – V

Graph Theory for AI: Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Text Books:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learningby Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Online Learning Resources:

1. https://ocw.mit.eduhttps://
2. https://cs229.stanford.edu/
3. https://deepai.org

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MATERIALS CHARACTERIZATION TECHNIQUES (MCT)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE510	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Analyze the crystal structure and crystallite size by various methods
CO2:	Analyze the morphology of the sample by using a Scanning Electron Microscope
CO3:	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope
CO4:	Explain the principle and experimental arrangement of various spectroscopic techniques
CO5:	Identify the construction and working principle of various Electrical & Magnetic Characterization technique

UNIT – I

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT – II

Microscopy technique -1 –Scanning Electron Microscopy (SEM): Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT – III

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT – IV

Spectroscopy techniques: Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT – V

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Text Books:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.

2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall , 2001 – Science.

3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.

4. Materials Characterization Techniques -Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

Online Learning Resources:

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CHEMISTRY OF ENERGY SYSTEMS (CES)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE511	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Solve the problems based on electrode potential, Describe the Galvanic Cell, Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2:	Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell, Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3:	Differentiate between Photo and Photo electro chemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photo electron catalytic conversion.
CO4:	Apply the photovoltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power
CO5:	Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic framework, Illustrate the carbon and metal oxide porous structures, Describe the liquification methods.

UNIT – I

Electrochemical Systems: Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction, Lead-acid, Nickel- cadmium, Lithium ion batteries and their applications.

UNIT – II

Fuel Cells: Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT – III

Photo and Photo electrochemical Conversions: Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT – IV

Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications

UNIT – V

Hydrogen Storage: Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Text Books:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.

3.	Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4.	Hydrogen storage by Levine Klebonoff

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ENGLISH FOR COMPETITIVE EXAMINATIONS (ECE)

V Semester: All Branches					Scheme: 2023			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE512	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course, students will be able to

CO1:	Identify the basics of English grammar and its importance
CO2:	Explain the use of grammatical structures in sentences
CO3:	Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams
CO4:	Analyze an unknown passage and reach conclusions about it
CO5:	Choose the appropriate form of verbs in framing sentences
CO6:	Develop speed reading and comprehending ability thereby perform better in competitive exams

UNIT – I

Grammar - I: Nouns-classification-errors, Pronouns-types-errors, Adjectives-types-errors, Articles-definite indefinite, Degrees of Comparison, Adverbs-types- errors, Conjunctions-usage Prepositions-usage, Tag Questions, types-identifying errors- Practice

UNIT – II

Grammar - II: Verbs-tenses- structure-usages- negatives- positives- time adverbs, Sequence of tenses--If Clause, Voice-active voice and passive voice, reported Speech, Agreement-subject and verb Modals-Spotting Errors-Practices

UNIT – III

Verbal Ability: Sentence completion-Verbal analogies-Word groups-Instructions, Critical reasoning-Verbal deduction-Select appropriate pair, Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT – IV

Reading Comprehension and Vocabulary: Competitive Vocabulary :Word Building – Memory techniques, Synonyms, Antonyms, Affixes-Prefix &Suffix, One word substitutes, Compound words, Phrasal Verbs, Idioms and Phrases, Homophones, Linking Words, Modifiers, Intensifiers - Mastering Competitive Vocabulary, Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT – V

Writing for Competitive Examinations: Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing Expansion of proverbs- Essay writing-types

Text Books:

1. Wren & Martin, English for Competitive Examinations, S.Chand & Co, 2021.
2. Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014

Reference Books:

1. Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3. Shalini Verma , Word Power Made Handy, S Chand Publications
4. Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.

5. Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.

6. Michel Swan, Practical English Usage,Oxford,2006.

Online Learning Resources:

1. https://www.grammar.cl/english/parts-of-speech.htm
2. https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3. https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice
4. https://languagetool.org/insights/post/verb-tenses/
5. https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
6. https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

Question Paper Pattern:

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ENTREPRENEURSHIP AND NEW VENTURE CREATION (ENVC)

V Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE513	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the concept of entrepreneurship, analyze its role in economic development, and develop a creative mindset for starting a business.
CO2:	Understand customer problems, validate them with potential customers, and evaluate customer segments and personas.
CO3:	Evaluate customer needs through jobs-to-be-done analysis and develop value propositions using prototypes and MVPs.
CO4:	Apply lean business models, financial and sales plans to design a venture with suitable funding and marketing channels.
CO5:	Analyze scaling aspirations and venture components to develop an investor-ready pitch

UNIT – I

Entrepreneurship Fundamentals and Context: Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

UNIT – II

Problem & Customer Identification: Understanding and analyzing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion –identifying and defining problem using Design thinking principles –Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

UNIT – III

Solution Design, Prototyping & Opportunity Assessment and Sizing: Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

UNIT – IV

Business & Financial Model, Go-To-Market Plan: Introduction to Business model and types, Lean approach,9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity Map the Start-up Life-cycle to Funding Options.

UNIT – V
Scale Outlook and Venture Pitch Readiness: Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.
Text Books:
1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha. Entrepreneurship, McGrawHill, 11th Edition.(2020)
2. Ries, E.The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, (2011).
Reference Books:
1. Simon Sinek,Start with Why, Penguin Books limited. (2011)
2. Brown Tim,Change by Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business.(2019)
4. Namita Thapar(2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
Online Learning Resources:
1. https://wadhwanifoundation.org/initiatives/entrepreneurship/
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

DISASTER MANAGEMENT (DM)								
VI Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE601	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the definitions and terminologies used in disaster management.
CO2:	Understand the types and categories of disasters.
CO3:	Understand the impact of disasters on socio-economic and environment.
CO4:	Plan for disaster risk reduction, mitigation and management strategies.
CO5:	Understand the relationship between development and disasters.

UNIT – I

Introduction: Concepts and definitions: disaster, hazard, vulnerability, risks, severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT – II

Disasters: Disasters classification

Natural Disasters: Floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.

Manmade Disasters: Industrial pollution – Artificial flooding in urban areas –Nuclear radiation – Chemical spills – Transportation accidents – Terrorist strikes, etc. – Mountain and coastal areas.

UNIT – III

Disaster Impacts: Disaster impacts –Environmental, physical, social, ecological, economic, political, etc., Health - psycho-social issues – Demographic aspects – Hazard locations – Global and national disaster trends – Climate change and urban disasters.

UNIT – IV

Disaster Risk Reduction:

Disaster Management Cycle - its phases: Prevention, mitigation, preparedness, relief and recovery – Risk analysis, vulnerability and capacity assessment – Early warning systems.

Post-Disaster Environmental Response (i.e. water, sanitation, food safety, waste management, disease control, security, and communications): Role and responsibilities of government, community, local institutions, NGOs and other stakeholders – Policies and legislation for disaster risk reduction – Activities of National Disaster Management Authority.

UNIT – V

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications – Sustainable and environmental friendly recovery – Reconstruction and development methods.

Text Books:

3. PradeepSahni, Disaster Risk Reduction in South Asia, PHI, New Delhi.

4. Ghosh G.K., Disaster Management, APH Publishing Corporation.

5. Singh B.K., Handbook of Disaster Management Techniques &Guidelines, Rajat Publication.

6. V. K. Sharma, Disaster Management, National Centre for Disaster Management, IIPE, Delhi

Reference Books:

6. A Status Report Publication of the Govt. of India, Ministry of Home Affairs, National Disaster Management Division, Disaster Management in India.
7. A. S. Arya, Anup Karanth, and Ankush Agarwal, Hazards, Disasters and Your Community; A Primer for Parliamentarians, GOI–UNDP Disaster Risk Management Programme.
8. Interagency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC.

Online Learning Resources:

4. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
5. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
6. www.odihpn.org, Disaster Preparedness Programme in India. A Cost Benefit Analysis, Commissioned and Published by the Humanitarian Practice Network 'at ODI HPN.
7. www.empowerpoor.org, Drought in India: Challenges and Initiatives; Poorest Areas in Civil Society (PACS) Programme. [2001–2008]

Question Paper Pattern:

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End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SUSTAINABILITY IN ENGINEERING PRACTICES (SIE)								
VI Semester: All Branches					**Scheme: 2023**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE602	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
CO2:	Analyze sustainable construction materials, their durability, and lifecycle assessment.
CO3:	Apply Energy Calculations in construction materials and assess the embodied energy.
CO4:	Evaluate green building standards, energy codes, and performance ratings.
CO5:	Assess the environmental effects of energy use, climate change, and global warming.

UNIT – I

Introduction: Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO2Contribution From Cement and Other Construction Materials.

UNIT – II

Materials Used in Sustainable Construction: Construction Materials and Indoor Air Quality-No/Low Cement Concrete-Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT – III

Energy Calculations: Components of Embodied Energy-Calculation of Embodied Energy for Construction Materials-Energy Concept and Primary Energy-Embodied Energy Via-A-Vis Operational Energy in Conditioned Building -Lifecycle Energy Use.

UNIT – IV

Green Buildings: Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building.

UNIT – V

Environmental Effects: Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

Text Books:

1. Charles J kibert Sustainable Construction: Green Building Design & Delivery,4th Edition, Wiley Publisher 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK,2016.

Reference Books:

1. Carig A.Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods& Techniques (3e),Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105157/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

RENEWABLE ENERGY SOURCES (RES)								
VI Semester: All Branches Except EEE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE603	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand principle operation of various renewable energy sources.
CO2:	Identify site selection of various renewable energy sources.
CO3:	Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomass, Tidal Wave and Fuel cell energies.
CO4:	Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems
CO5:	Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT – I

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT – II

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT – III

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT – IV

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT – V

Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Biomass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration.

Fuel Cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text Books:

1. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.
2. Chetan Singh Solanki "Solar Photo voltaics fundamentals, technologies and applications" 2nd Edition PHI Learning Private Limited. 2012.

Reference Books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. S. P. Sukhatme, "Solar Energy", 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
3. B H Khan,"Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
4. S. Hasan Saeed and D.K.Sharma, "Non-Conventional Energy Resources", 3rd Edition, S.K.Kataria& Sons, 2012.
5. G. N. Tiwari and M.K.Ghosal, —Renewable Energy Resource: Basic Principles and Applications, Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

AUTOMATION AND ROBOTICS (ART)								
VI Semester: All Branches except ME					**Scheme: 2023**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE604	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand the fundamentals of automation, manufacturing systems and automation hardware.
CO2:	Analyze automated flow lines and apply assembly line balancing methods.
CO3:	Classify robots, joints, actuators, and sensors used in robotic systems.
CO4:	Solve basic manipulator kinematics using transformation matrices.
CO5:	Explain the robot programming method and its applications.

UNIT – I

Introduction to Automation: Notion of Automation, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT – II

Automated Flow Lines: Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – III

Introduction to Robotics: Definition of Robot, Classification of Robot configurations, Types of Joints, degrees of freedom, End effectors, types of end effectors, Grippers-Mechanical grippers, Vacuum cups, magnetic grippers, Tools.

Robot Actuators and Feedback Components: Electrical Actuators (Variable Reluctance stepper motor, Permanent magnet stepper motor), Hydraulic and Pneumatic actuators. Position sensors–Potentiometer, Resolvers, Encoders. Velocity sensors, Tactile sensors, Proximity sensors.

UNIT – IV

Manipulator Kinematics: Introduction to manipulator kinematics, position representation, forward transformation and reverse transformation of two degree freedom robot arm, three degree of freedom arm in two dimensions, four degree freedom manipulators in three dimension, 3×3 Rotation matrix, Homogeneous transformation matrix and D – H notation matrix.

UNIT – V

Robot Programming: Methods of robot programming- Lead through- WAIT, SIGNAL and delay commands; The textual robot programming languages, robot language structures, constants, variables and other data objects, motion commands, end effectors, sensors commands and monitor mode commands.

Robot Applications in Manufacturing: Material transfer and machine loading and unloading general considerations in material handling.

Processing Operations: Spot welding, continuous arc welding, spray coating, and other processing operations. Assembly and Inspection.

Text Books:
1. M P Groover, Automation , Production systems and Computer Integrated Manufacturing, Pearson Education, India
2. Mickel P Groover et. al, Industrial Robotics- Technology, Programming and Applications, McGraw Hill Publishers, New Delhi.
3. Deb S.R., Robotics Technology and Flexible Automation, TMH Publishers, New Delhi.
Reference Books:
1. Richard D. Klafter, Robotic Engineering: An Integrated Approach, Pearson Publications, New Jersy.
2. K. S. Fu, Ralph C. Gonzalez and C.S.G. Lee, Robotics, control, sensing, vision, Mc Graw Hill, New York.
3. Ashitava Ghosal, Robotics fundamental concepts and analysis, Oxford Higher Education, India
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

PRODUCT LIFECYCLE MANAGEMENT (PLM)								
VI Semester: All Branches Except CE						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE605	**OE- II**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes: At the end of the course the student will be able to

CO1:	Understand Product life cycle management process.
CO2:	Understand different steps in Product development process.
CO3:	Get knowledge on Product data management
CO4:	Understand the implementation of PLM and its impact on the organization
CO5:	Understand core functions of PLM and supply chain and ERP systems

UNIT – I

Organization Business Models **(**MTS, MTO, CTO, ETO Etc), Basics of Enterprise Systems (PLM, ERP, MES), Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Components / Elements of PLM, Emergence of PLM, Significance of PLM, Differences between PLM and PDM

UNIT – II

Integrated Product development process-Conceive-Specification, Concept design, Design-Detailed design, Validation and analysis (Simulation), Tool design, Realize-Plan manufacturing, Manufacture, Build/Assemble, Test(quality check).

UNIT – III

Workflow Processes, Design Collaboration, Processes Management, Document Management, Visualization, Bill of Materials (BOM) Management – Lab exercises.

UNIT – IV

Engineering Change Control, Configuration Management, Manufacturing Process Management, Variant Management, Classification PLM Architecture, Various PLM tools, Data Modeling, Security management.

UNIT – V

CAD Integrations, Information authoring tools (e.g., MCAD, ECAD, Technical publishing), Core functions (e.g., data vaults), Data Flow to Other systems such as Supply chain and ERP systems. (4 hours for lab exercises)

Text Books:

1. Grieves, Michael, Product Lifecycle Management, McGraw-Hill publishers.
2. Antti Saaksvuori and Anselmi Immonen, Product Life Cycle Management, Springer publications

Reference Books:

1. Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill International
2. Burden, Rodger PDM: Product Data Management, Resource Publications.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

DIGITAL ELECTRONICS (DE)								
VI Semester: All Branches Except ECE						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE606	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : After the completion of the course students will be able to	
CO1:	Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
CO2:	Analyze combinational circuits like adders, sub tractors, and code converters.
CO3:	Explore combinational logic circuits and their applications in digital design.
CO4:	Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
CO5:	Gain knowledge about programmable logic devices and digital IC's.

UNIT – I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR AND and NAND/NOR realizations.

UNIT – II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Grayto Binary, BCD to excess3, BCD to Seven Segment display.

UNIT – III

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT – IV

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT – V

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL). Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

Text Books:

1. M Morris Mano and Michel D Ciletti, Digital Design, 5th Edition, Pearson Education, 1999
2. Zvi Kohavi and Nirah K Jha, Switching theory and Finite Automata Theory, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Charles H Roth, Jr., Fundamentals of Logic Design, 5th Edition, Brooks/cole Cengage Learning, 2004.

Online Learning Resources:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. www.odihpn.org, Disaster Preparedness Programme in India. A Cost Benefit Analysis,

Commissioned and Published by the Humanitarian Practice Network 'at ODI HPN.
4. www.empowerpoor.org, Drought in India: Challenges and Initiatives; Poorest Areas in Civil Society (PACS) Programme. [2001–2008]

Question Paper Pattern:

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FOUNDATIONS OF OPERATING SYSTEMS (FOS)								
VI Semester: CE, EEE, ME and ECE						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE607	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
CO2:	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
CO3:	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
CO4:	Illustrate different conditions for deadlock and their possible solutions,memory management and its allocation policies.
CO5:	Design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms.

UNIT – I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging.

UNIT – II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson‘s Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT – IV

Memory- Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Allocation of frames, Thrashing. Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT – V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File System Mounting, Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:

1. Silber schatz A, Galvin P B, Gagne G, Operating System Concepts, 10th Edition, Wiley, 2018.
2. Tanenbaum A S, Modern Operating Systems, 4th Edition, Pearson , 2016

Reference Books:

1. Stallings W, Operating Systems -Internals and Design Principles, 9th edition, Pearson, 2018
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach, 3rd Edition, McGraw-Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/

Question Paper Pattern:

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End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

FOUNDATIONS OF MACHINE LEARNING (FML)								
VI Semester: CE, EEE and ECE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE608	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Identify machine learning techniques suitable for a given problem.
CO2:	Solve the problems using various machine learning techniques.
CO3:	Design application using machine learning techniques.
CO4:	Understand and explore Supervised Learning techniques.
CO5:	Understand and explore unsupervised learning techniques.

UNIT – I

Introduction to Machine Learning & Preparing to Model: Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.

UNIT – II

Modelling and Evaluation &Basics of Feature Engineering: Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.

UNIT – III

Bayesian Concept Learning & Supervised Learning: Classification: Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network. Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour(kNN), Decision tree, Random forest model, Support vector machines.

UNIT – IV

Supervised Learning: Regression: Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT – V

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K- Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules.

Text Books:

1. Saikat Dutt, Subramanian Chandra mouli, Amit Kumar Das, Machine Learning, Pearson, 2019.

Reference Books:

1. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Online Learning Resources:

1. Andrew Ng, "Machine Learning B.Techning"
2. https://www.deeplearning.ai/machine-learning- B.Techning/
3. Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press.
4. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Question Paper Pattern:

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WEB TECHNOLOGIES (WT)								
VI Semester: CE, EEE, ME and ECE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE609	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Design a Web Page using Text Formatting Tags, Hyperlinks.
CO2:	Develop a webpage with Images, Tables Hyperlinks, Lists, and CSS.
CO3:	Design dynamic web pages using JavaScript.
CO4:	Design a Form using HTML Forms & Controls.
CO5:	Understand the basic concepts of PHP and database connection using XAMPP Server.

UNIT – I

HTML5: Overview of HTML5 and other web technologies, HTML5 and its essentials, Fundamentals of HTML5,Working with Text and organizing Text in HTML, Working with Links and URLs.

UNIT – II

Images: Working with Images, Image Maps, Creating Tables, Frames CSS: Overview of CSS, Backgrounds and Color Gradients in CSS, Fonts and Text Styles, List Styles, Table Layouts

UNIT – III

JavaScript: Overview of java script, Functions, Events, Java script Objects, Working with Browser Objects, Document Object, Document Object Model, Validation, Errors, and Exception Handling in JavaScript.

UNIT – IV

Forms: What's a Form? What Controls are available? Creating a Form and adding HTML Controls, Submitting Data from forms, Customizing Controls in CSS, Form validation using Java Script, Interactive Elements.

UNIT – V

Introduction to PHP: Installing and Configuring PHP: Building PHP with Apache on Windows, The Basics of PHP scripts. The Building blocks of PHP: Variables, Data Types, Operators and Expressions, Constants. Creating Forms, Accessing Form Input with User defined Arrays, Combining HTML and PHP code on a single Page, XAMPP Server configuration.

Text Books:

1. HTML5 Black Book, 2nd Edition, Dreamtech Press, 2016
2. Deitel and Deitel and Nieto, ―Internet and World Wide Web - How to Program‖ , Prentice Hall, 5th Edition, 2011.
3. Julie C. Meloni, PHP MySQL and Apache, SAMS Teach yourself, Pearson Education (2007).

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford Higher Education., 1st edition, 10th impression, 2015.
2. Robert Pattinson, Beginners Guide for HTML and CSS Web Design and Web Development,2018.
3. Jeffrey C and Jackson, ―Web Technologies A Computer Science PerspectivePearsonEducation, 2011.

4. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.

Online Learning Resources:

1. https://www.tutorialspoint.com/Html/index.htm
2. https://www.w3.org/Style/CSS/
3. https://www.w3schools.com/php/

Question Paper Pattern:

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INTRODUCTION TO INFORMATION SYSTEMS (IIS)

VI Semester: CE, EEE, ME and ECE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE610	OE-II	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the concepts of Computer architecture and functionalities of System Software.
CO2:	Understand the page replacement and CPU Scheduling Algorithms
CO3:	Understand the phases of software development life cycle and process models.
CO4:	Design ER model for real life scenarios
CO5:	Apply SQL commands to create, update, modify, retrieve and normalization on the databases.

UNIT – I

Fundamentals of Computers & Computer Architecture: Introduction, Organization of a small computer, Central Processing Unit, Execution cycle, Instruction categories, measure of CPU performance, Memory, Input/output devices, BUS, addressing modes

System Software: Assemblers, Loaders and linkers, Compilers and interpreters.

UNIT – II

Operating System: Introduction, Memory management schemes, Page replacement algorithms, Process management, CPU scheduling algorithms.

Software engineering: Software engineering: Introduction to Software engineering, Life cycle of a software project, software Development models.

UNIT – III

Relational Database Management System: Introduction to DBMS, the database technology, data models, Database Users.

Entity Relationship (E-R) Modeling: Introduction, Notations, Modeling E-R Diagrams, Case Studies, Merits and Demerits of E-R modeling.

UNIT – IV

Structured Query Language (SQL): Introduction to SQL, Data types, Data Definition language commands, Data Manipulation Language Commands and Data control Language Commands, Candidate Key, Primary key, Foreign key, Select Clause, Where Clause, Logical Connectives – AND, OR, Range Search, Pattern Matching, Order By, Group By, Set Operations – Union, Intersect and Minus, Aggregate Functions, Join Operations

UNIT – V

Normalization: Introduction, Need for Normalization, Process of Normalization, Types of Normal Forms (1NF, 2 NF,3 NF & BCNF), Merits and Demerits of Normalization.

Text Books:

1. Campus Connect Foundation Program – Computer Hardware and System Software Concepts, Programming Fundamentals- Vol. – 1, INFOSYS
2. Campus Connect Foundation Program – Relational Database Management System, Client Server Concepts, Introduction to Web Technologies - Vol. – 4, INFOSYS
3. Henry F. Korth& Abraham Silberschatz, - Data Base System Concepts, 5th Edition, 2005, Mc Graw hill

Reference Books:

1. M. Morris Mano [2011], [3 rd Edition], Computer system architecture, Pearson

Education, 2011

2. Sommerville [2008], [7th Edition], Software Engineering, Pearson education.

3. Raghu Ramakrishna and Johannes Gehrke [2003], [3rd Edition], Data Base Management Systems, TATA McGraw Hill

4. Tanenbaum [2000], Modern Operating System, Pearson Education

Online Learning Resources:

1. https://www.w3schools.com/sql/

2. https://www.geeksforgeeks.org/dbms/

3. https://www.tutorialride.com/software-engineering/software-engineering-tutorial.htm

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

OPTIMIZATION TECHNIQUES (OT)								
VI Semester: All Branches Except ME						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE611	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
CO2:	Interpret the transportation models' solutions and infer solutions to the real-world problems.
CO3:	Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
CO4:	Apply the concept of non-linear programming for solving the problems involving non linear constraints and objectives
CO5:	Apply the concept of unconstrained geometric programming for solving the problems L2, L3 involving non-linear constraints and objectives.

UNIT – I

Linear programming I: Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II

Linear programming II: Duality in Linear Programming

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III

Non-linear programming: Unconstrained Optimization Techniques

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV

Non-linear programming: **Constrained Optimization Techniques**

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT – V

Geometric Programming :

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Text Books:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

Reference Books:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

PHYSICS OF ELECTRONIC MATERIALS AND DEVICES (PEMD)								
VI Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE612	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand crystal growth and thin film preparation
CO2:	Summarize the basic concepts of semi conductors
CO3:	Illustrate the working of various semi conductor devices
CO4:	Analyze various luminescent phenomena and the devices based on the concepts
CO5:	Explain the working of different display devices

UNIT – I

Fundamentals of Materials Science: Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge.

UNIT – II

Semiconductors: Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT – III

Physics of Semiconductor Devices: Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Hetero junctions, Transistors, MOSFETs.

UNIT – IV

Excitons and Luminescence:

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photo luminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

UNIT – V

Display devices: LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Text Books:

1. S O Kasap, Principles of Electronic Materials and Devices, McGraw-Hill Education(India)Pvt.Ltd.,4th edition,2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. B G Streetman and S Banerjee, Solid State Electronic Devices, PHI Learning,6th edition
2. Eugene A Irene, Wiley, Electronic Materials Science,2005

3. Grover and Jamwal, DhanpatRai and Co., Electronic Components and Materials, New Delhi., 2012.

4. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineer, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

Online Learning Resources:

1. https://nptel.ac.in/courses/113/106/113106062/https://onlinecourses.nptel.ac.in/noc20_ph24/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CHEMISTRY OF POLYMERS AND APPLICATION (CPA)

VI Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE613	OE-II	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2:	Describe the physical and chemical properties of natural polymers and Modified cellulosics.
CO3:	Differentiate Bulk, solution, suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4:	Identify types of polymer networks, describe methods involve in hydrogel reparation, Explain applications of hydrogels in drug delivery
CO5:	Explain classification and mechanism of conducting and degradable polymers

UNIT – I

Polymers-Basics and Characterization: Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers,

Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT – II

Natural Polymers & Modified Cellulosics: Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified Cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT – III

Synthetic Polymers: Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT – IV

Hydrogels of Polymer Networks: Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

UNIT – V

Conducting and Degradable Polymers:

Conducting Polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable Polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. Billmayer, A Text book of Polymer science
2. G.S.Mishra, Polymer Chemistry
3. Gowarikar, Polymer Chemistry

Reference Books:

1. K J Saunders, Chapman and Hall, Organic polymer Chemistry
2. B Miller, Prentice Hall, Advanced Organic Chemistry
3. Premamoy Ghosh, Polymer Science and Technology, 3rd edition, McGraw-Hill, 2010.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ACADEMIC WRITING AND PUBLIC SPEAKING (AWPS)								
VI Semester: All Branches					**Scheme:** 2023			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE614	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration:** 3 Hrs			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand various elements of Academic Writing
CO2:	Identify sources and avoid plagiarism
CO3:	Demonstrate the knowledge in writing a Research paper
CO4:	Analyse different types of essays
CO5:	Assess the speeches of others and know the positive strengths of speakers
CO6:	Build confidence in giving an impactful presentation to the audience

UNIT – I

Introduction to Academic Writing:

Academic Writing: Introduction

Essential Features of Academic Writing: Courtesy, Clarity, Conciseness, Correctness, Coherence, Completeness

Types of Academic Writing: Descriptive, Analytical, Persuasive, Critical writing

UNIT – II

Academic Journal Article:

Art of condensation: summarizing and paraphrasing

Abstract Writing

Writing: Project Proposal, an application for internship, Technical/Research/Journal Paper Writing, Conference Paper Writing

Editing and Proofreading

Understanding and avoiding Plagiarism

UNIT – III

Essay Writing & Writing Reviews:

Types of Essays: Compare and Contrast Essay, Argumentative Essay, Exploratory Essay

Features and analysis of sample essays

Writing a Book Report

Summarizing

Writing a Book/Film Review

Writing a Statement of Purpose (SoP)

UNIT – IV

Public Speaking:

Public Speaking: Introduction, Nature, characteristics, and significance

Presentation skills: 4 P's of Presentation, Stage Dynamics, Answering Strategies during presentations

Analysis of impactful speeches

Types of speeches for academic events

UNIT – V
Public Speaking and Non-Verbal Delivery: Body Language, Facial Expressions, Kinesics, Oculesics, Proxemics, Haptics, Chronomics, Paralanguage, Signs
Text Books:
1. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. The Definitive Book of Body LanguageRHUS Publishers, 2016
Reference Books:
1. Alice Savage, Masoud Shafiei Effective Academic Writing,2Ed.,2014 Oxford University Press.
2. Shalini Verma, Body Language, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998
Online Learning Resources:
1. https://youtu.be/NNhTIT81nH8 **2.** phttps://www.youtube.com/watch?v=478ccrWKY-A **3.** https://www.youtube.com/watch?v=nzGo5ZC1gMw **4.** https://www.youtube.com/watch?v=Qve0ZBmJMh4 **5.** https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12 nonverbal-aspects-of delivery/ **6.** https://onlinecourses.nptel.ac.in/noc21_hs76/preview **7.** https://archive.nptel.ac.in/courses/109/107/109107172/# **8.** https://archive.nptel.ac.in/courses/109/104/109104107/
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES (MFQT)								
VI Semester: All Branches						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE615	**OE-II**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the Transformation theory and Hilbert space
CO2:	Analyze the properties and operators of Hilbert space and apply Eigen values to it.
CO3:	Apply statistics to measure theory, uncertainty relations and radiation theory.
CO4:	Evaluate problems on reversibility, equilibrium and macroscopic measurements.
CO5:	Formulate problems of composite system and measuring process

UNIT – I

Introductory Considerations: The origin of the Transformation Theory, The Original Formulation of Quantum Mechanics, The Equivalence of the two Theories: (i) The Transformation Theory, (ii) Hilbert Space.

UNIT – II

Abstract Hilbert Space: The definition of Hilbert space, The Geometry of Hilbert space, Degression on the Conditions A-E, Closed linear Manifolds, Operators in Hilbert space, The Eigen Value Problem, Continuation, Initial Consideration concerning the Eigenvalue Problem, Degression on the Existence and Uniqueness of solutions of the Eigenvalue Problems, Cumulative operators, The Trace.

UNIT – III

The Quantum Statistics: The statistical assertions of quantum mechanics, the statistical interpretation, Simultaneous Measurability and Measurability in General, Uncertainty Relations, Projections as Propositions, Radiation Theory.

UNIT – IV

Deductive Development of the Theory and General Considerations: The fundamental basis of the statistical theory, Conclusions from Experiments. Measurement and reversibility, Thermodynamics Considerations, Reversibility and equilibrium problems, The Macroscopic Measurement.

UNIT – V

The Measuring Process: Formulation of the problems, Composite systems, discussion of the Measuring process.

Text Books:

1. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).
2. M D Srinivas, Measurements and Quantum Probabilities, University Press, Hyderabad.

Reference Books:

1. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education) (2010)
2. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.
3. Gerad Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger. operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

BUILDING MATERIALS AND SERVICES (BMS)								
VII Semester: All Branches Except CE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE701	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, and plastics
CO2:	Analyze the composition, manufacturing process, and properties of cement and admixtures.
CO3:	Apply knowledge of building components such as lintels, arches, stairs, floors, roofs, foundations
CO4:	Evaluate masonry, mortars, finishing techniques ,and form work systems
CO5:	Assess various building services including plumbing, ventilation, acoustics, and fire protection.

UNIT – I

Building Materials:

Building Stones: Classifications– Properties – Structural Requirements.

Bricks: Composition of Brick Earth – Qualities of good brick – Types of brick.

Tiles: Characteristics of good tile– Types of tiles.

Wood: Structure – Types and Properties – Seasoning.

Other Materials: Properties and uses of Steel, Aluminum and Plastics.

UNIT – II

Cement & Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency– Initial &Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components:

Foundations: Types.

Floors: Types of Floors.

Roofs: Flat, Curved, Trussed.

Stair Cases – terminology: Types.

Lintels and Arches.

UNIT – IV

Mortars: Lime and Cement Mortars

Masonry: Bonds in Brick Masonry and Stone Masonry

Finishers: Plastering, Pointing, Painting.

Form Work: Types, Requirements – Scaffolding.

UNIT – V

Building Services:

Plumbing Services: Water Distribution, Sanitary – Lines &Fittings;

Ventilations: Functional Requirements – Natural and Mechanical ventilation

Acoustics: Characteristic – Absorption – Acoustic Design.

Fire Protection: Fire Hazards – Classification of Fire Resistant Materials and Constructions.

Text Books:

7. Building Materials and Construction–Arora & Bindra, Dhanpat Roy Publications

8. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt. Ltd., 2015

Reference Books:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delh

2. P.C.Varghese, Building Materials, Prentice Hall of India, 2015.

3. N.Subramanian, Building Materials Testing and Sustainability, Oxford Higher Education, 2019.

4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.

5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:

8. https://archive.nptel.ac.in/courses/105/102/105102088/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE702	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Apply various methodologies for conducting Environmental Impact Assessments
CO2:	Analyze the impact of land-use changes on soil, water, and air quality.
CO3:	Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
CO4:	Develop environmental audit reports and assess compliance with environmental policies.
CO5:	Interpret and apply environmental acts and regulations related to EIA.

UNIT – I

Concepts and methodologies of EIA: Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II

Impact of Developmental Activities and Land Use: Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment: Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

UNIT – IV

Environmental Audit: Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V

Environmental Acts and Notifications: The Environmental Protection Act, The Water Preservation Act, The Air(Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/124/107/124107160/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SMART GRID TECHNOLOGIES (SGT)

VII Semester: All Branches Except EEE | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE703	OE-III	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understanding the Concept and Evolution of Smart Grids.
CO2:	Analyzing Wide Area Monitoring System and Synchrophasor Technology.
CO3:	Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts.
CO4:	Evaluating Information and Communication Technology (ICT) Systems in Smart Grids.
CO5:	Designing Smart Grid Applications and Cybersecurity Measures.

UNIT – I

Introduction to Smart Grid: Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT – II

Wide Area Monitoring System: Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT – III

Smart Meters: Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT – IV

Information and Communication Technology: Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT – V

Smart Grid Applications and Cyber Security: Applications: Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Text Books:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Books:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2. Fereidoon. P. Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

Online Learning Resources:

1. https://nptel.ac.in/courses/108107113

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

3D PRINTING TECHNOLOGIES (3DPT)

VII Semester: All Branches Except ME | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE704	OE–III	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Explain the fundamentals of AM, its process steps, classification, materials, and describe Vat Photo-polymerization methods with applications.
CO2:	Explain Material Jetting, Binder Jetting, and FDM processes in terms of materials, working principles, benefits, and illustrate their applications.
CO3:	Explain the working of Sheet Lamination, 3DP, and Powder Bed Fusion processes, and analyze their advantages and industrial use cases.
CO4:	Describe Directed Energy Deposition AM processes, benefits, and applications.
CO5:	Explain post-processing techniques in AM and understand the concepts of direct and indirect rapid tooling methods with examples.

UNIT – I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM.

Vat Photo-polymerization AM Processes: Stereolithography (SL), Materials, Process Modeling, SL resin curing process, SL scan patterns, Micro-Stereolithography, Mask Projection Processes, Process Benefits and Drawbacks, Applications of Vat Photo-polymerization, case studies.

UNIT – II

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes, case studies.

UNIT – III

Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies.

Three Dimensional Printing (3DP): Principle, Process, Applications, advantages and disadvantages of 3DP.

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, case studies.

UNIT – IV

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Benefits and drawbacks,

Applications of Directed Energy Deposition Processes.

UNIT – V

Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Property Enhancements using Non-thermal and Thermal Techniques.

Rapid Tooling: Direct and Indirect methods AIM tooling, SLS rapid steel, Direct Laser Metal Sintering (DMLS), Laminate tooling. RTV silicon rubber moulds, Vacuum casting, Reaction injection Moulding (RIM),Wax Injection moulding, Spray metal tooling, 3D kelt tool

Text Books:

1. Chua C.K., Leong.K.F, and Lim C, C.S., Rapid Prototyping Principles and Applications, World Scientific Publishing Co. Pte. Ltd
2. D.T.Pham and S.S.Dimov, Rapid manufacturing The technologies and applications of rapid Prototyping and rapid tooling. Springer Publications

Reference Books:

1. Terry Wholers, Wholers report, Wholers Associates
2. Gibson D. W. Rosen and B. Stucker., Additive manufacturing technologies, Springer Publication

Online Resources:

1. https://www.nist.gov/additive-manufacturing
2. https://www.metal-am.com/
3. http://additivemanufacturing.com/basics/
4. https://www.3dprintingindustry.com/
5. https://www.thingiverse.com/
6. https://reprap.org/wiki/RepRap

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

COMPOSITE MATERIALS (CM)								
VII Semester: All Branches						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE705	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Identify the properties of fiber and matrix materials used in commercial composites.
CO2:	Describe the manufacture of polymer matrix composites.
CO3:	Compare and evaluate the metal manufacturing methods.
CO4:	Analyze the Hooke's law for different type of materials.
CO5:	Examine the elastic behaviour of the unidirectional composite.

UNIT – I

Basic Concepts and Characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites

UNIT – II

Manufacturing of Polymer Composites: Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, Resin Transfer Moulding, injection moulding, compression moulding Properties and applications.

UNIT – III

Manufacturing of Metal Matrix Composites: Stir Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

Manufacturing of Carbon – Carbon Composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT – IV

Coordinate Transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation.

UNIT – V

Elastic Behaviour of Unidirectional Composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Text Books:

1. R M Jones, Mechanics of Composite Materials Mc Graw Hill Company, New York.
2. Isaac and M.Daniel, Engineering Mechanics of Composite Materials, Oxford University Press, New York

Reference Books:

1. Madhujit Mukhopadadhyay, Mechanics of composite materials and structures, Universities Press, Hyderabad
2. L. R. Calcote, Analysis of Laminated Composite Structures ,Van Nostrand Rainfold, US

3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley Interscience, New York

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

APPLICATIONS OF MICROPROCESSORS AND MICROCONTROLLERS (AMMC)								
VII Semester: All Branches Except EEE and ECE					**Scheme: 2023**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE706	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Analyze the architectural concepts of 8086 microprocessor.
CO2:	Apply the programming model of 8086 in assembly language programming.
CO3:	Analyze the multiple concepts of 8086 interfacing.
CO4:	Analyze the architectural concepts the 8051 microcontroller.
CO5:	Apply the programming model of 8051 in interfacing with peripherals.

UNIT – I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT – II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT – III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT – IV

8051 Microcontroller: Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT – V

Interfacing Microcontroller: Programming 8051 Instruction set - Addressing modes Programming Switches, LEDs, Displays – Seven Segment, LCD, Sensors, Stepper Motor and Waveform generation- Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Text Books:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Mazidi Muhammad Ali, Mazidi Janice Gillespie & Mc KinlayRolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

Reference Books:

1. John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, 3rd Edition, Pearson Ed, 2006.

2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publication Ltd, 2006.

Online Learning Resources:

1. www.nptel.onlinecourseac.in/.microprocessorsandmicrocontrollers
2. https://onlinecourses.nptel.ac.in/noc18_ec03/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO DATABASE SYSTEMS (IDS)								
VII Semester: CE, EEE, ME and ECE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE707	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the basic concepts of database management systems
CO2:	Analyze a given database application scenario to use ER model for conceptual design of the database
CO3:	Utilize SQL proficiently to address diverse query challenges.
CO4:	Employ normalization methods to enhance database structure.
CO5:	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

UNIT – I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT – II

Entity Relationship Model: Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, IS A relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modelling.

UNIT – III

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF)

UNIT – IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

UNIT – V

PL/SQL: Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create a PL/SQL, Program, Iterative Control, Procedure, Function, Database Triggers, Types of Triggers.

Text Books:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,
3. SQL: The Ultimate Beginners Guide by Steve Tale

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282 02 2456_shared/overview
3. Oracle SQL Developer - Full Course
4. https://www.youtube.com/watch?v=9ic3KEH4Ah4

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CYBER SECURITY (CS)								
VII Semester: CE, EEE, ME and ECE						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE708	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Classify the cybercrimes and understand the Indian ITA 2000.
CO2:	Analyse the vulnerabilities in any computing system and find the solutions.
CO3:	Predict the security threats of the future.
CO4:	Investigate the protection mechanisms.
CO5:	Design security solutions for organizations

UNIT – I

Introduction to Cyber crime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, and Cybercrime: The Legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III

Cyber crime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones.

UNIT – IV

Tools and Methods Used in Cyber crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan –Hwa (john) Wu ,J. DavidIrwin.CRC Press T&F Group

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://www.udemy.com/course/cybersecurity-from-beginner-to-expert

Question Paper Pattern:

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MODERN C++ (MC)								
VII Semester: All Branches						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE709	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Distinguish the procedural and object oriented paradigm along with principles
CO2:	Understand dynamic memory management techniques using pointers, constructors, destructors
CO3:	Understand the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO4:	Classify inheritance with the understanding of early and late binding.
CO5:	Illustrate the process of data file manipulations using C++.
CO6:	Analyze an ability to incorporate Exception handling in Object Oriented program.

UNIT – I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts Abstraction, Encapsulation, Inheritance and Polymorphism

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, go to statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions

UNIT – II

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT – III

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

UNIT – IV

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT – V

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Overloading operators, Error handling during file operations, Formatted I/O

Exception Handling:

Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications.

Text Books:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.

2.	Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch, Pearson Education.
Reference Books:	
1.	The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education
2.	OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press
3.	Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd
Online Learning Resources:	
1.	https://nptel.ac.in/courses/106105234
2.	https://www.geeksforgeeks.org/cpp/c-plus-plus/
3.	https://www.tutorialspoint.com/cplusplus/index.htm
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

WAVELET TRANSFORMS AND ITS APPLICATIONS (WTA)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE710	OE-III	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms.
CO2:	Illustrate the multi resolution analysis ad scaling functions.
CO3:	Implement discrete wavelet transforms with multirate digital filters.
CO4:	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
CO5:	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

UNIT – I

Wavelets: Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete Time and Continuous Wavelet Transforms.

UNIT – II

A Multi resolution Formulation of Wavelet Systems: Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III

Filter Banks and the Discrete Wavelet Transform: Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - - Different Points of View.

UNIT – IV

Time-Frequency and Complexity: Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform-Numerical Complexity of the Discrete Wavelet Transform.

UNIT – V

Bases and Matrix Examples: Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Text Books:

1. C. Sidney Burrus, Ramesh A. Gopinath, —Introduction to Wavelets and Wavelets Transforms , Prentice Hall, (1997).
2. James S. Walker, —A Primer on Wavelets and their Scientific Applications , CRC Press, (1999).

Reference Books:

1. Raghuveer Rao, —"Wavelet Transforms", Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SMART MATERIALS AND DEVICES (SMD)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE711	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Provide exposure to smart materials and their engineering applications.
CO2:	Impart knowledge on the basics and phenomenon behind the working of smart materials
CO3:	Explain the properties exhibited by smart materials.
CO4:	Educate various techniques used to synthesize and characterize smart materials
CO5:	Identify the required smart material for distinct applications/devices

UNIT – I

Introduction to Smart Materials: Historical account of the discovery and development of smart materials, Shape memory materials, chromo active materials, magnet orheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT – II

Properties of Smart Materials: Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT – III

Synthesis of Smart Materials: Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT – IV

Characterization Techniques: Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT – V

Smart Materials Based Devices: Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Text Books:

1. Yaser Dahman, Nanotechnology and Functional Materials for Engineers-,Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. P Gauenzi, Smart Structures, Wiley, 2009.
2. Mahmood Ali of khazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhery Mustansar Hussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials, Mohsen Shahinpoor, Royal Society of Chemistry, 2020

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (GCSE)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE712	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand principle and concepts of green chemistry.
CO2:	Understand the types of catalysis and industrial applications.
CO3:	Apply green solvents in chemical synthesis.
CO4:	Enumerate different sourced of green energy.
CO5:	Apply alternative greener methods foe chemical reactions.

UNIT – I

Principles And Concepts of Green Chemistry: Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un- economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT – II

Catalysis And Green Chemistry: Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio- catalysis and Photo-catalysis with examples.

UNIT – III

Green Solvents In Chemical Synthesis: Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethyleneglycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT – IV

Emerging Greener Technologies: Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock‘s, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Bio refinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT – V

Alternative Greener Methods: Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books:

1. M. Lancaster,Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

EMPLOYABILITY SKILLS (ESK)

VII Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE713	OE-III	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the importance of goals and try to achieve them.
CO2:	Explain the significance of self-management.
CO3:	Apply the knowledge of writing skills in preparing eye-catchy resumes.
CO4:	Analyse various forms of Presentation skills.
CO5:	Judge the group behaviour appropriately.
CO6:	Develop skills required for employability

UNIT – I

Goal Setting and Self-Management: Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT – II

Writing Skills: Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT – III

Technical Presentation Skills: Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT – IV

Group Presentation Skills: Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

UNIT – V

Job Cracking Skills: Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Text Books:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills,2014.Cambridge Publisher
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback , Sage Publications. 2015
2. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics f Communication Skills A Relational Perspective, Sage press, 2012

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs

2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO QUANTUM MECHANICS (IQM)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE714	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Explain the key principles of quantum mechanics and wave-particle duality
CO2:	Apply Schrödinger equations to solve one-dimensional quantum problems
CO3:	Solve quantum mechanical problems using operator and matrix methods.
CO4:	Evaluate quantum states using Dirac notation and expectation values.
CO5:	Analyze angular momentum and spin systems using Pauli matrices and operators.

UNIT – I

Principles of Quantum Mechanics: Introduction, Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT – II

One Dimensional Problems and Solutions: Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT – III

Operator Formalism: Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT – IV

Mathematical Tools for Quantum Mechanics: The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT – V

Angular Momentum and Spin: Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half (1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Text Books:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam, 1961.
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi.
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co. Inc., London, (1960).
4. Quantum Mechanics. S L Gupta, V Kumar, H V Sarama and R C Sharma, Jai Prakash Nath & Co, Meerut, (1996).

Reference Books:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.), 2003.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

Question Paper Pattern:

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End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

GEO-SPATIAL TECHNOLOGIES (GST)

VII Semester: All Branches Except CE | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE715	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand raster-based spatial analysis techniques, including query, overlay, and cost- distance analysis.
CO2:	Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
CO3:	Apply network analysis techniques for geocoding, shortest path analysis, and location- allocation problems.
CO4:	Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
CO5:	Assess GIS customization, WebGIS, and mobile mapping techniques for real-world applications.

UNIT – I

Raster Analysis

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering- Zonal Operations-Statistical Analysis–Cost- Distance Analysis-Least Cost Path.

UNIT – II

Vector Analysis

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance **Topological Analysis:** Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line- In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering.

UNIT – III

Network Analysis: Network – Introduction **-** Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path inA Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT – IV

Surface And Geostatistical Analysis: Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram

UNIT – V

Customisation, Webgis, Mobile Mapping:

Customisation of Gis: Need, Uses, Scripting Languages –Embedded Scripts

Web Gis: Web Gis Architecture, Advantages Of Web Gis, Web Applications-

Location Based Services: Emergency And Business Solutions.

Text Books:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008
2. Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

Reference Books:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, —An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

9. https://archive.nptel.ac.in/courses/105/105/105105202/
10. https://onlinecourses.nptel.ac.in/noc19_cs76/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SOLID WASTE MANAGEMENT (SWM)

VII Semester: All Branches | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE716	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
CO2:	Analyze engineering systems for solid waste collection, storage, and transportation.
CO3:	Apply resource and energy recovery techniques for sustainable solid waste management.
CO4:	Evaluate landfill design, construction, and environmental impact mitigation strategies
CO5:	Assess hazardous waste management techniques, including biomedical and e-waste

UNIT – I

Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes ,Elements of Solid Waste Management-Integrated Solid Waste Management, Solid Waste Management Rules 2016

UNIT – II

Engineering Systems for Solid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning- Transfer and Transport; Processing Techniques;

UNIT – III

Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products–Composting, Preand Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT – IV

Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills –Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT – V

Hazardous Waste Management: Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management.

Text Books:

1. Tchobanoglous G, Theisen Hand Vigil SA, Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, Solid Waste Engineering‘ Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering‘, McGraw Hill Inc., New York, 1985.

2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/103/105103205/
2. https://archive.nptel.ac.in/courses/120/108/120108005/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRIC VEHICLES (EV)

VII Semester: All Branches Except EEE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE717	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
CO2:	Understand Various dynamics of Electric Vehicles.
CO3:	Remember and understand various configurations in parameters of EV system and dynamic aspects of EV.
CO4:	Analyze fuel cell technologies in EV and HEV systems
CO5:	Analyze the battery charging and controls required of EVs.

UNIT – I

Introduction to EV Systems and Energy Sources: Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT – II

EV Propulsion and Dynamics: Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT – III

Fuel Cells: Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT – IV

Battery Charging and Control

Battery Charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller‘s designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT – V

Energy Storage Technologies: Role of Energy Storage Systems- Thermal- Mechanical- Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Text Books:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition.

2.	Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, 2017,1st Edition.
Reference Books:	
1.	Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2.	Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, “Energy Storage in Power Systems” Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition.
3.	A.G.Ter-Gazarian, “Energy Storage for Power Systems”, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004,1st Edition.
5.	James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003,2nd Edition.
Online Learning Resources:	
1.	https://nptel.ac.in/courses/108/102/108102121/
2.	https://nptel.ac.in/syllabus/108103009
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

TOTAL QUALITY MANAGEMENT (TQM)

VII Semester: All Branches Except ME						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE718	OE-IV	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the basic concepts and evolution of TQM ; Professional ethics and quality costs
CO2:	Understand the concepts of leadership, quality council, strategic planning and communications
CO3:	Apply the methods to improve costumers satisfactions
CO4:	Analyse motivational aspects of employees and functioning of teams
CO5:	Apply TQM tools like P-D-S-A cycle, Benchmarking, FMEA towards achieving TQM objectives

UNIT – I

Quality: Definition; Dimensions of Quality

Total Quality Management (TQM): Definition; basic concepts of / basic approach to TQM; Benefits of TQM, Barriers / Obstacles to TQM implementation; Evolution of TQM

Ethics: Route causes for unethical behaviour; Ethics Management Program

Quality costs

UNIT – II

Leadership: Characteristics of quality leaders; Leadership concepts; Stephen R. Covey's 7 habits of highly effective people; The Deming's philosophy (14 principles)

Quality Council: Composition; Duties of Quality Council

Quality Statements: The Vision and the Mission statements

Seven steps to Strategic Planning

Communications: Interactive and Formal

UNIT – III

Customer Satisfaction: Customer Satisfaction and its importance; Customer perception of quality; Methods to improve customer satisfaction; Customer Feedback; Handling the customer complaints; Service Quality; Customer Retention

UNIT – IV

Employee Involvement

Motivation: Maslow's hierarchy of needs; Achieving a motivated workforce, Employee empowerment

Teams: Characteristics of successful teams; Roles of team members; Common barriers to team progress; Suggestion system; Recognition and Reward; Gain sharing; Benefits of employee involvement

UNIT – V

TQM Tools

The Problem solving method and P-D-S-A cycle

Benchmarking: Reasons to Benchmark; Process of Benchmarking

Failure Modes and Effects Analysis (FMEA): Benefits; Stages of FMEA; Adapting FMEA to service sector

Pareto diagram; Cause and Effects diagram; Scatter diagram

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

Online Learning Resources

1. https://www.youtube.com/watch?v=VD6tXadibk0
2. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
3. https://blog.capterra.com/what-is-total-quality-management/
4. https://nptel.ac.in/courses/110/104/110104080/
5. https://onlinecourses.nptel.ac.in/noc21_mg03/preview
6. https://nptel.ac.in/courses/110/104/110104085/
7. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SAFETY IN ENGINEERING INDUSTRY (SEI)

VII Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE719	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the principles of safety management including safety audit, safety education and accident investigation.
CO2:	Understand the causes and implication of fire and explosion and the preventive measures
CO3:	Understand machine and construction safety assessment and safeguarding methods
CO4:	Understand the effect of toxic substances and hazardous chemicals
CO5:	Understand the modes of electrical hazards and safety measures in electrical and information technology industries

UNIT – I

Safety in Engineering Industry: Safety need, General hazards and control measures in engineering industry, Four significant industrial disasters happened in the world (Bhopal, Chernobyl, Flixborough and Rana plaza), Safety audit procedure.

Accident Investigation: Learning from accident, Layered investigations, Investigation process and summary.

UNIT – II

Fire Safety: The fire triangle, Explosions, Distinction between fire and explosions, Flammability characteristics of liquids and vapours, Fire protection techniques, Fire extinguishers, Fire hazard and analysis, Prevention of fire, Steps after occurrence of fire, Fire detection, Fire alarm and firefighting systems, Explosion proof equipment and instruments.

UNIT – III

Machine Safety: Machine guarding, Machine guarding assessment, Safeguarding machines and equipment, Guards, Safeguarding devices, Other potential safeguards.

Construction Safety: Scope, Safety in - Underground works, Above ground works, Under waterworks, Demolition works.

UNIT – IV

Chemical Safety: Hazardous chemicals, Definition of a hazardous chemical, Toxic effects, Working with toxins, Storing hazardous chemicals, Process hazards, Transportation of hazardous chemicals, Chemical waste management, Hazardous chemical emergency procedures, Worker contamination, Chemicals and worker health.

UNIT – V

Electrical Safety: Electrical dangers, Electrical pathways, Static electricity, Result of electrical contact, Shock versus electrocution, Electrical burns, Handling electrical hazards, Controlling electrical hazards, Training, Safety and Health program.

IT Industry Safety: Hazardous in IT industry, General precautions, Employer's responsibility, Employees responsibilities, Office ergonomics, Computer workstation – health & safety tips, Laptop safety precautions.

Text Books:

1. L M Deshmukh, Industrial Safety and Management, McGraw Hill Education (India)

2. D A Crowl and J F Louvar, Chemical Process Safety (Fundamentals with Applications), Prentice Hall, 2011.

3. Charles D Reese, Industrial Safety and Health for People-oriented Services, CRC Press, 2008.

4. M P Poonia and S C Sharma. Industrial Safety and Maintenance Management, Khanna Book Publishing, 2019.

Reference Books:

1. Charles Reese, Industrial Safety and Health for Infrastructure Services, CRC Press, 2009

2. R K Jain and Sunil S Rao, Industrial Safety and Health and Environment Management Systems, Khanna Book Publishing, 2000.

3. K U Mistry, Fundamentals of Industrial safety and Health, Siddharth Prakashan Publisher, 2008.

Online Learning Resources

1. https://archive.nptel.ac.in/courses/110/105/110105094/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

TRANSDUCERS AND SENSORS (T&S)								
VII Semester: All Branches Except ECE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE720	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand characteristics of Instrumentation System and the operating principle of motion transducers.
CO2:	Explore working principles, and applications of different temperature transducers and Piezo-electric sensors
CO3:	Gain knowledge on flow transducers and their applications.
CO4:	Learn the working principles of pressure transducers.
CO5:	Understand the working principle and applications of force and sound transducers.

UNIT – I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers

UNIT – II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT – III

Flow Transducers: Bernoulli‘s principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT – IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT – V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Text Books:

1. A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation‖, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

Reference Books:

1. Doebelin. E.O, —Measurement Systems Application and Design‖, McGraw Hill International, New York, 2004.

2. Nakra B.Cand Chaudhary K.K , —Instrumentation Measurement and Analysis , Second Edition, Tata McGraw-Hill Publication Ltd.2006.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

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DRONE TECHNOLOGY (DT)								
VII Semester: All Branches						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE721	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand the historical development of unmanned aerial vehicles
CO2:	Understand different drone parts and their contribution for successful flight operation
CO3:	Identify the battery to be used for UAV application.
CO4:	Understand work in go f motor that can be used in UAV.
CO5:	Classify different microcontrollers and flight controllers.

UNIT – I

Introduction to Drones and Their Applications: Definition of drones, history of drones, Structural classification of drones: - fixed wing structure, lighter than air systems, rotary wings aircraft and applications of drones.

UNIT – II

Components of Drones: classifications of drone structures and their suitability, applications and uses of drone frame materials, classifications and applicability of propeller motors, drone materials, design parameters for propellers, composition and structuring of Electronic speed controller, flight control board, characteristics of FCB and their structure.

UNIT – III

Battery and its Management: Introduction of Battery, Description of Li-Po Battery, Charging / Discharging of Battery. Back up, Ratings, Shelf Life, Maintenance and safety of Battery. Selection criteria of Battery for Drone application

UNIT – IV

Sensors: Wi-Fi devices, RADAR and range finder, GPS receiver, Gyro sensor, Speed and Distance sensor, Image sensor, TOF sensor, Chemical sensor. Cameras in drones and selection criteria Of camera for different range. Barometers, Accelerometer, Magnetometer, remote control for drone.

Motors: Difference between AC and DC motors and stepper motor, Brushed and Brushless motors, brief idea of motor capabilities for a drone build. Selection criterion of motor for drone application. Working and application of BLDC motor

UNIT – V

Connections and Interfaces of Devices in Drone: Brief introduction of RS232, RS422, RS485, UART ports. Different types of connectors and their specifications. Microcontroller interfacing techniques.

Introduction to Drone Programming: Introduction to programming language used in drone: C and Python. Installation of cards. Auto Pilot software i.e. Ardupilot, Openpilot

Text Books:

1. Terry Kil by and Belinda Kil by, “Make: Getting Started with Drones“, Maker Media, Inc, 2016
2. Vasilis Tzivaras, “Buildinga Quadcopter with Arduino”, Packt Publishing, 2016
3. Donald Norris, “Build Your Own Quadcopter - Power Up Your Designs with the Parallax Elev - 8”, McGraw – Hill Education, 2014

Reference Books:

1. Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
2. Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment. Wiley, 2010.
3. Sebbane, Smart Autonomous Aircraft: Flight Control and Planning for UAV. CRCPress,2015
4. Zavrsnik, Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance. Springer, 2015.

Online Learning Resources:

1. https://www.dronezon.com/learn-about-drones-quadcopters/
2. http://ardupilot.org/copter/docs/advanced-multicopter-design.html

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO COMPUTER NETWORKS (ICN)

VII Semester: CE, EEE, ME and ECE | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE722	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Describe the architecture of the Internet, reference models, and explain different types of transmission media used in networking.
CO2:	Apply error detection and correction techniques and analyze data link layer protocols and LAN technologies.
CO3:	Explain routing algorithms and the structure of the network layer, including internetworking
CO4:	Analyze the working of transport layer protocols like TCP and UDP, including concepts of connection management and congestion control.
CO5:	Explain the principles of network applications and describe the functionality of protocols such as HTTP, SMTP, DNS, and peer-to-peer systems, including multimedia streaming and content delivery networks.

UNIT – I

Computer Networks and the Internet: What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission

UNIT – II

The Data Link Layer, Access Networks, and LANs: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols , Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks

Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

UNIT – III

The Network Layer: Routing Algorithms, Internetworking, The Network Layer in The Internet

UNIT – IV

The Transport Layer: Connectionless Transport: UDP , The Internet Transport Protocols: TCP, Congestion Control

UNIT – V

Principles of Network Applications: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, —Computer Networking: A Top-Down Approach , 6thedition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication
2. Youlu Zheng, Shakil Akthar, Networks for Computer Scientists and Engineers, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105183
2. https://gaia.cs.umass.edu/kurose_ross/interactive/
3. https://www.netacad.com/courses/packet-tracer
4. https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTERNET OF THINGS (IOT)

VII Semester: CE, EEE, ME and ECE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE723	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes : At the end of the course, students will be able to

CO1:	Understand general concepts of Internet of Things.
CO2:	Apply design concept to IoT solutions.
CO3:	Analyze various M2M and IoT architectures.
CO4:	Evaluate design issues in IoT applications.
CO5:	Create IoT solutions using sensors, actuators and Devices.

UNIT – I

Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, , Embedded Systems.

UNIT – II

Prototyping IoT Objects using Microprocessor/Microcontroller: Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors. Communication: communication through Bluetooth, Wi-Fi.

UNIT – III

IoT Architecture and Protocols: Architecture Reference Model- Introduction, , IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak

UNIT – IV

Device Discovery and Cloud Services for IoT: Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT – V

UAV IoT : Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software – Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study Flyt Base**.**

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, — Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016..

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, — From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
3. Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781-4493- 9357-1
5. DGCA RPAS Guidance Manual, Revision 3 – 2020

6. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal
Online Learning Resources:
1. https://www.arduino.cc/ **2.** https://www.raspberrypi.org/ **3.** https://nptel.ac.in/courses/106105166/5 **4.** https://nptel.ac.in/courses/108108098/4
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MULTIMEDIA & ANNIMATION (MMA)								
VII Semester: All Branches					**Scheme: 2023**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE724	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the basic components of a multimedia project.
CO2:	Understand the usage of text and formats in multimedia.
CO3:	Understand the audio digitization, audio file format and audio software.
CO4:	Understand the colour, image, image formats and Correction in multimedia.
CO5:	Understand the digital video standards, formats and basic principles behind animation and Techniques.

UNIT – I

Introduction to Multimedia: What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media.

UNIT – II

Computer Fonts and Hypertext: Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap fonts, International character sets and hypertext, Digital fonts techniques.

UNIT – III

Audio fundamentals and representations: Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.

UNIT – IV

Image fundamentals and representations: Colour Science, Colour, Colour Models, Colour palettes, Dithering, 2D Graphics.

Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

UNIT – V

Video and Animation: Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video, Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.

Text Books:

1. Tay Vaughan, “Multimedia making it work”, Tata McGraw-Hill, 2008.
2. Rajneesh Aggarwal & B. B Tiwari, “ Multimedia Systems”, Excel Publication, New Delhi, 2007.
3. Li & Drew, “ Fundamentals of Multimedia” , Pearson Education, 2009

Reference Books:

1. Parekh Ranjan, “Principles of Multimedia”, Tata McGraw-Hill, 2007
2. Anirban Mukhopadhyay and Arup Chattopadhyay, “Introduction to Computer Graphics and Multimedia”, Second Edition, Vikas Publishing House.

Online Learning Resources:

1. https://www.wisdomjobs.com/e-university/multimedia-tutorial-270.html
2. http://www.multimediatrainingvideos.com/
3. https://www.tutpad.com/tag/multimedia

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ADVANCED INFORMATION SYSTEMS (AIS)

VII Semester: CE, EEE, ME and ECE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE725	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

Course Outcomes : At the end of the course, students will be able to

CO1:	Demonstrate the Object oriented concepts.
CO2:	Interpret different types of Inheritance and Polymorphism.
CO3:	Classify layer functionalities of OSI reference model and TCP Protocol suite.
CO4:	Summarize the concepts of internetworking, security and IP addressing.
CO5:	Demonstrate different types of protocols and web contents used in web design

UNIT – I

Introduction to Object Oriented Concepts: Introduction, Programming Techniques, Introduction to Object Oriented Concepts, Concept of Structured Procedural Programming, Class, Object

Characteristics of Objects: Data Abstraction, Classification, Encapsulation and Message Passing. Access Specifiers in Class, UML Class Diagrams.

UNIT – II

Advanced Concepts in Object Oriented Technology: Relationships, Inheritance- Protected Access Specifier, Multiple and Multilevel Inheritance, Generalization and Specialization, Abstract classes, Polymorphism, Implementation of OOC through C++.

UNIT – III

Introduction to Computer Networks: Introduction, Network Topology, OSI Reference Model, TCP Protocol Suite, Routing Devices, Types of Networks.

UNIT – IV

Internetworking: Protocols for Internetworking, Internet Address and Domains, Packets, Packet Switched Networks, Virtual Private Networks, and Working of Internet.

UNIT – V

Introduction to Web Technology: Introduction, Hyper Text Transfer Protocol (HTTP), File Transfer Protocol (FTP), Domain Name Server (DNS), Web Applications, Types of Web Content, Multi-Tier Web Applications, Performance of Web Applications.

Text Books:

1. Campus Connect Foundation Programme – Object Oriented Concepts – System
2. Campus Connect Foundation Programme – Computer Hardware and System Software - Vol. – 3, INFOSYS Concepts

Reference Books:

1. Campus Connect Foundation Programme – Relational Database Management System,Client Server

Online Learning Resources:

1. https://www.tutorialspoint.com/cplusplus/
2. https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

QUANTUM COMPUTING (QC)

VII Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE726	OE-IV	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course, students will be able to

CO1:	Explain the fundamental concepts of quantum mechanics used in computing.
CO2:	Construct and analyze quantum circuits using standard gates.
CO3:	Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
CO4:	Develop simple quantum programs using Qiskit or similar platforms.
CO5:	Analyze applications and challenges of quantum computing in real-world domains.

UNIT – I

Fundamentals of Quantum Mechanics and Linear Algebra: Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT – II

Quantum Gates and Circuits: Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT – III

Quantum Algorithms and Complexity: Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT – IV

Quantum Programming and Simulation Platforms: Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT – V

Applications and Future of Quantum Computing: Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Text Books:

1. Michael A Nielsen, Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

FINANCIAL MATHEMATICS (FM)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE727	**OE-IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Explain fundamental financial concepts, including arbitrage, valuation, and risk.
CO2:	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts..
CO3:	Analyze mathematical techniques for pricing options and financial derivatives.
CO4:	Evaluate interest rate models and bond pricing methodologies.
CO5:	Utilize computational techniques such as Monte Carlo simulations for financial modeling.

UNIT – I

Asset Pricing and Risk Management: Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT – II

Stochastic Models in Finance: Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito‘s Lemma, Ito Integral, and Ito Isometry.

UNIT – III

Interest Rate and Credit Modelling: Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR),Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT – IV

Fixed-Income Securities and Bond Pricing: Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.□

UNIT – V

Exotic Options and Computational Finance: Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Text Books:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas& Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (SAEA)								
VII Semester: All Branches					**Scheme: 2023**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE728	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	To provide exposure to various kinds of sensors and actuators and their engineering applications.
CO2:	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
CO3:	To explain the operating principles of various sensors and actuators
CO4:	To educate the fabrication of sensors
CO5:	To explain the required sensor and actuator for interdisciplinary application

UNIT – I

Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT – II

Temperature and Mechanical Sensors

TemperatureSensors: Typesoftemperaturesensorsandtheirbasicprincipleofworking:Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT – III

Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonicsensors, Piezo-electricresonators, Microphones

UNIT – IV

Magnetic and Electromagnetic Sensors: Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT – V

Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors,

Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Text Books:

1. Sensors andActuators– Clarence W.deSilva, CRC Press, 2nd Edition, 2015
2. Sensors andActuators, D.A. Halland C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers-D.Patranabhis,Prentice Hall of India(Pvt)Ltd.2003
2. Measurement, Instrumentation, and Sensors Handbook John G.Webster, CRC Press 1999
3. Sensors–A Comprehensive Sensors-Henry Bolte, John Wiley.
4. Hand book of modern sensors, Springer, Stefan Johann Rupitsch

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CHEMISTRY OF NANO MATERIALS AND APPLICATIONS (CNMA)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE729	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to

CO1:	Classify the nanostructure materials; describe scope of nano science and importance of technology.
CO2:	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling.
CO3:	Discuss different technique for characterization of nano material, Explain electron Microscopy techniques for characterization of nano material, Describe BET method for surface area analysis.
CO4:	Explain synthesis and properties and applications of nanao materials, Discuss about fullerenes and carbon nano tubes, Differentiate nano magnetic materials and thermo electric materials, nonlinear optical materials.
CO5:	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

UNIT – I

Basics and Characterization of Nano materials: Introduction, Scope of nano science and nano technology, nano science in nature, classification of nano structured materials, importance of nano materials.

UNIT – II

Synthesis of Nano Materials: Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electro deposition method, high energy ball milling method.

Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, micro emulsions orrever semicelles, co-precipitation method, solvo thermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis

UNIT – III

Techniques for Characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination

UNIT – IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT – V

Advanced Engineering Applications of Nanomaterials: Applications ofNano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation

Text Books:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, B B Rath and James Murday, Univ. Press, 2012.

Reference Books:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

LITERARY VIBES (LB)								
VII Semester: All Branches						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE730	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:** 3 Hrs		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Identify genres, literary techniques and creative uses of language in literary texts.
CO2:	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces
CO3:	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments
CO4:	Analyze the underlying meanings of the text by using the elements of literary texts
CO5:	Evaluate their own work and that of others critically
CO6:	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance

UNIT – I

Poetry:

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT – II

Drama: Twelfth Night- William Shakespeare

Shakespeare -life and works

1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT – III

Short Story:

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT – IV

Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT – V

Novel: Hard Times- Charles Dickens

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel

3. Themes and criticism

4. Style and literary elements

5. Characters and characterization

Text Books:

1. Charles Dickens.Hard Times.(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

1. WJ Long.History of English Literature, Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University,2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008.

Online Learning Resources:

1. https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
2. https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
3. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
4. https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
5. https://www.litcharts.com/lit/twelfth-night/themes
6. https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

Question Paper Pattern:

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End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.