Rashtreeya Sikshana Samithi Trust

R. V. COLLEGE OF ENGINEERING

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V Vidyaniketan Post, Mysore Road
Bengaluru-560 059

Scheme & Syllabus
III & IV Semester B.E
Telecommunication Engineering
(2012 Scheme)

Department of Telecommunication Engineering
R V College of Engineering, Bengaluru.

Vision

Imparting quality education in electronics and telecommunication engineering with a focus on fundamentals, research and innovation for sustainable development.

Mission

- Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.
- Create state-of-the–art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering education.
- Encourage students to be innovators to meet local and global needs.
- Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Center of Excellence with focus on affordable and sustainable innovation.
- Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.

Program Educational Objectives (PEOs):

PEO1: Acquire appropriate knowledge of the fundamentals of basic sciences, mathematics, engineering sciences, Electronics & Telecommunication engineering so as to adapt to rapidly changing technology

PEO2: Think critically to analyze, evaluate, design and solve complex technical and managerial problems through research and innovation.

PEO3: Function and communicate effectively demonstrating team spirit, ethics, respectful and professional behavior.

PEO4: To face challenges through lifelong learning for global acceptance.

Program Outcomes:

PO1: An ability to apply knowledge of mathematics, science and basic engineering to the area of Telecommunication engineering.

PO2: An ability to design and conduct experiments, analyze and interpret data obtained from devices, subsystems and systems of Electronics and Telecommunication Engineering.

PO3: An ability to identify, formulate and solve problems in the areas of wired communication, wireless communication, signal processing and system design.

PO4: An ability to use the computer techniques, skills and modern engineering tools necessary for investigating complex problems in wired communication, wireless communication, signal processing and system design.

PO5: Ability to conceive, design and implement as a team, demonstrating, organizing, managerial leadership and effective communication qualities with a focus on lifelong learning.

PO6: An ability to understand and derive engineering solutions for sustainability considering economics, environmental, social, ethical and safety issues with global perceptions.

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

(Autonomous Institution, affiliated to VTU, Belgavi)

DEPARTMENT OF TELECOMMUNICATION ENGINEERING

THIRD SEMESTER								
Sl No	**Course Code**	**Course**	**BOS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self Study**	
1	12MA31	Applied Mathematics-III	Science	3	1	0	0	**4**
2	12EB32	Environmental Science and Biology for Engineers	Science	3	0	0	1	**4**
3	12TE/EE/IT 33	Analog Electronics Circuits	TE	3	0	1	1	**5**
4	12TE/EE/CS/IS/IT34	Digital Logic Design	TE	3	0	1	1	**5**
5	12EC/TE35	Network Analysis and Control Theory	ECE	3	1	0	0	**4**
6	12TE/EC/EE36	Signals and Systems	TE	3	1	0	1	**5**
7	12MA37	*Bridge Course Mathematics– I	Science	2	-	-	-	**-**
								27
		No. of Hrs.		**18**	**06**	**04**	**16**	**44**

* Mandatory audit course for lateral entry diploma students

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

(Autonomous Institution, affiliated to VTU, Belgavi)

DEPARTMENT OF TELECOMMUNICATION ENGINEERING

FOURTH SEMESTER								
Sl No	**Course Code**	**Course**	**BOS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self Study**	
1.	12MA41	Applied Mathematics -IV	Science	3	1	0	0	**4**
2.	12EM42	Engineering Materials	ME	3	0	0	0	**3**
3.	12EC/EE/TE43	Microprocessors & Microcontrollers	ECE	3	0	1	1	**5**
4.	12EE/EC/TE44	Fields and Waves	EEE	3	1	0	1	**5**
5.	12TE/EC/EE45	Digital Signal Processing	TE	3	0	1	1	**5**
6.	12TE46	Data structure using C	TE	3	1	0	1	**5**
7.	12HSS47	Innovation and social skills	HSS	0	0	1	0	**1**
8.	12MA48	*Bridge Course Mathematics - II	Science	2	-	-	-	**-**
								28
		No. of Hrs.		**18**	**06**	**04**	**16**	**44**

EC, CS, EE, IS, TE	III Semester 12BT32	IV Semester 12MS42
ME,CH,IM,IT,CV,BT	III Semester 12MS32	IV Semester 12BT42

*Mandatory audit course for lateral entry diploma students

1 Hr. Lecture=1 Credit, 2 Hr. Practical=1 Credit, 2 Hr. Tutorial=1 Credit, 4 Hr. Self Study=1 Credit

APPLIED MATHEMATICS III

Course Code	**:**	**12MA31**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S : 3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To analyze periodic phenomena using concept of Fourier series
2. Understand the basics of matrix theory and its applications to find solution of system of linear equations.
3. To find the approximate solutions using numerical methods, for problems which do not have analytical solutions.
4. To approximate functional values with different curves.
5. To optimize real functional with various applications

UNIT I

Fourier series and Fourier Transforms : **08 Hrs**

Introduction, periodic functions, Even and odd functions, properties. Special waveforms - Square wave, half wave rectifier, saw-tooth wave and triangular wave. Euler's formula for Fourier series, Fourier series for functions of period 2L (particular cases), Dirichlet's conditions - problems. Half Range Fourier series- Construction of Half range cosine and sine series, Complex form of Fourier series problems. Complex Fourier Transforms –Properties & simple problems.

UNIT II

Matrices and Linear Equations : **07Hrs**

Elementary transformation, rank of matrix by using Echelon form, consistency of system of linear equations and solutions, solution of system of linear equations using Gauss elimination method, Gauss Jordan method, Gauss Seidel method, Eigen values and Eigenvectors, finding largest Eigen value by using Power method.

UNIT III

Curve Fitting : **07 Hrs**

Method of Least squares - fitting of the curves of the form $y = ax + b$, $y = ae^{bx}$, $y = ax^b$ and $y = ax^2 + bx + c$, Correlation and Regression analysis.

Finite differences-forward and backward differences, Interpolation-Newton's forward and backward interpolation formulae, Lagrange's interpolation formula.

UNIT IV

Numerical methods for Ordinary differential equations : **07 Hrs**

Numerical integration– Simpson's rules, Weddle's rule and Gaussian quadrature (two point & three point formula). Numerical methods for first order ODE – Single step & Multistep methods-Taylor's series method, Runge-Kutta fourth order method, Adam-Bash forth's method, BVP for ODE – Shooting methods for second order ODE (All methods without proof).

UNIT V

Calculus of Variation : **07Hrs**

Introduction, Variation of functions and functional, extremal of a functional, variational problem, Euler's equation and special cases. Examples - Geodesics, Hanging cable, and Brachistochrome problem.

Course outcomes:

After completion of the course the student would be able to:

CO1: Apply knowledge of linear algebra for finding the solution of system of linear equations.

CO2: Analyze and interpret physical phenomena which are periodic in nature by applying Fourier series.

CO3: Solve Algebraic and transcendental equations using effective numerical methods.

Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2007, ISBN: 81-7409-195-5, Chapters 2, 10, 24, 28, 29, 31, 34.
2. N.P Bali & Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, 7th edition, 2010, ISBN: 978-81-7008-992-6, Chapters: 3(3.34-3.40,3.46, 3.47), 10 (10.1-10.7-10.10), 2 (2.24 -2.26).`
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2007, ISBN: 978-81-265-3135-6, Chapters: 6, 7.1, 7.2,10(10.1-10.5,10.9-10.11),17, 18,19.
4. Murray R Spiegel, "Theory & problems of Fourier Analysis with applications to Boundary Value problems", Schaum's Outline Series. ISBN:9780070602199

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily

ENVIRONMENTAL SCIENCE AND BIOLOGY FOR ENGINEERS

Course Code	**:**	**12EB32**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S : 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

Objectives for Environmental Technology

1. To make engineering graduates understand the changes happening in the environment over decades (to give statistics with causes)
2. Role of human beings in the changes in environment and ways and means of controlling the changes through technology
3. Sustainability issues in new technologies and its adaptation
4. Innovation (case studies) to arrest degradation of environment.

Objectives for Applied Biology

1. To create awareness among all engineering graduates the need of biological study in engineering (biology related issues in each engineering profession with case studies and also application of biology in each program of engineering
2. Various branches of biological sciences (this might contain discussion of basic human physiology, sensors and systems).
3. Effect of environment on biological issues and think of solutions (case studies in industrial environment to be studied)

UNIT I

Ecosystems and environment : **06Hrs**

Principles of ecosystem, impact of human being on environment: pollution, resource depletion and global environmental issues, ecosystem health and environmental changes and human health. Procedure to assess ecosystem's health. Standards- ISO14000 and Environmental Impact Assessment – definition, objectives, and types. Rapid and Comprehensive Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS) and Finding Of No Significant Impact (FONSI). Some EIA examples –Thermal Power Plant, Mining, Fertilizer, Construction Projects, Airport, Water and Wastewater Treatment Plants.

UNIT II

Strategies and Technology-based solutions for Improvement of Environment Quality: **10Hrs**

Environment quality objectives and 'Waste challenge' in modern society - types of waste: municipal, agricultural, medicinal, E-waste, industrial. Engineering ethics, 3 R's – Reduce, Reuse & Recycle, and Sustainable waste management: Compacting, drying, dewatering, bio-drying, composting, bioremediation, biodegradation (chemicals and oil spillage). Waste to energy – energy recovery by incineration, bio-gasification, gasification and pyrolysis, bioconversion to clean energy (biofuels). Some examples: Upflow anaerobic sludge blanket (UASB) digestion for waste water treatment and biogas production. Overview of emerging technologies.

Technology to reduce pollution:

SO_2/CO_2 reduction by smoke-scrubber in coal thermal plants, chlorofluorocarbon (CFC) and incandescent bulb replacement, Renewable energy sources – wind, solar, tidal waves and biomass. Emerging technologies: Geo-engineering - ocean iron fertilization, green cement, bioremediation by terminator insects and synthetic biology.

UNIT III

Design and Modeling for Development of Environment : **06 Hrs**

Environmental Design:

Principles, benefits and motivation. Environmental design for manufactured products, building and for developmental planning. Systems Engineering – Analysis - Design – synthesis - applications to environmental Engineering Systems.

Environmental Modeling:

Introduction, forecast modeling and growth modeling, sensitivity analysis. Application of remote-sensing and geographic information systems (GIS) in environmental modeling.

UNIT IV

Introduction to cell and organ systems : **06 Hrs**

Cell Types: Structure of plant, animal and microbial cell and Specialized cells like stem cells and nerve cells. Biological macromolecules: Carbohydrates, proteins and nucleic acids and Special biomolecules – hormones, enzymes, vitamins and antibiotics. Introduction to organ systems for example digestive, respiratory, excretory nervous and circulatory. Nervous Control and coordination, sensory organs: Auditory, vision, olfactory, touch and taste.

UNIT V

Bio-Inspired engineering (BIE) or Bionics : **08Hrs**

Biological phenomena and innovative engineering. Introduction to Bioelectronics, Bio-computing, bio-photonics and bio-mechatronics. Locomotion and Bio-inspired Robotics, Prosthesis and biomedical implants, Aerodynamics and flight muscle functioning (birds & Drosophila).

Signaling: Enzymes and recognition receptors in biosensors; Neurotransmission and neural networks (artificial intelligence, signal processing and imaging); Bioelectric signals and cardiac generator.

Sound: Ultrasonics in biology (echolocation in bats, sonar in whales & dolphins) and instrumentation (medical ultrasonography - ultrasound imaging).

Light: Photosynthesis and photovoltaic cells.

Course outcomes :

After completion of the course the student would be able to:

CO1: The adverse changes in the environment due to human activities

CO2: The need of innovative technology to arrest or reverse these changes.

CO3: Ethical considerations important for systems engineering.

CO4: Basics of biological phenomena.

CO5: Their application in innovative engineering and development of technology.

Reference Books :

1. Vijay Kulkarni and T. V. Ramachandra, "Environment Management", TERI Press, 2009, ISBN: 8179931846, 9788179931844
2. Gerald Kiely 1997, "Environmental Engineering", McGraw-Hill, ISBN: 9780077091279
3. Sven Erik Jørgensen, " Integration of Ecosystem Theories: A Pattern Ecology & Environment", 3rd Edition, Springer,2002, ISBN: 1402007558, 9781402007552
4. Linvil Gene Rich "Environmental Systems Engineering", McGraw-Hill, 2003ISBN: 9780070522503
5. Ni-Bin Chang, "Systems Analysis for Sustainable Engineering: Theory and Applications (Green Manufacturing & Systems Engineering)", McGraw-Hill Professional, 2011, ISBN: 0071630058, 9780071630054
6. Larry Canter, "Environmental Impact Assessment", McGraw-Hill, 1995, ISBN: 0070097674

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily

ANALOG ELECTRONICS CIRCUITS

Course Code	**:**	**12TE/EE/IT33**	**CIE Marks**	**:**	**150**
Hrs/Week	**:**	**L: T:P:S: 3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3+3**

Course Learning Objectives (CLO):

1. To study different parameters and basic circuits of op-amps
2. To design and characterize differential amplifiers using BJT and MOSFET
3. To design analog circuits using IC 555 and IC565.
4. To realize basic ADC and DAC circuits.

UNIT I

Active sources and Differential amplifiers: **07Hrs**

Review of devices -BJT, JFET and MOSFET and their characteristics.

Introduction to active sources and differential amplifiers, internal structure of differential amplifiers, BJT current sources, MOSFET current sources, design of active current sources, characteristics of differential amplifiers, BJT differential amplifiers, BJT differential amplifiers with active loads, MOS differential amplifiers and design of differential amplifiers

UNIT II

Characteristics of practical Op-Amps: **07Hrs**

Introduction, Internal Structures of Op-Amps, Parameters of Practical Op-Amps, Input resistance, output resistance, input capacitance, Common mode rejection ratio, Large signal voltage gain, rise time, open loop voltage gain and bandwidth, slew rate, input voltage limits, output voltage limits, input offset voltage, input biasing current, input offset current, power supply rejection ratio, Thermal drift and offset voltage adjustment. Characteristics of ideal Op-Amps, op-amp SPICE models, Analysis of ideal Op-Amp circuits, non inverting amplifier, inverting amplifier, and Differential amplifiers using op-amp, op-amp SPICE models

UNIT III

Circuits with Op-Amps and Diodes: **07Hrs**

Positive signal detectors, precision peak voltage detectors, precision Half-wave rectifiers, Precision Full-wave rectifiers, Precision clamping circuits, fixed voltage limiters, Adjustable voltage limiters, comparators, Threshold comparators, Zero-crossing detectors, Schmitt Triggers- inverting and non inverting Schmitt trigger, Schmitt trigger with reference voltage, effects on hysteresis on the output voltage, Square wave generators, Triangular wave generators, saw tooth-wave generators

UNIT IV

Active Filters: **07Hrs**

Introduction, Active versus passive filters, Types of Active filters, the Biquadratic function, Butterworth filters (Butterworth function for n=2 and n=3), Low -pass filters,(first order low pass filter, second order low pass filter, Butterworth low pass filters),Band-pass filters (wide band pass filters, narrow band pass filters) Band reject filters(wide band reject filters, narrow band reject filters). All pass filters.

Regulators:

Introduction, classification, linear regulators using op-amp and IC723

UNIT V

Other Analog IC's and Applications: **07Hrs**

Voltage controlled oscillators-NE/SE-566, 555 Timer-functional block diagram, monostable and astable multivibrators and its applications, Phase lock loops-phase detectors, integrated circuit PLL and applications of 565 PLL, Sample and Hold circuits, Digital to analog converters-R-2R ladder, weighted resistor D/A converters, ICD/A converters, Analog to digital converters-successive approximation A/D converter and IC A/D converter.

Laboratory Experiments

The students are expected to simulate the following circuits using Orcad PSPICE tool.

1. Modeling of current controlled voltage source, voltage controlled current source, current controlled current source using Orcad PSpice, Schematic entry of current sources & simulation of BJT, FET and MOSFET as Non linear devices.
2. Schematic entry of designed amplifier circuit and simulation of - Direct coupled and cascaded amplifiers, with Analysis of Bandwidth, Gain and Gain Bandwidth product.
3. Schematic entry of designed amplifier circuit and simulation of - Resistance capacitance coupling with Analysis of Bandwidth, Gain and Gain Bandwidth product
4. Schematic entry of designed amplifier circuit and simulation of - Feedback Amplifiers - Design and testing of voltage series feedback amplifier.
5. Designing and simulation of active filters (LPF, HPF).

The students are expected to implement the following circuits on hardware.

1. Wave shaping - Precision rectifiers (Half Wave & Full Wave), peak detector using IC 741.
2. Astable and Monostable multivibrators using IC555 timer
3. Waveform generation- Wein-bridge and phase shift oscillators, Schmitt trigger using IC741
4. Design and testing of a DAC using Ladder type using IC741.
5. Design and testing of ADC (Flash type).
6. Design and realization of second order LPF and HPF.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome :

After completion of the course the student would be able to:

CO1: Understand the various parameters ,characteristics and specifications of devices, amplifiers Data converters and Timers

CO2: Appreciate and analyze the performance of subsystems.

CO3: Design Electronic subsystems for various applications

CO4: Implement and demonstrate various analog Electronic circuits.

Reference Books:

1. M.H Rashid, "Microelectronics circuits Analysis and Design", Thomson, ISBN:0-534-95174-0¸ Chapter 6, 7, 9, 11, 13 & 16.
2. Sedra& Smith, "Microelectronics circuits", Oxford 5th Edition, ISBN-13: 978-0195338836.
3. Millman & Grabel: "Microelectronics", TMH, 2nd Edition, ISBN13: 9780074637364.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:

In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practical's is 60% and Viva-voce is 20%.

DIGITAL LOGIC DESIGN

Course Code	**:**	**12TE/EE/CSE/ISE/IT 34**	**CIE Marks**	**:**	**150**
Hrs/Week	**:**	**L:T:P:S : 3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3+3**

Course Learning Objectives (CLO):

1. To describe the optimization techniques for logic expressions using Karnaugh map and Tabular method.
2. To derive Boolean equation and design combinational circuits with optimal gates.
3. To illustrate the working principles of Flip-Flops and design asynchronous sequential circuits
   To design simple synchronous digital circuits based on finite state machine algorithm

UNIT I

Simplification of Boolean Expressions: **07 Hrs**

Formulation of the Simplification Problem, Prime Implicants and Irredundant Disjunctive Expressions, Prime Implicates and Irredundant Conjunctive Expressions, Karnaughs Map-Using Karnaugh Maps to obtain minimal Expressions for Complete Boolean functions, Minimal Expressions of Incomplete Boolean Expressions, The Quine MC-Cluskey Method of Generating Prime implicants and Prime implicates, Prime-Implicant / Prime-Implicate Tables and Irredundant expressions, VEM Technique (upto 4 variables), Binary Adders and Substractors, Decimal Adders.

UNIT II

Logic Design with MSI Components and Programmable Logic Devices (PLD's): **07 Hrs**

Comparators, Decoders, Encoders, Parity Generators and Parity Checking Circuits, Multiplexers, Programmable Logic Devices, Programmable Read-only memories, Programmable Logic Arrays, Programmable Array Logic .

UNIT III

Flip-Flops and Applications: **08 Hrs**

The Basic Bistable Elements, Latches, Timing Considerations, Master-Slave Flip-Flops (Pulse-triggerred Flip-Flops), Edge – Triggerred Flip-Flops, Characteristics Equations, Registers, Counters, Design of Synchronous and asynchronous Counters.

UNIT IV

Synchronous Sequential Networks: **08 Hrs**

Structure and operation of Clocked synchronous Sequential Networks, Analysis of Clocked Synchronous Sequential Networks, Modeling clocked synchronous sequential network behavior, State Table Deduction, The State Assignment, Completing the design of clocked synchronous sequential networks.

UNIT V

Logic Families: **06 Hrs**

Working Principles of Transistor – Transistor Logic (TTL), Emitter – Coupled Logic (ECL), The MOS Field Effect Transistor as Switch, NMOS and Design of Boolean Expressions using PMOS Logic, CMOS Logic, Interface between logic families, Tri-state buffer, RAM and ROM memory, Static and dynamic hazards in logic circuits.

Laboratory Experiments

PART A

1. Realization of Parallel adder / subtractor using IC 7483
2. Design and Realization of adder, subtractor using IC 74153 and binary to gray code conversion using IC 74139
3. Design and realization of One/Two bit comparators using basic gates. Realization of 4 bit comparators using IC 7485.
4. Realization of decoder, encoders and priority encoders
5. Realization and verification of SR and JK flip-flops using universal gate. Realization of Master-Slave flip-flop using IC7476.
6. Design of programmable counters using IC74192 & IC74193
7. Realization of ring counter and Johnson counter.
8. Design and verification of Parity generators and parity checkers.

PART B

The students are required to design any one digital system using the concepts learnt in PART A. The designed circuit has to be realized using discrete hardware components and implement on FPGA using HDL

1. Addition of two numbers whose sum is less than 9.
2. Design a Stop Clock to display from 0 to 9 Sec.
3. Design a Stop Clock to display from 1 to 9 min.
4. Design a Circuit that will display random numbers from 0 to 9.
5. Design a circuit that will transmit 4 bit of information serially / over a single channel.
6. Sequence Generator.
7. Switch debouncer.
8. Programmable Signal Generator.
9. 4 bit by 3 bit binary multiplier
10. Data serializer.
11. Design of parity generator and checker using multiplexer.
12. Design a digital system to control a dc motor using decoder.
13. Design a digital system to generate carry, overflow and auxiliary carry for an 8 bit addition and subtraction using suitable IC`s.
14. Design a 2 bit comparator using PAL.
15. Design a driver circuits with current rating.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design concepts of emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome :

After completion of the course the student would be able to:

CO1: Derive Boolean expressions and implement optimal Logic circuits
CO2: Design and implement combinational and sequential digital systems
CO3: Design and implement synchronous digital systems using state machines
CO4: Conceptualize design a digital system using programmable logic arrays.

Reference Books

1. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, 2002, ISBN 0-07-052906 Chapters: 3,4,5,6,7
2. Stephen Brown, "Fundamentals of Digital Logic Design with Verilog", Tata McGraw Hill, 2nd Edition, 2008.ISBN: 00-70-667241 Chapters: 2,3,4,5,6,7,8,9
3. M Morris Mano, Michael D.Ciletti, "Digital Design", Pearson, 4th Edition, ISBN-978-81-317-1450-8. Chapters: 3,4,5,6,7,10.
4. Samir Palnitkar "Verilog HDL A guide to digital design and synthesis", Pearson Education Asia, 2nd Edition, ISBN: 81-7758-918-0. Part 1 of this book.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Continuous Internal Evaluation for Practical's:

The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:

In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practicals is 60% and Viva-voce is 20%.

NETWORK ANALYSIS AND CONTROL THEORY

Course Code	**:**	**12EC/TE35**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T:P:S:3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To use mesh and nodal analysis for formulating the transfer function of electrical networks
2. To apply network theorems for reducing complex electrical networks into simpler networks.
3. To evaluate the initial and final values of different RL, RC and RLC networks for various input signals.
4. To apply Laplace transforms to analyze and synthesize the networks for different input signals.
5. To analyse control systems using signal flow graphs and block diagram techniques
6. To compute time domain response of first and second order systems.
7. To analyze the stability of systems using root locus methods

UNIT I

Basic Concepts: **07 Hrs**

Meaning of Networks and Network Analysis, Classification of Network Elements, Active and Passive, Linear & Non-Linear, Unilateral & Bilateral, Lumped & Distributed with examples.

Mesh and Node Analysis:

Loopand Node Analysis with Linearly Dependent and Independent Sources for DC and AC Networks including Concepts of Super Mesh and Super Node.

UNIT II

Network Theorems: **07 Hrs**

Principle of Dual Networks, Analysis of Networks using Superposition, Reciprocity, Thevenin's& Norton's, Millman's& Maximum Power Transfer Theorem with Proofs

UNIT III

Initial Conditions & Transient Analysis in Networks : **07 Hrs**

Behavior of R, L, C components under switching conditions and their representations. Examination of initial and final values in different types of RL, RC and RLC networks.

Laplace Transforms:

Introduction, The Laplace Transformation, Basic Theorem for the Laplace Transformation, Solution of Linear differential Equation, Partial Fraction Expansion

UNIT IV

Introduction to Control Systems: **07 Hrs**

Definition of Control System, Requirements of a Control System, Classification of Control Systems.- Linear, Non- Linear, Analog and Digital, Open Loop and Closed Loop (in detail), Single- Input, Single- Output, Multiple Input Multiple Output Systems.

System Modeling:

Modeling of Electrical (i) Mathematical Model (Integro-Differential Equations) (ii) Transfer Function, Definition, Three Forms of Transfer Functions, Polynomial Form, Pole- Zero Form and Time- Constant Form.

Block Diagram:

Block Diagram Reduction

Signal Flow Graphs:

Signal Flow Graphs, Mason's Gain Formula (No Proof), Relative Advantages

UNIT V

Time Response of feedback control Systems : **07 Hrs**

Standard Test Signals, Step Response for First and Second Order, Impulse Response for First and Second Order, Distinction between Type and Order of the System, Time Domain Specifications for Second Order System. t_r, t_d, t_p, M_p(No Derivation), e_{ss} Steady State Error Analysis, Error Constants, K_p, K_v, K_a.

Stability Analysis and Introduction to Root Locus Technique :

Concepts of Stability, Types of Stability, Asymptotic Stability. Introduction to Root Locus Technique: Definition of Root Locus Diagram, Steps to draw the Root Locus Diagram

Course Outcomes :

After completion of the course the student would be able to:

CO1: Demonstrate the use of Node and Mesh techniques to solve a given electrical circuit.

CO2: Apply various network theorems and Mathematical transformations to solve a given electrical network.

CO3: Analyze the behavior of the circuits in transient state and steady state.

CO4: Evaluate the stability criteria and perform stability analysis of the control system.

Reference Books :

1. D.RoyChoudhury, "Networks and Systems", New Age International Publications, 2nd Edition, 2008. ISBN : 978-81-224-2767-7, Chapter 1, 2.1-2.5, 5, 7.1-7.7,
2. M .E .Van Valkenburg, "Network Analysis", PHI, 3rd Edition, 2004. ISBN: 81-315-0200-7 6., Chapter 1, 2.1, 2.2, 3.1-3.5, 4, 5, 6, 7, 9.2-9.5,
   Nagarathand M.Gopal, "Control Systems Engineering", New Age International (P) Limited Publishers, 5th Edition,2007. ISBN 9788122420081 8122420087. Chapter 1,2,3, 5 & 7.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

SIGNALS AND SYSTEMS

Course Code	**:**	**12TE/EC/EE 36**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T: P: S: 3:2:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To analyze and recognize basic signals and its operations in electrical and communication context those are mathematically tractable in different domains
2. To analyze and define a system in electrical and communication context as a mathematical expression in time, frequency and Z domain.
3. To analyze a complex signals continuous and discrete time signals in frequency domain.
4. To analyze a signal and a system in time, frequency and Z domains and develop a mathematical process to migrate between the two representations of the same entity.

UNIT I

Signals: **07 Hrs**

Definition of Signals, Classification of Signals, Basic Operations on Signals: Operations Performed on the independent and dependent variable, Precedence rule, Elementary Signals.

Systems:

Definition of systems, system viewed as interconnection of operations, properties of systems.

UNIT II

Linear Time Invariant Systems: **08Hrs**

Discrete Time Systems:

Convolution sum, Convolution sum evaluation procedure.

Continuous Time Systems:

Convolution integrals, convolution integrals evaluation procedure, interconnections of LTI system, relations between LTI system properties and impulse response representation, difference equation representation of LTI system and solving difference equation (excluding differential equation), block diagram representation of systems.

UNIT III

Fourier Representation of Continuous Signals: **08 Hrs**

Fourier Series:

Introduction, Complex Sinusoids and Frequency Response of LTI System, Fourier series representation,

Fourier Transform:

Fourier Transform representation. Properties of Fourier Transform, Inverse Fourier Transform by using Partial Fraction Expansion, Fourier Transform of Periodic Signals, Frequency response of Systems characterized by LCC difference equation.

UNIT IV

Fourier Representation of Discrete signals: **08 Hrs**

Discrete Time Fourier series, Discrete time Fourier transforms. Properties of Fourier Transform, Inverse Fourier Transform

Application of Fourier representation:

Sampling: Sampling Continuous-Time Signals, Sampling theorem, Sub-sampling: Sampling Discrete Time Signals, Reconstruction of Continuous Time Signals from Samples.

UNIT V

Z Transforms: **08Hrs**

Introduction, Z Transforms, Properties of ROC, Poles and Zeros, Properties of Z- Transforms, Inverse of Z Transforms: Partial-Fraction Expansions, Power Series Expansion, Transfer Function, Causality, Stability and Inverse Systems. Unilateral Z transform and its application to solve difference equation. Relation between Z Transform and Fourier Transform

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Explain the representation of signals and systems in various domains.
CO2: Apply various mathematical operations on signals.
CO3: Analyze both continuous and discrete time systems in time, frequency domain and z-domain.
CO4: Evaluate the characteristics of systems

Reference Books:

1. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons, 2nd Edition, 2008. ISBN: 0471138207., Chapter Nos. 1,2,3,4 & 7.
2. V Oppenheim, Alan Willsky and A Hamid Nawab, "Signals and Systems", Alan, Pearson Education Asia/ PHI, 2nd Edition, 2006,ISBN: 9780138147570, Chapter Nos. 1,2,3, 4, 5 & 10.
3. H.P Hsu, R. Ranjan, "Signals and Systems", Schaum's outline series, TMH, 2006, ISBN: 0070306419.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self-learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

BRIDGE COURSE MATHEMATICS- I

Course Code	**:**	**12MA37**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**02**	**SEE Marks**	**:**	**100**
Audit Course	**:**		**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To apply the knowledge of ordinary and partial differentiation in engineering and real life problems;
2. To learn how to formulate and interpret a Taylor series approximation for a function.
3. To comprehend basic meaning of partial derivatives.
4. To make the student recognize and model differential equations and apply analytical techniques to compute solutions.
5. To recognize and model differential equations, apply analytic techniques to compute solution for engineering problems.

UNIT I

Differential Calculus **06Hrs**

Successive differentiation, n^{th} derivatives of standard functions, Leibnitz's theorem (without proof). Taylor's series and Maclaurin's series for function of single variable (without proof)

UNIT II

Partial Differentiation **06Hrs**

Introduction-partial derivatives, total derivative, differentiation of composite and implicit functions. Jacobians and problems.

UNIT III

Ordinary differential equations **06Hrs**

Solution of first order and first degree differential equations - variable separable methods homogeneous, linear, Bernoulli, exact equations (without integrating factor).

UNIT IV

Linear ordinary differential equations of second and higher order **07Hrs**

Linear differential equations of higher order with constant coefficients. Solution by inverse differential operator method. Solution by method of variation of parameters.

UNIT V

Vector Analysis **06Hrs**

Vector Algebra - Vector addition, Multiplication (dot, cross & triple products), Vector differentiation – velocity, acceleration of a vector point function.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Use the concept of functions of several variables and their partial derivatives for computing the areas, volumes using multiple integrals.

CO2: Apply concept of differential equations to handle physical problems.

Reference Books:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 40th edition 2007.ISBN: 8174091955, 9788174091956.
2. N. P. Bali, Manish Goyal "A Text Book of Engineering Mathematics", Laxmi Publications, 7th edition,2007 ISBN: 81-7409-195-5.
3. B. V. Ramana "Higher Engineering Mathematics", Tata McGraw Hill Publications, 2007.ISBN: 007063419X, 9780070634190.
4. E- Kreyszig "Advanced Engineering Mathematics", John Wiley & sons Publications,8th edition, 2007. ISBN 0-471-15496-2

Scheme of Continuous Internal Examination:

CIE consists of Two Tests each for 50 marks (20 marks for Quiz + 30 marks for descriptive)

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will consist of eight questions out of which five questions have to be answered.

APPLIED MATHEMATICS-IV

Course Code	**:**	**12MA41**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: P: T:S : 3: 0 : 2 :0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To provide basic definitions and theorems of the calculus of complex functions which are involved in any field problems of engineering?
2. To use Bessel functions and Legendre polynomials and their properties in Heat, wave and Laplace equations with cylindrical and spherical symmetry.
3. To apply theory of probability in study of random phenomena; analyzing and interpreting data that involves uncertainty.
4. To apply linear programming techniques for optimization problems subject to linear constraints in the various areas of Engineering & Science.
5. To find the solution of partial differential equations that arises in physical situations.

UNIT I

Complex Analysis : **07 Hrs**

Complex variables - Function of a complex variable, analytic functions-Cauchy-Riemann equations in cartesian and polar forms (without proof), properties of analytic functions, construction of analytic functions by Milne-Thomson method.

Complex integration - Complex line integrals-Cauchy's theorem and corollaries (without proof), Taylor's and Laurent's series (statements only), singularities, poles, residues, residue theorem (without proof) - problems.

UNIT II

Special Functions : **07Hrs**

Introduction of Bessel's and Legendre's differential equation using the solution of Laplace equation in cylindrical and spherical system. Series solution of Bessel's differential equation leading to Bessel function of first kind, recurrence relations, generating functions, Bessel's integral formula, orthogonality of Bessel function. Legendre's differential equation, Legendre polynomials, Rodrigue's formula.

UNIT III

Linear Programming Problem : **08 Hrs**

Mathematical formulation of Linear Programming Problem, Graphical method, Simplex method and Big M method.

UNIT IV

Probability and Distributions : **07 Hrs**

Basics of Probability: Sample Space, events, probability of an event, addition theorem. Conditional probability, Multiplication theorem, Baye's rule. Random Variables: Discrete and continuous, Probability mass function, Probability density function, Cumulative density function, Mean, Variance, standard deviation Binomial, Poisson, Exponential and Normal Distributions.

UNIT V

Partial Differential Equations : **07Hrs**

Classification of second order Partial differential equations - Elliptic, Parabolic and Hyperbolic. Solution of two dimensional Laplace equation in polar coordinates by the method of separation of variables. Solution of two dimensional heat flow in transient state and steady state. Solution of two dimensional wave equation by the method of separation of variables. Vibrating membrane, solution in the case of rectangular and circular membrane - Simple problems

Course outcomes:

After completion of the course the student would be able to:

CO1: Provide basic definitions and theorems of the calculus of complex functions which are involved in any field problems of Engineering.

CO 2: Use Bessel functions, Legendre polynomials and their properties in heat, wave and Laplace equations with cylindrical and spherical symmetry.

CO3: Study of random phenomena, analyzing and interpreting data that involves uncertainty, using theory of probability.

CO4: Interpret the models of probability distributions for real life and engineering problems.

Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers; 40th Edition; 2007; ISBN: 81-7409-195-5, Chapters 16, 17, 19, 20, 26, 32;
2. N.P Bali & Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications; 7th edition, 2010; ISBN: 978-81-7008-992-6, Chapters: 1, 15, 16, 21;
3. Murray R Spiegel, "Theory & problems of Fourier Analysis with applications to Boundary Value problems", Schaum's Outline Series, ISBN: 007058883X, ISBN-13**:** 9780070588837.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition; 2007, ISBN: 978-81-265-3135-6, Chapters: 4,11, 12, 20, 22;

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

ENGINEERING MATERIALS

Course Code	**:**	**12EM42**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T:P:S : 3: 0 : 0 : 0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. The versatile use of materials from biomedical applications to aerospace industries
2. The different properties of materials.
3. Different types of ferrous alloy its properties and applications.
4. Concept of phase transformation due to temperature in alloys.
5. Various heat treatment methods employed in the industry and its effect on the mechanical properties.
6. Importance of ceramics, polymers and composites, its types, applications.
7. Nano Materials synthesis, advantages over conventional materials.

UNIT I

Introduction: **06 Hrs**

Classification of Materials - Metals, Ceramics, Polymers, composites, Advanced Materials-semiconductors, biomaterials, smart materials, nanostructured materials and their applications
Material properties **–** Mechanical properties, thermal properties – Heat capacity, CTE, thermal conductivity, Electrical and Electronic conductivity, Magnetic properties – dia, para, ferro, ferri, antiferro, domains and hysteresis. Optical properties -Luminescence and photoconductivity.

UNIT II

Ferrous materials and Alloys: **08Hrs**

Binary phase diagrams, Phase Rule, Lever Rule, Solidification, Nucleation and Grain Growth.
Cast Iron,Chromium steels, Nickel steels, Silicon Steels, Tungsten and Molybdenum Steels & Stainless Steels; Tool Steels, structural steels, Corrosion and Heat Treatment

Non-ferrous materials and alloys :

Aluminum, Copper and Titanium, their alloys, properties and applications.

UNIT III

Overview of Flexible Electronics Technology : **08 Hrs**

History of Flexible Electronics, Materials for Flexible Electronics , Fabrication Technology for Flexible Electronics Fabrication on Sheets by Batch Processing, Fabrication on Web by Roll-to-Roll Processing, Additive Printing, Low-temperature Amorphous and Nanocrystalline Silicon Materials, Low-temperature Dielectrics, Low-temperature Thin-film Transistor Devices.

Ceramic Materials :

Definition, Classification of Ceramic Materials, Processing Methods, Properties and Industrial, Medical and Commercial Applications.

Ceramic Materials :

Definition, Classification of Ceramic Materials, Processing Methods, Properties and Industrial, Medical and Commercial Applications

UNIT IV

Composites : **08 Hrs**

Types of Matrix Materials and Reinforcements, Selection of Composites, Properties, Applications, Rule of Mixture for density, elastic modulus and tensile strength.
Nanomaterials - Definition, classification and synthesis – physical and chemical processes,

Characterization of nanomaterials – Electron microscope, X-Ray Diffraction, particle size analyzer

UNIT V

06Hrs

Advanced materials for :

Construction Applications, Biomedical applications, High temperature Applications, Sensors and Actuators - Shape Memory Alloys and Composites, Thin films and coatings.

Course Outcome

After completion of the course the student would be able to:

CO1: Classify materials based on properties
CO2: Compute the properties of composites based on the properties of the constituents
CO3: Draw Binary phase diagrams and identify the phases
CO4: Identify characterization techniques for nanomaterials, thin films, flexible electronics, biomedical applications, high temperature applications, sensors and actuators.

Reference Books :

1. William D. Callister, "Materials Science & Engineering- An Introduction", Wiley India Pvt. Ltd., 6th Edition, 2006, New Delhi, ISBN:9814-12-669-1, Chapter Nos.1,4,6,7,8,9.
2. Fred W. Billmeyer, Jr, " Text Book Of Polymer Science", Wiley-Interscience Publication, 2nd Edition; 1984, ISBN:0-471-82834-3, Chapter No.8.
3. Donald R. Askland, Pradeep P. Phule, "Essentials of Materials Science and Engineering", Thomas Canada Learning INDIA EDITION, ISBN:81-315-0233-3.
4. William Smith, "Foundation of Materials Science and Engineering", 3rd Edition, McGraw Hill, 1997, ISBN: 9780073529240.
5. William S. Wong and Alberto Salleo, "Flexible Electronics: Materials and Applications", ISBN 978-0-387-74362-2, 2009.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

MICROPROCESSOR AND MICROCONTROLLER

Course Code	**:**	**12EC/EE/TE43**	**CIE Marks**	**:**	**150**
Hrs/Week	**:**	**L: T:P:S:3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3+3**

Course Learning Objectives (CLO) :

1. To describe the architecture of microcontroller and microprocessor
2. To explain different operational & non operational attributes for designing processor/controller based application
3. To designing processor/controller based application.
4. To analyze performance of different architectures.

UNIT I

MPU Organization **07 Hrs**

CISC & RISC Design Philosophy, Harvard & Von-Neuman Architectures, Microprocessor & Microcontroller, Intel's 8086 architecture, Pin groups, Functioning, Segmentation, Maximum Mode, Minimum Mode, Address generation, Stack, Interrupts

UNIT II

8086 Assembly Language Programming : **08Hrs**

Addressing Modes of 8086, Instruction Formats, Program Development Tools, Assembler Directives, Instruction Set of 8086. Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, Branching Instructions, Processor Control Instructions and String Instructions, Macros, Modular Programs, Procedures, Assembly Language Programming Examples.

UNIT III

Hardware of 8051 Microcontroller : **08 Hrs**

Introduction of Intel MCS 51 family, Comparison of Microprocessor and Microcontroller, Architecture and Pin Functions of 8051 Microcontroller, CPU Organization, Program Counter, Timing and Machine Cycles, Internal Memory Organization, Registers, Stack, Input/ Output Ports, Counters and Timers, Serial Data Input and Output, Interrupts, Power Saving Modes.

UNIT IV

8051 Microcontroller Based System Design **07 Hrs**

Input/output Port Programming, Programming timers, Asynchronous Serial Data Communication, Interrupt Service Routines. Programming in C, Inline Assembly , Interfacing Matrix Keyboard and Seven Segment Displays, Interfacing ADC and DAC, Interfacing of LCD Display

UNIT V

Advanced Processors & Controllers : **07 Hrs**

Parallel Architectures, Pentium, Multicore Architectures, Cache Coherence issues, ARM, PIC Architectures

Laboratory Experiments

Experiments with 8086 Assembly using MASM

1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions
2. Arithmetic Operations: Addition, Subtraction, Multiplication & Division on 32-Bit Data.
3. Code Conversions: Use XLAT Instruction to Convert Binary to BCD, Binary to ASCII. Input from Keyboard & Display Result on the Console
4. a) Search for A Key in an Array of Elements using Linear Search, Binary Search Find Efficiency in each case.
   b) Sort An Array Using Bubble Sort & Selection Sort. Find Efficiency in each case.
5. a) ASCII Operations: Addition, Subtraction, Multiplication & Division on 16-Bit Data.
   b) Logic Controller Interfacing: Realize Boolean Expressions Like Full Adder, Full Subtractor, Code Conversions, Etc

Experiments with 8051 C using Keil software.

1. a) Write 8051 C program to interface Logic Controller card and perform various logical Functions.
   b) Write 8051 C program to interface stepper motor to rotate in clockwise/ anti clockwise directions & and to rotate the motor through predefined angle of rotation
2. a) Write 8051 C program to interface elevator card & simulate the operations of the Elevator
   b) Write 8051 C program to interface DAC to generate sine wave.
3. Write 8051 C program to interface 4X4 keypad &display the key pressed on LCD.
4. a) Write 8051 C program to interface ADC in polled mode.
   b) Write 8051 C program to interface ADC in interrupt mode.
   c) Generate PWM wave on pin P3.1 to control speed of DC motor. Control the duty cycle by analog input.
5. Write 8051 C program to measure frequency of TTL waveform.
6. Write 8051 C program to interface relay to control AC device

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course outcomes :

After completion of the course the student would be able to:

CO1: Describe the architectural features of different microprocessor and microcontroller

CO2: Apply instruction set of microprocessor and microcontroller in writing assembly level program

CO3: Analyze the working of different on chip modules of the 8051 microcontroller and experiment its configuration and programming concepts

CO4: Design simple embedded systems using 8051 microcontroller.

References Books:

1. Douglas Hall, "Micro-Processors and Interfacing-Programming & Hardware", TMH, 2nd Edition, 2002. Chapter Nos. 1,2,3,4,5& 6.
2. Barry B. Brey, "The Intel Micro-processors, Architecture, Programming and Interfacing", Pearson Education, 6th Edition, 2008 ISBN: 138027455. Chapter Nos. 1,2,3,4,5& 6.
3. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming &Applications", Thomson Learning, 2nd Edition, 2004, ISBN: 81-315-0180-9. Chapter Nos. 3 to 11.
4. Muhammad A Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2nd Edition, 2009 ISBN:-978-81-317-1026-5, Chapter nos.1 to 16.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks

Scheme of Continuous Internal Evaluation for Practical's:

The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:

In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conduction is 60% and Viva-voce is 20%.

FIELDS AND WAVES

Course Code	**:**	**12EE/EC/TE44**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T: P:S : 3: 2 : 0 :4**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To apply Knowledge of Mathematics, science and engineering to the analysis and design of electrical systems involving electric and magnetic fields as well as electromagnetic waves.
2. To interpret and apply the concepts which comes in Antenna and RF Communication
3. To develop and design Mathematical models and communication channels.
4. To analyze and compare different type of wave propagation

UNIT I

Electrostatics 1: **07 Hrs**

Coulomb's law, illustrative examples, Electric Field Intensity, Applications (field due to Line charge distribution, Surface charge distribution- sheet, Circular ring, disk), Illustrative examples.

Flux, flux density Gauss' Law, Divergence Theorem(qualitative treatment), Application of Gauss's Law (Field due to Continuous Volume Charge, Line Charge, Sheet Charge, Metal sphere, spherical shell) Illustrative examples.

UNIT II

Electrostatics 2: **08Hrs**

Work done to move a point charge, Electric potential, Relation between E and V, Applications (field and potential due to Line charge distribution, Surface charge distribution- sheet, Circular ring), Energy Density in an Electric Field , Illustrative examples.

Boundary Conditions (dielectric-dielectric, dielectric-conductor), Poisson's and Laplace's Equations, Uniqueness Theorem, Applications Laplace's and Poisson's Equations (different capacitors, Coaxial conductors), Illustrative examples.

UNIT III

Magnetostatic Fields 1: **08 Hrs**

Current ,Current density**,** Biot-Savart Law , Ampere's Circuital Law Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law , Magnetic Flux Density—Maxwell's Equation ,Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials.

Magnetic Forces, Materials, and Devices: Forces due to Magnetic Fields, A Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials.

UNIT IV

Magnetostatic Fields 2: **07 Hrs**

Magnetic Boundary Conditions, Inductors and Inductances.

Maxwell's Equations: Introduction, Faraday's Law, Transformer and Motional EMFs ,Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples.

UNIT V

Electromagnetic Waves: **07 Hrs**

Introduction, Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence. Illustrative examples.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course outcomes:

After completion of the course the student would be able to:

CO1: Understand the basic concepts of electric fields, magnetic fields and electromagnetic waves.
CO2: Apply the basic concepts to solve complex problems in electric fields, magnetic fields and electromagnetic waves
CO3: Analyze different charge and current configurations to derive the electromagnetic fields.
CO4: Design simple solutions for applications in electric and electronic circuits, electrical machines and communication systems

Reference Books:

1. Matthew N O Sadiku, "Elements of Electromagnetics", Oxford University Press, 4th Edition, 2007 ISBN-13:978-3-540-69138-9. Chapter Nos. 4 to 10.
2. William H. Hayt Jr. and John A. Buck,"Engineering Electromagnetics", Tata McGraw Hill, 6th Edition, 2001ISBN: 978-0-67-067-1223-5. Chapter Nos. 2, 3, 5, 7, 8, 9, 10, 11, 12.
3. Edward C. Jordan and Keith G. Balmain, "Electromagnetics Waves and Radiating Systems", Prentice Hall of India, 2nd Edition, 1968. Reprint 2002.ISBN:8120300548 9788120300545, Ch-5, 6.
4. David K Cheng, "Fields and Waves", Pearson Publications, II Edition, Chapter Nos. 3 to 8.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

DIGITAL SIGNAL PROCESSING

Course Code	**:**	**12EE/EC/TE45**	**CIE Marks**	**:**	**150**
Hrs/Week	**:**	**L:T:P:S:3 : 0 : 2 : 4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3+3**

Course Learning Objectives(CLO):

1. To define discrete-time signals and systems, and express the differences with their continuous-time counterparts.
2. To analyze the effect of sampling on continuous-time signal and system.
3. To develop an efficient method of calculating the DFTs.
4. To define various structures for discrete-time systems.
5. To demonstrate the Frequency transformation in Analog and Digital Domains.
6. To design & implement FIR & IIR filters.

UNIT I

07 Hrs

Frequency Domain Sampling :
Discrete Fourier Transform (DFT), Frequency domain Sampling and Reconstruction of Discrete time signals, DFT as a linear Transformation, and Relationship of DFT to other transforms.

Properties of DFT:
Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and circular convolution, additional DFT properties.

Linear filtering methods based on the DFT:
Use of DFT in linear filtering, Filtering of long data sequences.

UNIT II

07 Hrs

Efficient computation of DFT: FFT Algorithms
Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2 FFT Algorithms and Implementation of FFT Algorithms.

Application of FFT algorithms:
Efficient computation of DFT of two real sequences, Efficient computation of DFT of a 2N – point real sequence, Use of the FFT Algorithm in linear Filtering and correlation.

UNIT III

08 Hrs

Structures for the realization of the discrete time systems:

Structures for FIR systems:
Direct form structure, Cascade form structures, and frequency Sampling structures, lattice Structure.

Structure for IIR systems:
Direct form structures, Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel- Form Structures, Lattice and Lattice – Ladder Structures for IIR Systems.

UNIT IV

07 Hrs

Design of Digital Filters:
Causality and its Implications, Characteristics of practical Frequency Selective Filters.

Design of FIR Filters:
Symmetric and anti-symmetric FIR Filters, Design of Linear phase FIR Filters using Windows, Design of Linear phase FIR filters by frequency Sampling method, Design of Optimum Equi-ripple Linear Phase FIR Filters

UNIT V

Design of IIR Filter from Analog Filters: **07Hrs**

IIR Filter design by approximation of derivatives, IIR Filter design by Impulse Invariance, IIR Filter Design by Bilinear Transformation, Characteristics of commonly used Analog Filters, Some Examples of Digital Filter Designs based on the Bilinear Transformation.

Frequency Transformations: Frequency transformation in the Analog Domain, Frequency transformation in the Digital Domain.

Laboratory Experiments

PART-I

List of Experiments using MAT Lab/SCI Lab/OCTAVE/WAB

1. Verification of sampling theorem.
2. Impulse response and response for a given input of a system by solving difference equation
3. Linear and circular convolution of two given sequences.
4. Autocorrelation and Cross correlation of a given sequence.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
6. Linear and circular convolution of two sequences using DFT and IDFT.
7. Design and implementation of FIR filter to meet given specifications.
8. Design and implementation of IIR filter to meet given specifications.
9. Verification of Cross correlation and Auto correlation of the sequence

PART-II

List of Experiments using DSP Processor

(Note: Experiments no: 1,2,3, & 7 may be performed on CCS)

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications.
5. Realization of an IIR filters to meet given specifications.
6. Impulse response and step response of first order and second order system.

Self-Learning (1 Credit – 4Hrs/Week):

Self-learning will be on the topics of DSP Algorithms, Processors, Adaptive Filters, Multi-rate Systems and Analysis of Digital Filters.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Explain the different mathematical representations of digital systems.
CO2: Apply the Fourier Analysis on Signals and obtain the Fourier representations.
CO3: Evaluate and test the DSP systems using simulation tool.
CO4: Design digital filters to suit specific requirements

Reference Books:

1. Proakis G, Dimitris G. Manolakis, "Digital Signal Processing", PHI; 4th Edition; 2007, ISBN: 978-81-203-3030-6. Chapter Nos. 7,8,9& 10.
2. Lonnie C. Ludeman, "Fundamentals of Digital Signal Processing", John Wiely &Sons, 1986; ISBN: 0471603635.
3. Monson H.Hayes, "Digital Signal Processing", Schaum's Outline Series, 2nd Edition, 2011; ISBN: 0071635092.
4. Alan .V.Oppemheim, "Discrete Time Signal Processing", PHI, 2nd Edition, 1998, ISBN:0-13-754920-2

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self-learning is evaluated for 20 marks.

Scheme of Continuous Internal Evaluation for Practical's:

The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:

In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practicals is 60% and Viva-voce is 20%.

DATA STRUCTURES USING C

Course Code	**:**	**12TE46**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T:P:S:3:2:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To discuss elementary data Structures using C programming languages.
2. To explain the concepts for various kinds of structured data.
3. To illustrate the concepts of data structures in real time applications.
4. To design and to program dynamic data structures using C program.

UNIT I

Introduction to Data Structures: Data types, abstract data type, pointers. **07 Hrs**
Arrays: The array as an ADT, Implementation of One- dimensional, multi- dimensional arrays.
Structures: Implementing structures, Unions, Implementation to Unions, Structure parameters, repressing other data structure, Allocation of storage and scope of variables.

UNIT II

Stacks: Introduction and primitive operations on stack; representing stack in C. stack application: Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix. **07 Hrs**
Recursion: Recursive Definition and Processes, recursion in C, writing recursive programs, simulating recursion.

UNIT III

07 Hrs

Queues: The queue and its sequential representation.
Lists: Linked lists, Lists in C, Other List Structures: Circular lists, Stacks as a circular List, Primitive operations on circular Lists, Doubly Linked lists.

UNIT IV

Trees: Binary trees, Binary tree representations, Representing list as binary trees, Trees and their applications. **07 Hrs**
Graphs: Graphs, Linked representation of Graphs, Graph Traversal.

UNIT V

Sorting: Exchanges sorts, Selection and tree sort, Insertion sorts, Merge and Radix sorts. **07 Hrs**
Searching: Tree searching, General Search trees, Hashing.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for 20 marks is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome

After completion of the course the student would be able to:

CO1: Exhibit program design and implementation competence through the choice of appropriate data structure.

CO2: Design a new data structures based on the need of the application.

CO3: Identify how choice of data structures influences the performance of programs.

CO4: Visualize the need of appropriate data structures in solving real-life problems

Reference Books:

1. Yedidyahlangsam, Moshe J Augenstein Aaron M. Tenenbaum, "Data Structures UsingC and C++", Prentice-Hall of Pvt. Ltd, 2007, ISBN-13: 978-0130369970, chapter Nos. 1 to 9.
2. D. Samantha, Classic Data Structures, Second Edition, Eastern Economy Edition, PHI, 2009,**ISBN**: 978-81-203-4428-0.
3. Richard F Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Thomson, India Edition, 2005, ISBN-13: 978-0534390808.
4. Robert Kruse, C.L.Tondo and Bruce Leung, Data Structures & Program Design in C, Pearson Education, 2nd Edition, Asia, ISBN-10: 0137689950.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

INNOVATION & SOCIAL SKILLS

Course Code	**:**	**12HSS47**	**CIE Marks**	**:**
Hrs/Week	**:**	**L:T:P:S : 0:0:2:0**	**SEE Marks**	**:**
Credits	**:**	**01**	**SEE Hrs**	**:**

Objectives:

1. To provide a platform for the students to exhibit their organizational capabilities, team building, ethical values and extra mural abilities.
2. To encourage to carryout innovative ideas and projects.
3. Take part in societal and community building activities.
4. Make self learning, ethics and lifelong learning a motto.

Guidelines:

The HSS will be evaluated individually based on the broad parameters which include the progress made by student during 3^{rd}& 4^{th} year in innovative projects, Seminar, Paper Presentation, Field activity & other Co-curricular activities. Students shall submit a report and documents as a proof his/her achievements.

BRIDGE COURSE MATHEMATICS II

Course Code	**:**	**12MA48**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S : 2:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**Audit**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. The student should be able to analyze periodic phenomena using concept of Fourier series.
2. Understand the basics of matrix theory and its applications for finding solution of system of linear equations.
3. Finding the approximate solutions using numerical methods, for problems which do not have analytical solutions.

UNIT I

Laplace Transforms **07 Hrs**

Definition, transforms of elementary functions, properties, derivatives and integrals, unit step function

UNIT II

Inverse Laplace Transforms **07Hrs**

Inverse Laplace transforms- properties, convolution theorem (statement only) – problems, solution of linear differential equations, with constant coefficients.

UNIT III

Integral Calculus **06 Hrs**

Multiple integrals – Double and Triple integrals. Area enclosed by plane curves, Volume of solids. Definition of beta and gamma functions and problems.

UNIT IV

Partial Differential Equations (PDE) **06 Hrs**

Formation of Partial differential equations by elimination of arbitrary constants/functions. Solution of Lagrange's linear PDE. Solution of PDE by the Method of separation of variables (first and second order equations).

UNIT V

Vector Analysis **06Hrs**

Vector Differentiation – Scalar and vector point functions, gradient, directional derivative, divergence and curl. Solenoidal and Irrotational fields, vector identities.

Course Outcomes:

After completion of the course the student would be able to:

CO1: The student will be able to solve problems arising in signal processing and various systems using Laplace transforms techniques for problems arising in signals and systems.

CO2: The student will be able to apply vector integration to different Engineering applications.

Reference Books:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 40th edition 2007. ISBN: 81-7409-195-5.
2. N. P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 7th edition, 2007. ISBN: 978-81-7008-992-6.
3. B. V. Ramana "Higher Engineering Mathematics", Tata McGraw Hill Publications, 2007. ISBN: 007063419X, 9780070634190.
4. E- Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons Publications, 8th edition, 2007. ISBN 0-471-15496-2.

Scheme of Continuous Internal Evaluation:

CIE consists of Two Tests each for 50 marks (20 marks for Quiz + 30 marks for descriptive).

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will have eight questions out of which five questions have to be answered.

Rashtreeya Sikshana Samithi Trust

R. V. COLLEGE OF ENGINEERING

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V Vidyaniketan Post, Mysore Road

Bengaluru-560 059

Scheme & Syllabus
V & VI Semester B.E
Telecommunication Engineering

(2012 Scheme)

Department of Telecommunication Engineering
R V College of Engineering, Bengaluru

Vision

Imparting quality education in electronics and telecommunication engineering with a focus on fundamentals, research and innovation for sustainable development.

Mission

- Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.

- Create state-of-the–art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering education.

- Encourage students to be innovators to meet local and global needs.

- Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Center of Excellence with focus on affordable and sustainable innovation.

- Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.

Program Educational Objectives (PEOs):

PEO1: Acquire appropriate knowledge of the fundamentals of basic sciences, mathematics, engineering sciences, Electronics & Telecommunication engineering so as to adapt to rapidly changing technology

PEO2: Think critically to analyze, evaluate, design and solve complex technical and managerial problems through research and innovation.

PEO3: Function and communicate effectively demonstrating team spirit, ethics, respectful and professional behavior.

PEO4: To face challenges through lifelong learning for global acceptance.

Program Outcomes:

PO1: An ability to apply knowledge of mathematics, science and basic engineering to the area of Telecommunication engineering.

PO2: An ability to design and conduct experiments, analyze and interpret data obtained from devices, subsystems and systems of Electronics and Telecommunication Engineering.

PO3: An ability to identify, formulate and solve problems in the areas of wired communication, wireless communication, signal processing and system design.

PO4: An ability to use the computer techniques, skills and modern engineering tools necessary for investigating complex problems in wired communication, wireless communication, signal processing and system design.

PO5: Ability to conceive, design and implement as a team, demonstrating, organizing, managerial leadership and effective communication qualities with a focus on lifelong learning.

PO6: An ability to understand and derive engineering solutions for sustainability considering economics, environmental, social, ethical and safety issues with global perceptions.

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

(Autonomous Institution, affiliated to VTU, Belgavi)

DEPARTMENT OF TELECOMMUNICATION ENGINEERING

FIFTH SEMESTER								
Sl. No.	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self Study**	
1	12HSM51	Management and Organizational Behavior	HSS	3	0	0	0	3
2	12TE52	Communication Channels and Microwave Engineering	TE	3	1	0	1	5
3	12TE53	Analog & Digital Communication	TE	3	0	1	1	5
4	12TE54	Switching and Networks	TE	3	0	1	1	5
5	12TE5AX	Elective A	TE	3	1	0	0	4
6	12TE5BX	Elective B	TE	3	0	0	1	4
								26
		No. of Hrs.		**18**	**04**	**04**	**16**	**42**

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

(Autonomous Institution, affiliated to VTU, Belgavi*)*

DEPARTMENT OF TELECOMMUNICATION ENGINEERING

SIXTH SEMESTER								
Sl. No.	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self Study**	
1	12HSI61	Intellectual Property Rights & Entrepreneurship	HSS	3	0	0	0	3
2	12TE62	Optical Communication and Networks	TE	3	1	0	0	4
3	12TE63	Digital Modulation & Coding	TE	3	0	1	1	5
4	12TE64	Radiating Systems	TE	3	0	1	1	5
7	12TE65X	Emerging Technologies	TE	2	0	0	0	2
5	12TE6CX	Elective C	TE	3	0	0	1	4
6	12TE6DX	Elective D	TE	3	0	0	1	4
								27
		No. of Hrs.		**20**	**02**	**04**	**16**	**42**

EC, CS, EE, IS	V Semester 12HSI51	VI Semester 12HSP61
ME,CHEM,IEM,IT,CV,BT,TE	V Semester 12HSP51	VI Semester 12HSI61

Elective – A **12TE5AX**	**Elective – B** **12TE5BX**	**Elective – C** **12TE6CX**	**Elective – D** **12TE6DX**
Semester : V		**Semester : VI**	
Credits 4	**Credits 4**	**Credits 4**	**Credits 4**
Modern Control Theory-12TE5A 1	ARM Processor-12TE5B1	Multimedia Communication-12TE6C1	Video Engineering-12TE6D1
Digital Signal Processor Architecture-12TE5A2	Digital System Design using HDL -12TE5B2	Digital Image Processing-12TE6C2	Multirate Systems and Filter Banks-12TE6D2
CMOS Circuit Design -12TE5A 3	Cryptography- 12TE5B3	ASIC Design-12TE6C3	Microwave Integrated Circuits-12TE6D 3
Computer Organization and Architecture-12TE5A4	Operating Systems-12TE5B4	Error Control Coding-12TE6C4	Real Time Embedded systems-12TE6D4

MANAGEMENT & ORGANIZATIONAL BEHAVIOR

Course Code	**:**	**12HSM51**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

UNIT I

Introduction to Management: Management Functions, Roles & Skills, Management History – Classical Approach: Scientific Management & Administrative Theory, Quantitative Approach: Operations Research, Behavioral Approach: Hawthorne Studies, Contemporary Approach: Systems Theory, Overview of Social Responsibility & Managerial Ethics, Case Study. **6 Hrs**

UNIT II

Foundations of Planning: Types of Goals &Plans, Approaches to Setting Goals & Plans, Strategic Management Process, Corporate & Competitive Strategies, Decision Making Process, Types of Decisions& Decision Making Conditions, Case Study. **4 Hrs**

Organizational Structure & Design: Designing Organizational Structure: Work Specialization, Departmentalization, Chain of Command, Span of Control, Centralization & Decentralization, Mechanistic &Organic Structures, Organizational Design: Traditional & Contemporary, Case Study. **4 Hrs**

UNIT III

Understanding Organizational Behavior: Attitudes, Job Satisfaction& Organizational Commitment, Cognitive Dissonance Theory, Personality: MBTI & Big Five Model, Emotional Intelligence, Perception & Factors Influencing Perception, Attribution Theory, Learning: Classical & Operant Conditioning, Social Learning & Shaping Behavior, Case Study. **6 Hrs**

UNIT IV

Managing Teams: Groups & Stages of Group Development, Group Structure, Processes & Tasks,Work Team & Types of Work Teams, Case Study. **2 Hrs**

Motivating Employees: Early Theories of Motivation: Maslow's Hierarchy of Needs Theory, McGregor's Theory X& Theory Y, Herzberg's Two Factor Theory& McClelland's Three Needs Theory, Contemporary Theories of Motivation: Adam's Equity Theory & Vroom's Expectancy Theory, Case Study. **4 Hrs**

UNIT V

Managers as Leaders: Early Leadership Theories: Trait Theories, Behavioral Theories: Ohio State Studies, University of Michigan Studies, Blake & Mouton's Managerial Grid, Contingency Theories of Leadership: The Fiedler Model, Hersey & Blanchard's Situational Leadership, Contemporary Views of Leadership: Transactional & Transformational Leadership, Case Study. **4 Hrs**

Introduction to Controlling: The Control Process, Controlling for Organizational Performance & Tools for Measuring Organizational Performance, Case Study. **2 Hrs**

Course Outcomes:

After completion of the course the student would be able to:

CO1: Understand the principles of management theory & Recognize the characteristics of an organization.

CO2: Demonstrate the importance of key performance areas in strategic management & decision-making process.

CO3: Design appropriate organizational structures and possess an ability to conceive organizational dynamics.

CO4: Evaluate leadership practices in organizations & Implement the right one that would enable systems orientation.

Reference Books:

1. Stephen Robbins, Mary Coulter & Neharika Vohra, "Management", Pearson Education Publications, 10th Edition, ISBN: 978-81-317-2720-1.
2. James Stoner, Edward Freeman & Daniel Gilbert Jr, "Management", PHI, 6th Edition, ISBN: 81-203-0981-2.
3. Stephen Robbins, Timothy Judge& Seema Sanghi, "Organizational Behavior", Pearson Education Publications, 13th Edition, ISBN: 978-81-317-2121-6.

Scheme of Continuous Internal Evaluation (CIE):

CIE consists of three tests, each for 45 Marks, (15 Marks for Quiz + 30 Marks for Descriptive – inclusive of case studies) out of which, the best two will be considered. In addition, there will be one seminar on emerging topics in Management and Organizational Behavior for 10 Marks.

Scheme of Semester End Examination (SEE):

The question paper consists of Part A and Part B. Part A will be for 20 Marks covering the complete syllabus and is compulsory. Part B will be for 80 Marks and will consist of five questions, inclusive of case studies, carrying 16 Marks each. All five questions from Part B will have an internal choice and one of the two have to be answered compulsorily.

COMMUNICATION CHANNELS AND MICROWAVE ENGINEERING

Course Code	**:**	**12TE52**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 3:2:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Applied Mathematics III&IV[12MA31,12MA41]
2. Network Analysis & Control Theory [12TE35].
3. Fields and Waves [12TE44]

Course Learning Objectives (CLO):

1. To use the concept of Electromagnetic field theory and network analysis to analyze microwave transmission line and Waveguides
2. To design an impedance matching circuit at microwave frequency using transmission lines.
3. To analyze the characteristics of Microwave passive devices, active devices and vacuum tube devices.
4. To measure various network parameters used to analyze microwave networks.

UNIT I

Introduction to Microwaves – Properties, Frequency bands, Application of Microwaves in Domestic, Industrial and Medical fields, Microwave Hazards. **09 Hrs**

Transmission Line Theory:

The Lumped- Element Circuit Model for a Transmission Line- Wave Propagation on a Transmission Line, The Lossless Line, The Terminated Lossless Transmission Line- Special Cases of Lossless Terminated Lines, Smith Chart – Construction , Basic Smith Chart Operations – Impedance and Admittance Chart, The Slotted Line, The Quarter Wave Transformer – The Impedance Viewpoint, Frequency response of a Quarter wave Transformer, Generator and Load Mismatches- Load Matched to Line, Generator matched to Load Line, Conjugate Matching, Lossy Transmission Lines- The Low Loss Line, The Distortionless Line, The Terminated Lossy Line.

UNIT II

Transmission Lines and Waveguides: **09 Hrs**

General Solutions for TEM, TE and TM waves – Attenuation due to Dielectric Loss, Rectangular Waveguide-TE modes, TM modes for unloaded rectangular waveguides only, Circular Waveguide TE and TM modes – only Qualitative Discussion, ,Excitation of Waveguides – Aperture Coupling (Qualitative Discussion), Coaxial Line – TEM modes, Higher order modes, Stripline- Formulas for Propagation Constant, Characteristic Impedance and Attenuation, Microstrip - Formulas for Effective Dielectric Constant, Characteristic Impedance and Attenuation

UNIT III

Microwave Network Analysis: **09 Hrs**

Impedance and Equivalent Voltages and Currents- Equivalent Voltages and Current and Concept of impedance, Impedance and Admittance Matrices – Reciprocal Networks, Lossless Networks, The Scattering Matrix- Reciprocal Networks and Lossless Networks, A shift in Reference Planes, Generalized Scattering Parameters

UNIT IV

Impedance Matching and Tuning: **09 Hrs**

Single Stub Tuning- Shunt Stubs, Series Stubs, Double Stub Tuning- only Smith Chart Solution, The Quarter Wave Transformer.

Microwave Resonators:

Transmission Line Resonators- Short Circuited λ/2 line, Short Circuited λ/4 line, Rectangular Waveguide Cavities-Resonant Frequencies, Q of the TE_{101} Mode.

Power Dividers and Directional Couplers: - Basic Properties of Dividers and Couplers

Ferite Devices: The Ferrite Isolators , Ferrite Phase shifters , Ferrite Circulators (only Qualitative Discussion)

UNIT V

Active RF Components: **09 Hrs**

RF Diode Characteristics-Schottky Diodes and Detectors, Varactor diodes, other diodes, RF Transistor Characteristics – FETs, BJTs, Microwave Integrated Circuits-Hybrid Microwave Integrated Circuits, Monolithic Microwave Integrated Circuits.

Microwave Vacuum Tube Devices:

Reflex Klystrons , Travelling Wave Tubes and Cylindrical Magnetrons – Construction , Operation (only Qualitative Discussion – No Derivations Included)

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Define the circuit parameters to be considered in design of microwave network/circuit and Discuss Microwave Active, Passive and Vacuum tube Devices working principle and their characteristics.

CO2: Explain and Apply S parameters, Z and Y parameters in analysing the microwave network/circuit.

CO3: Explain and Apply Smith Chart in the design of the microwave network/circuit.

CO4: Compute microwave network/circuit parameters and Evaluate their performance of circuits at higher frequency.

Reference Books:

1. David M Pozar ,"Microwave Engineering" John Wiley, 3rd edition, 2011, ISBN-978-81-265-1049-8
2. Annapurna Das, Sisir K das, "Microwave Engineering", Tata McGraw-Hill, 2nd Edition reprint, 2011, ISBN -13:978-0-07-066738-9, ISBN – 10: -0-07-066738-1, Unit I, IV, V
3. Robert E. Collin, "Foundations for Microwave Engineering", John Wiley ,2nd Edition Reprint 2009, ISBN - 978-81-265-1528-8

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

ANALOG AND DIGITAL COMMUNICATION

Course Code	**:**	**12TE53**	**CIE Marks**	**:**	**150**
Hrs /Week	**:**	**L:T:P:S:3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3+3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Basics of Electronics Engineering [12EC14].
2. Analog Electronics Circuits [12TE33]
3. Signals and systems[12TE36]
4. Fields and Waves[12TE44]

Course Learning Objectives (CLO):

1. To understand the functioning of a Communication system.
2. To analyze various analog modulation and demodulation schemes with its performance parameters.
3. To Classify different types of noise and its effect on communication systems .
4. To describe the working of the radio communication systems and Pulse modulation techniques.
5. To Design and build the analog modulation and demodulation circuits for different applications.

UNIT I

Introduction: **08 Hrs**

Elements of Communication systems, Transmission of Message signals, Limitations & Resources of Communication systems.

Filtering & Signal Distortion:

Linear Distortion & Equalization, Ideal Low-pass filters, Band pass transmission, Phase delay and Group delay.

Amplitude Modulation: Amplitude modulation (AM): Time domain and frequency domain descriptions, AM generation and AM detection. Envelope detector.

UNIT II

Suppressed Carrier Modulation Techniques: **08 Hrs**

DSBSC: Time domain and frequency domain descriptions, generation, coherent detection, Costas loop. Quadrature Carrier multiplexing;

SSBSC: Time domain and frequency domain descriptions, generation – Filtering method, Phase discrimination method. Coherent detection.

VSB: Generation and Detection. Comparison of AM techniques; Frequency Translation, Frequency Division Multiplexing, AM Radio.

UNIT III

Angle Modulation Techniques: **08 Hrs**

Basic concepts, Phase Modulation, Frequency Modulation – Direct and Indirect methods, Armstrong method. FM-Demodulation using PLL, Limiting of FM waves.

Application: FM Radio, FM Stereo Multiplexing.

UNIT IV

System Noise: **07 Hrs**

Introduction, Shot noise, Resistor noise, white noise; Spectral characteristics of Random signals and noise, Noise-equivalent Bandwidth; Noise figure and Noise temperature.

Noise in Analog Modulation:

Signal-to-Noise ratio, AM Receiver Model, SNR for Coherent reception, Noise in AM receivers, AM Threshold, FM receiver model, Noise in FM Reception, FM Threshold Effect, Pre-emphasis and De-emphasis in FM.

UNIT V

08 Hrs

Digital Coding of Analog Waveforms:

Sampling, Sampling Theorem, Pulse Modulation, Quantization, Coding and Regeneration, Pulse code Modulation, DPCM, Delta modulation; Time division multiplexing, T-1 system.

Laboratory Experiments

I. The following experiments to be Conducted using hardware.

1. Design and testing of Amplitude modulator and demodulator circuit.
2. Design and testing of Frequency modulator and demodulator circuit.
3. Design and testing of DSBSC modulator circuit.
4. Design and testing of Pulse amplitude modulator and Demodulator circuit.
5. Design and testing of Pre-emphasis and De-emphasis circuits.
6. Verify the Sampling Theorem and also demonstrate the oversampling, under sampling condition.

II. The following experiments to be demonstrated using Virtual Instrumentation (NI Lab view).

1. Design and Test AM & DSBSC modulation and demodulation circuits.
2. Design and Test SSBSC & VSB modulation and demodulation circuits.
3. Design and test Pulse amplitude modulation and Demodulation circuits and verify the sampling theorem.
4. Design and test Pulse Width modulation and Pulse Position modulation circuits.
5. Design and test Band pass and Band stop filter circuits and plot the graphs.
6. Design and test the Frequency modulation and demodulation circuits.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD

Course Outcomes:

After completion of the course the student would be able to:

CO1: Understand the fundamental concepts and applications of analog and digital communication.
CO2: Analyze the behavior of communication systems without and with noise.
CO3: Design of various analog and digital modulation and demodulation circuits with its applications.
CO4: Implement, demonstrate and Evaluate the performance parameters of different analog and digital Communication circuits.

Reference Books:

1. Simon Haykin, “An Introduction to Analog & Digital Communications”, John Wiley, 2002
2. Simon Haykin, “Communication Systems”, John Wiley, 3rd Edition, 1995.
3. H.P.Hsu, “Analog and Digital Communications”, Tata McGraw Hill, 2nd Edition, 2006.

Scheme of Continuous Internal Evaluation for Practical's:
The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

SWITCHING AND NETWORKS

Course Code	**:**	**12TE54**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Analog Electronics Circuits [12TE33].
2. Signals and Systems[12TE36].
3. Network Analysis and Control Theory[12TE35]

Course Learning Objectives (CLO):

1. To explain the basic concepts of traffic measurements and switching networks.
2. To Describe the concepts of networks and how communication takes place between computers and networks using OSI reference model and TCP/IP model.
3. To evaluate various protocols at Link, Network and Transport layer.
4. To analyze flow control, congestion control and QOS of the network for reliable data transfer.
5. To implement various protocols and algorithms in the network model

UNIT I

Telecommunication traffic **08 Hrs**

Introduction to switching, Unit of traffic, congestion, traffic measurement & units, mathematical model, cost-call systems, queuing systems.

Introduction to switching networks, single-stage networks, Grading's, Link systems (Multistage networks).

UNIT II

Switching Networks **08 Hrs**

Grades of service, Link systems, call packing, rearrangeable networks, strict-sense non blocking networks.

Time division switching: Introduction, Time Division Switching, Space and Time Switching, Space switches, Time Switches, Bidirectional path, Call processing, State transition diagram, Common control, PCM signaling, Common channel signaling principles, CCITT signaling system No.7.

UNIT III

Introduction to Networking: Overview of the Internet, Protocol Layering. **08 Hrs**

Physical layer & transmission media :

Data and Signals: Analog and Digital, Transmission Impairment, Data Rate Limits, Performance**.**

Transmission Media: Guided Media, Unguided Media.

Data Link Control (DLC): Framing, Flow and Error Control, Error Detection and Correction, Two DLC Protocols.

Multiple Access Protocols: Random Access, Controlled Access.

Wired Lans: Ethernet Protocol

IEEE project 802, Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, Virtual LANs

UNIT IV

Network Layer : **08 Hrs**

Introduction to Network-Layer Services, Packet Switching, Network-Layer Performance, Network-Layer Congestion, Structure of a Router.

Network-Layer Protocols: IPv4 Datagram Format, IPv4 Addresses, Forwarding of IP Packets, ICMPv4.
Unicast Routing: General Idea, Routing Algorithms, Unicast Routing Protocols.
Multicast Routing: Introduction, Multicasting Basics, Intradomain Routing Protocols, Interdomain Routing Protocols.

UNIT V

Transport Layer: Introduction: Transport-Layer Services. **10 Hrs**
Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-/N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking, Internet Transport-Layer Protocols.
User Datagram Protocol (UDP): User Datagram, UDP Services, UDP Applications.
Transmission Control Protocol (TCP) : TCP Services , TCP Features , Segment, A TCP Connection , State Transition Diagram , Windows in TCP , Flow Control, Error Control , TCP Congestion Control , TCP Timers.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Laboratory Experiments

Part- A

Experiments Using Routers and Switches:

1. Construct a Cisco router network and use PING and trace route to test for successful communication.
2. Configure an IP static route.
3. Configure router configuration for RIP networking and examine routing protocols using router DEBUG commands.
4. Configure VLAN connectivity on CISCO 2950 Switches.
5. Design of a network using routers and switches.
6. Configuring routing protocol OSPF.

Part- B

Programs based on implementation of various algorithm using c/c++.

1. Simulate bit/character stuffing & de-stuffing using HDLC.
2. Program for error detecting code using CRC-CCITT (16-bits).
3. Shortest Path algorithm to find suitable path for transmission.
4. Spanning Tree algorithm to find loop less path.
5. Client-server program.
6. Message queues of FIFOs as IPC Channel.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Understanding the functions of switching systems and different layers in the network models.
CO2: Applying the fundamentals of probability, digital communication and switching.
CO3: Analyzing various protocols and algorithms in the network model.
CO4: Evaluating the performance parameters of telecommunication traffic and switching networks and Implementing various protocols and algorithms for a given network model.

Reference Books:

1. J.E.Flood "Telecommunications, switching traffic and networks", Pearson education Ltd, 2005, ISBN: 1844860140.
2. Behrouz A. Forouzan, Firouz Mosharraf, "Computer Networks- A Top-Down Approach", Mc Graw Hill Publishers, 8th edition.
3. Thiagarajan Viswanathan, "Telecommunication Switching Systems and Networks", PHI Publishers.
4. Andrew S. Tanenbaum, "Computer networks", 5th edition.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self-learning is evaluated for 20 marks.

Scheme of Continuous Internal Evaluation for Practical's:

The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:

In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practicals is 60% and Viva-voce is 20%.

MODERN CONTROL THEORY

Course Code	**:**	**12 TE5A1**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Applied Mathematics-III and Applied Mathematics-IV [12MA31/41]
2. Network Theory and Control Systems [12TE35]
3. Signals and Systems [12TE36]

Course Learning Objectives (CLO):

1. To describe stability analysis of the system.
2. To calculate frequency response (Bode and Nyquist plot) analysis of systems.
3. To discuss various constraints in designing a control system.
4. To describe digital control systems.
5. To identify a solution to a state model.
6. To develop the system model in state space representation.

UNIT I

09 Hrs

Stability Analysis of Control System: Absolute stability, R.H. Criterion, Discussion of R.H. table with different cases, Relative Stability.

Frequency-domain techniques: Co- relation between time & frequency response, Specifications, (Peak resonance, Phase Margin, Gain Margin Bandwidth) Bode's & Nyquist plots, Stability analysis, determination of Phase Margin, Gain Margin.

UNIT II

09 Hrs

Introduction to state space approach: Need of state space approach, Advantages of modern control approach compared to conventional approach, Definitions of state, state variable, state trajectory, state model state equation & output equation of SISO, MIMO.

State- space representation: State models using physical variable, companion form, Canonicals form, Diagonal form, Non uniqueness of state model, Transfer function from state model signal flow graph & Laplace transform approaches, state diagrams Eigen valves, Eigen vectors, Generalized Eigen vectors.

UNIT III

09 Hrs

Solution of state model: Solution of homogenous system, state transition matrix – different evaluation methods, power series, Laplace transform, similarity transformation, Caley Hamilton methods. Properties of STM. (with proof), solution of forced systems Laplace Transform method

UNIT IV

09 Hrs

Design of controllers: State controllability, Observability, tests- Gilbert's & Kalman's approaches (without proof); pole placement by state feedbacks-sufficient & necessary conditions for arbitrary pole placement, design of full-order state observer, necessary & sufficient conditions, duality property, principal of separation.

UNIT-V

Digital Control Systems: Review of difference equations and Z-transforms, Z-transfer function (Pulse transfer function), Z-transforms analysis sampled data systems, Stability analysis (Jury's Stability Test and Bilinear Transformation). **09 Hrs**

Applications: Microprocessor Control of Control systems, Digital Signal Processors-TMS320 DSPs, Effects of Finite Work length and Quantization on Controllability and Closed-Loop Pole Placement, Effects of Quantization- Least Upper bound on Quantization Error, State-Variable Analysis.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Describe classical and modern control methods to design the control system.

CO2: Calculate the frequency response and comment on the stability of the control system.

CO3: Apply the concepts of control systems to understand various industrial processors and controllers.

CO4 : Design a control system with constraints and various approaches and have a basic understanding of digital control system

Reference Books:

1. I.J. Nagrath, M. Gopal, "Control Systems Engineering", New Age International Pvt. Ltd., 4th Edition 2005.
2. Benjamin C. Kuo and Farid Golnaghi, "Automatic Control Systems",Wiley, 8th edition 2009
3. M.Gopal, "Digital control & state variable methods", 2nd election, Tata-McGraw-Hill
4. Ogata. K. "Modern Control Engineering", PHI, 2004

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

DIGITAL SIGNAL PROCESSOR ARCHITECTURE

Course Code	**:**	**12 TE5A2**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36]
2. Microprocessor and Microcontrollers[12TE43]
3. Digital Signal Processing [12TE45]

Course Learning Objectives (CLO):

1. To describe the architectural features of DSP processor.
2. To analyze various addressing modes of TMS320C54xx DSP processor.
3. To compare the architectural features of different fixed point DSPs.
4. To Interface Memory and Parallel I/O Peripherals and CODEC to Programmable DSP Device.
5. To develop different applications on TMS320C54xx DSP processor.
6. To write the simple programs to implement different DSP algorithms.

UNIT I

09 Hrs

Introduction to Digital Signal Processing :
Introduction, A Digital Signal-Processing System, Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

Architectures for Programmable Digital Signal-Processing Devices :
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability an Program Execution, Speed Issues, Features for External Interfacing .

UNIT II

09 Hrs

Programmable Digital Signal Processors:
Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx Digital Signal Processors, 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 III

09 Hrs

Implementations of Basic DSP Algorithms and FFT algorithms:
The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, Adaptive filters.An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and Scaling, Bit-Reversed Index Generation, FFT Implementation on the TMS320C54xx, Computation of the Signal Spectrum

UNIT IV

09 Hrs

Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices:. Introduction, Memory Space Organization, External Bus Interfacing Signals, Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O, Direct Memory Access.

Interfacing Serial Converters to a Programmable DSP Device:
Introduction, Synchronous Serial Interface, A multi-channel Buffered Serial Port (McBSP), A CODEC Interface Circuit.

UNIT V

09 Hrs

Applications: DSP system, DSP based Biotelemetry Receiver, Speech processing Systems, Image Processing Systems.

Overview of Floating Point Processors: Architectural features of C67X processor.

Course Outcomes: After completion of the course the student would be able to:

CO1: Explain basic requirements and features of programmable DSP devices.
CO2: Describe the importance of McBSP, CODEC interfaces and DSP applications.
CO3: Analyze and develop simple programs to implement different DSP algorithms.
CO4: Design interfaces for digital signal processors with memory and I/O peripherals.

Reference Books:

1. Avatar Singh and S Srinivasan, "Digital Signal Processing", Thomson Learning, 2004.
2. B Venkataramani and M Bhaskar, "Digital Signal Processors" - TMH, 2nd edition, 2011
3. E.C.Ifeachor and B.W.Jervis, "Digital Signal Processing – A Practical approach", Second edition, Pearson Education, 2002.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

CMOS CIRCUIT DESIGN

Course Code	**:**	**12 TE5A3**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T : P: S: 3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Analog Electronics Circuits [12TE33]
2. Digital Logic Design [12TE34]
3. Network Analysis and Control Theory[12TE35]

Course Learning Objectives (CLO):

1. To Define the structure of MOS transistors and explain geometrical effects of a MOSFET.
2. To Use the knowledge of CMOS to design an electronic system that performs the required task.
3. To Write stick diagram and corresponding layout for a given digital circuit.
4. To Analyze design steps involved in digital design and explain the need for low power in IC design.
5. To Evaluate the circuit reliability and signal integrity issues in IC design.

UNIT I

09 Hrs

Review of MOS transistor: MOS capacitor, Inversion layer MOS transistor, Derivation of MOS Current equation.

Physical and geometrical effects on the behavior of the MOS transistor:
Back-bias effect, Zero field mobility, Carrier mobility degradation, Channel length modulation, **S**mall-channel effects, Punch through, Hot carrier effects, and Weak inversion.

UNIT II

09 Hrs

CMOS circuits:
CMOS inverter, Electrical design of CMOS circuits, Digital CMOS circuits, CMOS I/O circuits.

UNIT III

09 Hrs

Introduction to Tools and Platforms
Fabrication: Basic fabrication operations, nMOS process steps.
CMOS Fabrication: n-well, p-well, twin-tub, SOI CMOS process, Latch-up in CMOS.
VLSI Layout: MOS layer, Stick diagrams, Layout design rules, Layout diagrams for Boolean equations.

UNIT IV

09 Hrs

VLSI and ASICs:
Introduction, Digital ICs, Abstraction levels for VLSI, Digital VLSI design, Use of ASICs, Silicon realization of VLSI and ASICs.

UNIT V

09 Hrs

Low power IC design: Sources of CMOS power consumption, Technology options for low power, and Design options for low power (excluding topics from capacitance reduction).
Circuit reliability and Signal Integrity: Introduction, Design for reliability, Signal integrity (9.3.1-9.3.3) (excluding topics from large current fluctuations).

Course Outcomes:

After completion of the course the student would be able to:

CO1: Apply the fundamentals of semiconductor physics in MOS transistors.
CO2: Analyze VLSI design flow involved in IC design.
CO3: Justify the need for low power, circuit reliability and signal integrity in IC design.
CO4: Design digital circuits using CMOS and to create corresponding layout.

Reference Books:

1. Harry Veendrick, "Deep-Submicron CMOS ICs", VCH publisher, 1st edition, *ISBN:* 9044001116. Unit I, II, IV, V
2. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", PHI, 3rd edition, 2002, ISBN*:* 9788120309869. Unit III
3. Niel Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design" 3rd edition, Pearson education. Unit V

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

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COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code	**:**	**12TE5A4**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S: 3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Programming in C [12CS13]
2. Digital Logic Design[12TE34]
3. Microprocessor and Microcontroller [12TE43]

Course Learning Objectives (CLO):

1. To define the basic operational concepts and features of computer system design.
2. To understand the functions of major components and their organization in a computer system.
3. To apply the algorithms used in arithmetic unit.
4. To analyze & compare the algorithms of arithmetic unit.
5. To analyze the various processor architectures and compare them.
6. To Evaluate & compare the design issues of a microcontroller or an embedded system with the knowledge of computer organization.

UNIT I

Basic Structures of Computers , Machine Instructions and Programs: **09 Hrs**

Review of basic Operational concepts - Bus structures , Performance , Processor clock, Basic Performance equation, Pipelining & Superscalar operation, Multiprocessor & Multicomputer, General features if CISC & RISC, Big – endian & Little – endian assignments, Assembler Directives, Stacks & Queues : Subroutines : Subroutine Nesting.

UNIT II

Input/ Output Organization: **09 Hrs**

Accessing I/O devices, Interrupts, Interrupt Hardware, Enabling & Disabling Interrupt, Handling Multiple devices, Controlling Device Requests, Exceptions, Direct Memory Access, Bus Arbitration, Buses - Synchronous Bus, Asynchronous Bus.

UNIT III

The Memory System: **09 Hrs**

Review of Memory classification, characteristics and basic organization of memory chips. Static Memories, Asynchronous DRAMs, Synchronous DRAMs, Organization of Larger Memories, Memory System Considerations, Rambus memory; Cache Memories - Mapping functions, Performance considerations, Interleaving, Hit Rate & Miss Penalty, Virtual Memories - Address Translation.

UNIT IV

Arithmetic unit: **09 Hrs**

Implementation of Addition & Subtraction of Signed Numbers: Design of fast adders - Carry-Look ahead Addition; Multiplication of positive numbers - Signed – Operand Multiplication, Booth Algorithm, Fast Multiplication, Bit-pair Recoding of Multipliers; Integer division , Floating – Point Numbers & Operations.

UNIT V

Advanced Processor Architecture: Introduction to Advanced Architecture, ARM, SHARC, Tiger SHARC, DSP, Architecture of DSP, Processor and memory organizations, instruction level parallelism. **09 Hrs**

Course outcomes:

After completion of the course the student would be able to:

CO1: Describe the basic architecture and operational concepts involved in computer system design.

CO2: Identify the major components and understand their organization and usage in the system.

CO3: Design the memory unit of required size and Apply the appropriate algorithms for arithmetic operations and design the various components required for arithmetic unit.

CO4: Choose the appropriate processor for a particular application.

Reference Books:

1. Carl Hamacher, Z Vranesic & S Zaky, "Computer organization", 5th Edition, Tata McGraw- Hill, 5th Reprint , 2012
2. Morris Mano, "Computer System Architecture", 2nd Edition, PHI, 1986.
3. Raj Kamal, "Embedded Systems Architecture Programming and Design", Tata McGraw-Hill, 5th Reprint, 2005.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation or assignment for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

ARM PROCESSOR

Course Code	**:**	**12TE5B1**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Digital logic design[12TE34]
2. Microprocessors and Microcontrollers[12TE44]
3. Digital Signal Processing[12TE45]

Course Learning Objectives (CLO):

1. To describe basic architecture and operations of arm processors.
2. To explain instruction and Thumb instruction set for coding a program.
3. To design and development concept for an embedded system.
4. To analyzing the working principles of the cross compilers and Vxworks.

UNIT I

ARM embedded systems: ARM Architecture. ARM processor fundamentals: Registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions, Architecture revisions, ARM processor families. **08 Hrs**

Cache: The memory Hierarchy & Cache Memory, Cache architecture, Discussions on latest applications of ARM

UNIT II

Introduction to ARM instruction set: **09 Hrs**

Data processing instructions , Branch Instructions, Load Store Instructions, Software Interrupt Instruction, Program status Register Instructions, Loading Constants, ARMv5E Extensions, and Conditional Execution.

UNIT III

Introduction to the THUMB Instruction set: **09 Hrs**

Thumb register Usage, ARM-Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load – store Instructions, Multiple register Load Store Instruction, Stack Instructions, and Software Interrupt Instruction.

UNIT IV

Interrupts & Exception Handling: Exception Handling, Interrupts, Interrupt handling schemes. Basic Programming. **08 Hrs**

Embedded firmware Design and Development: Embedded firmware Design approaches, Embedded firmware Design languages.

UNIT V

Embedded system Design with Vxworks: Task creation and Management, Task Scheduling and Kernel Services, Inter task communication, Task synchronization and Mutual exclusion, Interrupt Handling, Watch dog for task execution Monitoring. **08 Hrs**

Types of file generated on cross compilation: Types of files, Disassembler / Decompiler, Simulators, Emulators and Debugging.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Describe the basic design principles of ARM processor based system design

CO2: Identify the different operational & non operational attributes to be satisfied while designing ARM processor based application.

CO3: Analyze the execution of Thumb instructions knowing the basic principles of ARM processors performance in THUMB mode.

CO4: Design ARM based embedded system using VxWorks

Reference Books:

1. Andrew N. Sloss, "ARM system developer's guide", Elsevier, 2008
2. Shibu KV, "Introduction to Embedded systems", Mc Graw Hill, 9th Reprint 2013.
3. William Hohl, "ARM Assembly Language – Fundamentals and Techniques", CRC Press, 2009.
4. J.R. Gibson, "ARM Assembly Language An Introduction", CENGAGE Learning, 2010.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

DIGITAL SYSTEM DESIGN USING HDL

Course Code	**:**	**12TE5B2**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S: 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Digital Logic Design[12TE34]
2. Microprocessors and Microcontrollers[12TE43]

Course Learning Objectives (CLO):

1. To Understand top down and bottom up design methodologies for digital design
2. To Describe four levels of abstraction- behavioral , data flow, gate level and switch level – to represent the same module
3. To Learn value sets, data types, compiler directives, macros etc of Verilog and VHDL.
4. To Identify and understand the components of verilog module definition such as module names, port list, and parameters variable declaration, instantiation of other modules, tasks and functions.
5. To Build basic switch level circuits in verilog, using available switches
6. To Construct SM Charts for a given digital circuit/problem and code the FSM using verilog.
7. To Learn floating point numbers, understand various floating point operations.

UNIT I

Introduction to Verilog: **06 Hrs**

Verilog History, System representation, Number representation and Verilog ports, Verilog Data Types: Net, Register and Constant. Operator Types: Logical, Arithmetic, Bitwise, Reduction and Relational

UNIT II

Basic Topics in Verilog: **08 Hrs**

Concatenation and Conditional, Dataflow Modeling, Behavioral Modeling (if, case, case x, case z), Blocking Assignment, Non-Blocking assignment, Loop Statement (For, repeat, while and forever), Modeling sequential circuits Flip-flops, Counter, Shift register using Verilog. Structural Modeling, Task & Function. Verilog Description of Combinational circuits, Multiplexer, Decoder, Adder etc.

UNIT III

Advanced Topic in Verilog: **07 Hrs**

Timings and delays: Distributed, lumped and pin to pin delays specify blocks, parallel and full connection, timing checks and delay and back annotation.

Switch level Modeling: MOS and CMOS switches, bidirectional Switches, modeling of power and ground, resistive switches, delay specification on switches.

UNIT IV

Introduction to VHDL: **07 Hrs**

VHDL Description of Combinational circuit, Modeling of Multiplexers, Decoder, Adder Modeling sequential circuits as Flip- flops, Counter, Shift register using VHDL, Variables, Signals and Constants, Arrays, VHDL Operators, functions and procedures.

UNIT V

Digital Design with SM Charts and coding in Verilog/VHDL: **07Hrs**

State Machine Charts, Derivation of SM Charts, and Realization of SM Charts for a given Digital Design/Boolean expression.

Floating-Point Arithmetic:

Representation of Floating-point Numbers, Floating-point Addition and Multiplication

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Describe the Dataflow, structural and Behavioral modeling in Verilog.
CO2: Construct SM Charts using Boolean equations for a digital design and modeling in verilog/VHDL.
CO3: Integrate various digital blocks and modeling a complete digital system in VHDL.
CO4: Develop an algorithm to perform various floating point operations.

Reference Books:

1. Samir Palnitkar, "Verilog HDL-A Guide to Digital Design & Synthesis", SunSoft Press, 1st Edition, 1996.
2. Charles H. Roth, "Digital Systems Design Using VHDL", Thomson Learning, Inc, 1st Edition, 2002.
3. D Perry, "Introduction to VHDL Programming", 4th Edition, 2002.
4. Floyd, " Digital Fundamentals using VHDL", Pearson Education, 2nd Edition, 2003
5. J Bhaskar , "Verilog Primer", Pearson / PHI, New Delhi, 3rd Edition, 2003

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. . In addition self learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

CRYPTOGRAPHY

Course Code	**:**	**12TE5B3**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subject:

1. Programming in C[12CS13]
2. Data Structure using C[12TE46]
3. Switching and Networks[12TE54]

Course Learning Objectives (CLO):

1. To define the fundamentals of Security and cryptography for data transmission.
2. To explain the principles of cryptography and encryption.
3. To analyze modern stenographic techniques and differentiate between stenography and cryptography.
4. To explain IRM features and describe DRM systems and technologies.
5. To identify the necessity of data security in various industries.

UNIT I

Introduction :
Introduction to encryption, Importance of prime numbers, Types of encryption, How encryption is used.

Classical Encryption Techniques:
Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines.

Block Ciphers and Data Encryption Standards (DES):
Block Cipher Principles, The Data Encryption Standard, The Strength of DES, AES

UNIT II

Public-Key Cryptography and RSA:
Principles of Public-Key Cryptosystems, The RSA Algorithm, Key management, Diffie-Hellman key exchange.

Message Authentication and Hash Functions:
Authentication Functions, Message Authentication Codes (MAC), Hash Functions, Security of MAC and Hash Functions.

UNIT III

Authentication Applications:
Kerberos, X-509 Authentication Service, Public-Key Infrastructure.

Electronic Mail security:
Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generation.

UNIT IV

Steganography:
Introduction to Steganography, Modern Techniques of Steganography, Comparison between steganography and cryptography, Stenographic Techniques, Detecting Steganography, Stegoanalysis, uses of Steganography

Information Rights Management:
Introduction to IRM, Features, Naming conventions of IRM.
Digital Right Management:
Introduction to DRM, Environment For DRM Systems, Evaluation Criteria for DRM Systems, Common DRM techniques, DRM technologies, Issues, Challenges.

UNIT V

Encryption and Data Security in Industries :

Data encryption (local and Cloud)in Banking and Financial Transactions, Data encryption Methods used in Secure Auto teller Machines, Role of encryption in Mobile industry, Importance of Email Encryption in Health Care Industry, Data Security in Manufacturing Industries,

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1 : Explain the fundamental concepts, issues, principles and theories of cryptography and Encryption for data transmission.

CO2 : Apply contemporary theories, process and tools in the development and evaluation of solutions to product design.

CO3: Analyze cryptographic and stegnographic techniques, and differentiate between them.

CO4 : Design solutions to securely communicate in the appropriate form with the clients

Reference Books:

1. Williams Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2003, ISBN:0-13-111502-2.Unit I,II, III
2. Perlman - Kaufman Spenciner, "Network Security", Pearson Education/PHI, 2002, ISBN: 9971–51–345–5.Unit I, II, III.
3. Atul Kahate, "Cryptography & Network Security", TMH 2003, ISBN-81-203-2186-3. Unit I, II.
4. Gregory Kipper, "Investigator's Guide to Steganography", Unit IV.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

INTELLECTUAL PROPERTY RIGHTS AND ENTREPRENEURSHIP

Course Code	**:**	**12HSI61**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**3**

Course Learning Objectives (CLO):

1. To build awareness on the various forms of IPR and to educate on the link between technology innovation and IPR.
2. To encourage invention, investment and innovation and disclosure of new Technology and to recognize and reward innovativeness.
3. To promote linkages with industries and stimulate research through developing and utilizing novel technologies.
4. To trigger the entrepreneurial thinking amongst the student community and to provide necessary inputs and motivation for promoting entrepreneurial careers.

UNIT I

Introduction: Types of Intellectual Property, International Scenario in IPR: WIPO, WTO, TRIPS. **08 Hrs**

Patents: Introduction, Object of patent; Scope and salient features of patent; patentable inventions, inventions are not patentable, Patent Procedure- Overview, Rights and obligations of patentee; Transfer of Patent Rights; Government use of inventions; Biotechnology patents, protection of traditional knowledge, Infringement of patents and remedy, Case study.

Trade Secrets: Definition, Significance, Tools to protect Trade secrets in India.

UNIT II

06 Hrs

Trade Marks: Introduction and overview of trade mark; Evolution of trade mark law; Object of trade mark; Features of good trade mark; Different forms of trade mark; Trade mark registry and register of trademarks; Registrable and non- registrable marks; Basic principles of registration of trade mark; Deceptive similarity; Assignment and transmission; Trade mark and ECO Label, Infringement of trade mark; Passing off; Offences and penalties,Case study.

UNIT III

Industrial Design: Introduction, Need for Protection of Industrial Designs, Subject Matter of Protection and Requirements, Procedure for obtaining Design Protection, Revocation, Infringement and Remedies , Case study. **08 Hrs**

Copy Right: Introduction, Nature and scope, Subject matter, the works in which copy right subsists, Rights conferred by copy right, Copy right protection in India, transfer of copy rights, right of broad casting organizations and of performer and Case Studies.

Intellectual property and cyberspace; Emergence of cyber-crime ; Grant in software patent and Copyright in software; Software piracy; Trademarks issues related to Internet (Domain name); Data protection in cyberspace;; Salient features of Information Technology Act; IPR provisions in IT Act; Internet Policy of Government.

UNIT IV

Entrepreneur and Entrepreneurship: Evolution of the concept of Entrepreneur, Characteristics of an Entrepreneur, Distinction between an entrepreneur and a manager, Functions of an entrepreneur, types of entrepreneur, Intrapreneur, Concept of Entrepreneurship ,Growth of entrepreneurship in India, Role of Entrepreneurship in economic development, overview on entrepreneurial development models, Case discussions on a couple of successful entrepreneurs. **07 Hrs**

UNIT-V

Micro Small & Medium Enterprises (MSME): Definition, Characteristics, Need and rationale, Objectives, Scope, role of MSME in Economic Development, Advantages of MSME, Steps to start an MSME – Government policy towards MSME, Impact of Liberalization, Privatisation & Globalization on MSME, Effect of WTO / GATT. Sustainability and MSME. **07 Hrs**

Institutional Support to entrepreneurs: Over view on National and State Agencies. Identification of Business Opportunities: Market Feasibility studies; Technical Feasibility Studies; Financial Feasibility Studies and Social Feasibility studies.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Define and recognize the applicable source, scope and limitations of the core Intellectual property disciplines such as Patent, Copyright, Trademark and Trade secret Law.

CO2: Appraise the Knowledge and Competence related to the various legal issues pertaining to Intellectual Property Rights.

CO3: Appraise the understanding of problems arising out of online transactions and provoke them to find solutions.

CO4: Demonstrate the Intellectual Property issues in the cyber space and the growth and development of the law in this regard.

CO5: Identify the business opportunities to initiate the entrepreneurship career.

CO6: Develop the interest among the target participants to appreciate the benefits of a career in Entrepreneurship.

Reference Books:

1. Dr. G.B Reddy, "Intellectual Property Rights and the Law", Gogia Law Agency, 7th Edn.,2008.
2. Prabuddha Ganguly, "Intellectual Property Rights: Unleashing Knowledge Economy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1st Edition, 2001. ISBN: 0074638602
3. Rodney Ryder, "Intellectual Property and the Internet". ISBN: 8180380025; LexisNexis Butterworth ,New Delhi , 2002.
4. Rahul Matthan, "The law relating to Computers and the Internet", Oscar Publications (Delhi, DEL, India), ISBN 10: 8187162139 / ISBN 13: 9788187162131.
5. S.R Myneni, "Law of Intellectual Property", Asia Law House, Hyderabad, 2001, SKU – 664773841
6. SS Khanka, "Entrepreneurial Development" , S Chand & Co, 2008,ISBN:81-219-1801-4
7. Poornima, M Charantimath, "Entrepreneurship Development & Small Business Enterprises", Pearson Education ,2007 ,ISBN: 81-7758-260-7

Scheme of Continuous Internal Evaluation:

CIE consists of two Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of one will be considered. The test component will have a weightage of 45 marks in CIE. In addition there will be one seminar on new topics / model presentation etc. for 05 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

OPTICAL COMMUNICATION AND NETWORKS

Course Code	**:**	**12 TE 62**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S:3:2:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Fields and Waves[12TE44]
2. Communication Channels and Microwave Engineering[12TE52]
3. Analog and Digital Communication [12TE53]

Course Learning Objectives (CLO):

1. To understand the topologies and generations.
2. To illustrate optical fiber as a transmission media.
3. To distinguish different types of losses, dispersion, their limitations and remedial measures.
4. To characterize optical sources and detectors.
5. To formulate the noise analysis of optical receivers.
6. To estimate the performance of Analog & Digital link.
7. To schematically represent WDM Network model and identify the elements.
8. To analyze different standards such as SONET/SDH and their functions.

UNIT I

Overview of Optical Fiber Communications: **08 Hrs**

Motivations for Light wave Communications, Optical Spectral Bands, Fundamental Data Communication Concepts, Network Information Rates, WDM Concepts, Key Elements of Optical Fiber Systems and Standards for Optical Fiber Communications.

Optical Fibers: Structures, Wave guiding:

The Nature of Light, Basic Optical Laws and Definitions, Optical Fiber Modes and Configurations, Mode Theory for Circular Waveguides, Single-mode Fibers, Graded-index Fiber Structure.

Signal Degradation in Optical Fibers:

Attenuation, Signal Distortion in Fibers, Characteristics of Single-Mode Fibers, International Standards.

UNIT II

08 Hrs

Optical Sources:

Topics from Semiconductor Physics, Light-Emitting Diodes (LEDs), Laser Diodes, Line Coding.

Power Launching and Coupling:

Source-to-Fiber Power Launching, Lensing Schemes for Coupling Improvement, Fiber-to-Fiber Joints, LED Coupling to Single-Mode Fibers, Fiber Splicing, Optical Fiber Connectors.

UNIT III

Photo detectors: Physical Principles of Photodiodes, Photo detector Noise, Detector Response Time, Avalanche Multiplication Noise, Structures for InGaAs APDs. **08 Hrs**

Optical Receiver Operation:

Fundamental Receiver Operation, Digital Receiver Performance, Eye Diagrams, Coherent Detection, Burst-Mode Receivers, Analog Receivers.

UNIT IV

Digital Links: **08 Hrs**

Point-to-Point Links, Power Penalties, Error Control.

Analog Links:

Overview of Analog Links, Carrier-to-Noise Ratio, Multichannel Transmission Techniques, RF Over Fiber, Radio-over-Fiber Links, Microwave Photonics**.**

UNIT V

WDM Concepts and Components: **08 Hrs**

Overview of WDM, Passive Optical Couplers, Isolators and Circulators, Fiber Grating Filters, Dielectric Thin Film Filters, Phased array Based Devices, Diffraction Gratings, Active Optical Components, Tunable Light Sources.

Optical Networks:

Network Concepts, Network Topologies, SONET/SDH, High speed Light wave Links, Optical ADM, Optical Switching, WDM Network Examples

Course Outcomes:

After completion of the course the student would be able to:

CO1: Identify the optical spectral bands, generation of optical communication systems & understand the concepts of light propagation in optical fibers.

CO2: Identify the components and their principles of optical communication systems.

CO3: Applying the design methodology for analog and digital optical links

CO4:. Analyze the concepts & components of WDM and optical networks with standards.

Reference Books:

1. Gerd Keiser, "Optical Fiber Communication", Tata MGH, 4th Edition, 2009, *ISBN*:0-07-064810-7.
2. John M Senior, "Optical Fiber Communication", PHI, 2nd Edition, 2009, *ISBN*-0324359810.
3. G.P. Agarwal, "Fiber Optics Communication Systems", John Wiley New York, 3rd edition, 2004, ISBN: 9-8141-2660-8.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation or assignment for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

DIGITAL MODULATION AND CODING

Course Code	**:**	**12 TE 63**	**CIE Marks**	**:**	**150**
Hrs /Week	**:**	**L: T:P:S: 3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3 +3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Signals and Systems[12TE36]
2. Communication Channels and Microwave Engineering[12TE52]
3. Analog and Digital Communication [12TE53]

Course Learning Objectives (CLO):

1. To Define the model of Digital communication Systems.
2. To Explain the various performance measures of Sources and Channels.
3. To Discuss different modulation techniques and its application.
4. To Examine spread spectrum concepts with application.
5. To Implement different channel coding and decoding schemes.
6. To Formulate simple communication systems with hardware/software and test the system.

UNIT I

Digital Modulation Techniques: **08 Hrs**

Digital Modulation Formats; Coherent Binary Modulation Techniques; Coherent Quadrature-Modulation Techniques; Non-coherent Binary Modulation Techniques; Comparison of various modulation techniques, QAM techniques, applications-digital radio and voice grade modem.

UNIT II

Detection concepts: **08 Hrs**

Model of Digital communication System; Gram-Schmidt Orthogonalization Procedure; Geometric Interpretation of Signals; Response of Bank Correlators to Noisy Input; Detection of known signals in noise; Probability of Error; Correlation Receiver; Matched Filter Receiver;

UNIT III

Spread Spectrum Modulation: **08 Hrs**

Notion of Spread Spectrum; PN sequences; DSS Coherent Binary PSK; Signal-Space Dimensionality and Processing Gain; Probability of Error; Frequency-Hop spread Spectrum; Applications.

UNIT IV

Fundamental Limits on Performance of Sources and Channels **08 Hrs**

Uncertainty, Information, and Entropy; Source Coding Theorem; Huffman Coding; Discrete Memoryless Channels ; Mutual Information; Channel Capacity; Channel Coding Theorem; Differential Entropy and Mutual Information; Channel Capacity theorem.

UNIT V

Error-Control Coding: **08 Hrs**

Rationale for Coding and Types of Codes; Discrete Memoryless Channels; Linear Block Codes; Cyclic Codes; Convolution codes – Time domain and Transfer domain approaches; Maximum-likelihood Decoding – Viterbi Algorithm;

Laboratory Experiments

Part A

The students are expected to simulate the following circuits/systems using LabVIEW or MATLAB tool.

1. Digital Modulation Scheme – QPSK generation and detection, calculation of bit rate.
2. Quadrature Amplitude modulation – generation and detection.
3. Spread Spectrum systems – DSSS and FHSS.
4. Huffman Coding
5. Convolution Coding.

Part B

The students are expected to implement the following circuits on hardware.

1. Generation and Detection of Line codes. (NRZ, Manchester and Bi-phase)
2. Generation and Detection of PAM and ASK signals.
3. Generation and Detection of FSK and BPSK signals.
4. Quadrature Phase Shift Keying – generation and detection.
5. Differential Phase Shift keying – generation and detection.
6. Spread Spectrum –FHSS generation and Detection.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Explain basic principles of digital modulation techniques, Source coding and channel coding schemes and theorem.

CO2: Apply Probability Theory, Random Variables, Random process knowledge in formulating and solving mathematical model for digital Communication system and Information Theory.

CO3: Demonstrate the implementation of Channel coder, Source Coder and digital modulation and demodulation.

CO4: Solve Problems, Evaluate and compare the performance of Digital Modulation Techniques, Channel Coding in presence of Additive white Gaussian noise.

Reference Books:

1. Simon Haykin, "Digital communication", John Wiley, 2009.
2. Sam Shanmugam, "Digital and Analog Communications", John Wiley, 2003.
3. H.P. HSU, "Analog and Digital Communications ", Tata-McGraw Hill, 2e, 2006.
4. Bernard Sklar, "Digital communications", Pearson Education, 2e, 2004.
5. Cory L.Cork, "LabVIEW Digital Signal Processing and Digital Communications", Tata McGraw Hill, 2005.

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Continuous Internal Evaluation for Practical's:
The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily

Scheme of Semester End Examination for Practical's:
In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practical's is 60% and Viva-voce is 20%.

RADIATING SYSTEMS

Course Code	**:**	**12 TE 64**	**CIE Marks**	**:**	**150**
Hrs /Week	**:**	**L: T:P:S:3:0:2:4**	**SEE Marks**	**:**	**150**
Credits	**:**	**05**	**SEE Hrs**	**:**	**3 + 3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Network Analysis and Control Theory[12TE35]
2. Fields and Waves[12TE44]
3. Communication Channels and Microwave Engineering [12TE52]

Course Learning Objectives (CLO):

1. To apply the fundamental concepts to Microwave devices and antenna design.
2. To design the antennas for various applications.
3. To understand the concept of Beam forming in Smart antenna design and its various configurations.
4. To design and demonstrate a Micro-strip antenna for the given specifications.

UNIT I

Antenna Basics: **09 Hrs**

Basic antenna parameters, Radiation patterns, Radiation Intensity, Beam area, Beam Efficiency, Directivity and Gain, Aperture antennas, Fields from oscillating electric Dipole with mathematical derivations, Antenna field zones, Shape-impedance, Power theorem & its applications, Radiation intensity, Power patterns, Examples of Power patterns.
Electric dipole-fields of short dipole, radiation resistance of short and half wave dipole.
Field patterns, Phase patterns of Point sources.

UNIT II

Types of Antennas: **09 Hrs**

Microwave antennas- Horn antenna and its types, Parabolic antenna and its feed types, Broadband antennas- Helical antenna and its modes, Spiral antennas, Log-Periodic Antenna. Antennas for terrestrial mobile communication systems, Antennas for Ground penetrating Radar (GPR), Embedded antennas, Ultra-wide band antennas, The plasma antennas, Meta material antennas.

UNIT III

Antenna arrays: **09 Hrs**

Arrays of two isotropic point sources, Arrays of Non-isotropic sources, Pattern multiplication and synthesis, Array of n-isotropic point sources with equal amplitude and spacing, Broadside & End fire arrays, Phased arrays ,Frequency –scanning Arrays , dipole arrays with parasitic elements, Yagi-Uda array

UNIT IV

Smart Antennas : **09 Hrs**

Smart Antenna Configurations, Switch Beam Antennas, Adaptive Antenna Approach , Space Division multiple access , Architectures of smart antennas, Benefits and drawbacks , Basic Principles, Mutual Coupling Effects.

UNIT V

08 Hrs

Microstrip Antenna:
Introduction, Advantages and Limitations, Rectangular Microstrip antennas, feeding methods, Characteristics of Microstrip Antennas, Impact of Different parameters on Characteristics, brief method of analysis - Transmission line model.

Laboratory Experiments

1. Determination of Gunn diode operating frequency and its V-I characteristics
2. Measurement of Directional Coupler characteristics and extraction of S – parameters,
3. Measurement of Power division of Magic-Tee junctions and extraction of S – parameters.
4. Study of Circulator and isolator characteristics.
5. Study of Radiation Characteristics of a Horn antenna and Parabolic Dish antenna using antenna bench.
6. Plot Radiation Pattern and measurement of return loss of a yagi Uda array antenna using Matlab.
7. Plotting of Radiation pattern for Dipole of Different lengths using matlab.
8. Plotting of array factor for N- isotropic point sources for Broadside radiation using matlab.
9. Plotting of array factor for N- isotropic point sources for end fire radiation using matlab.

Plotting of Radiation pattern for micro strip rectangular patch antenna using matlab and Microstrip bench.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Define the performance parameters for Microwave devices and antennas.
CO2: Identify antennas for different applications.
CO3: Experiment and evaluate the radiation characteristics of antennas using microwave benches and tools.
CO4: Design Antennas for required radiation characteristics.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Reference Books:

1. John D. Kraus & Ronald J. Marhefka, "Antennas", Mc Graw Hill, 4th edition; 2011, ISBN -0-07-060185-2. Units I-V.
2. Constantine A Balanis, "Antenna Theory", John Wiley & Sons, 2nd edition, 2005, ISBN – 9971-51-233-5.
3. Constantine A Balanis , Bannides " Inroduction to Smart Antennas" 2007, ISBN: 1598291769

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Continuous Internal Evaluation for Practical's:
The Record is evaluated for 35 Marks and final test is conducted for 15 Marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Scheme of Semester End Examination for Practical's:
In the laboratory examination, the student has to conduct one experiment randomly picked by him/ her. The percentage split of marks for Procedure & Write up is 20%, Conducting the Practicals is 60% and Viva-voce is 20%.

INTERNET OF THINGS[IOT]

Course Code	**:**	**12TEE651**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S: 2:0:0:0**			
Credits	**:**	**02**			

Prerequisites: The student should have the knowledge of the following subjects:

1. Microprocessors and Microcontrollers[12TE43]
2. Analog and Digital Communication[12TE53]
3. Switching and Networks[12TE54]

Course Learning Objectives (CLO):

1. To Describe the basic concepts of IEEE 802.15.4 standard at the level of Physical and MAC layer.
2. To Understand the applications of Internet of Things.
3. To List the requirements of a new PLC M2M system.
4. To Understand & Analyze the usage of BACNET protocol for building automation.
5. To Analyze the concepts of ZigBee technology and its application.

UNIT I

IEEE 802.15.4 **12 Hrs**

IEEE 802 Committee Family of Protocols, The Physical layer, Media access control layer, Uses of 802.15.4

Power line Communication for M2M Application

Overview of PLC Technologies, PLC landscape, Power line communication, The Ideal PLC system for M2M.

UNIT II

Legacy M2M Protocols for sensor Networks **12 Hrs**

The BACnet^{TM} Protocol Security, BACnet Over Web Services.

ZigBee

ZigBee, Association, Network layer, APS Layer, ZDO, ZDP, Security, ZCL, Application Profiles, Gateway specification for the Network Devices.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Understand the importance of IEEE 802.15.4 for Internet of Things.
CO2: Identify the recent research challenges 0related to the security and privacy of IoT.
CO3: Analyze the usage of PLC technology and its behaviour for M2M application.
CO4: Apply the concepts of Zigbee technology to design a wireless device.

Reference Books:

1. Oliver Hersent, David Boswarthick, Omar Elloumi, "Internet of Things key Applications and Protocols", A John Wiley & Sons, Ltd., Publication,2012.
2. 802.15.4, IEEE Standards for Information technology, "Telecommunications and information exchange between systems Local and metropolitan area networks specification requirements", IEEE Computer Society, October 2003.

Scheme of Continuous Internal Evaluation:
CIE consists of two phases
Phase 1: Test + Assignment = 20 + 5 = 25
Phase 2: Test + Assignment = 20 + 5 = 25
Total : 25 + 25 = 50 marks

Scheme of Semester End Examination:
There is no SEE for this course.

UNDER WATER COMMUNICATION

Course Code	**:**	**12TEE652**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S: 2:0:0:0**			
Credits	**:**	**02**			

Prerequisites: The student should have the knowledge of the following subjects:

1. Fields and Waves [12TE44]
2. Communication Channels and Microwave Engineering[12TE52]
3. Analog and Digital Communication[12TE53]

Course Learning Objectives (CLO):

1. To explain and analyze the Physical Models for underwater communication.
2. To evaluate propagation model for underwater communication.

UNIT I

12 Hrs

Introduction and Propagation: Introduction to Under Water acoustics, Speed of sound in sea water, Transmission loss, Refraction, Mixed Layer, Deep sound channel and reliable acoustic path, Sonar Equations, Noise and Bandwidth considerations, Passive Sonar, Active Sonar. Theoretical basis for propagation modelling. Mathematical Models: Basic concepts, sound channels, Spatial and temporal coherence ; Frequency-domain wave equation formulations including ray theory, normal mode, multipath expansion, fast field ; parabolic approximation techniques.

UNIT II

12 Hrs

Noise, Modelling and Simulation, Modern Applications: Observation of Physical Models: Noise sources and spectra; Depth dependence and directionality. Slope-conversion effects. Mathematical Models. Theoretical basis for noise modelling. Ambient noise and beam-noise statistics models. Model summary tables, Data support requirements. New developments in shallow-water and under-ice models. Bellhop ray tracing models: Time variable models, WOSS (Flow chart discussion), Underwater sensor, sensor networks, parametric analysis and Case study, Tomography. Introduction to MIMO-OFDM for sensor networks.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Compare the performance and accuracy of various models.
CO2: Develop acoustic communication system models.
CO3: Design sensor networks for under water communication.

Reference Books:

1. L.E. Kinsler et al., "Fundamentals of acoustics", 4th Edition, John Wiley, 2000.
2. Paul C. Etter, "Underwater Acoustic Modelling and Simulation: Principles, techniques and applications", E&FN Spon (Chapman & Hall), 2003.
3. Robert J. Urick, "Principles of Underwater Sound", 3rd edition, Peninsula, 1998.
4. oalib.hlsresearch.com/Rays/GeneralDescription.pdf
5. oalib.hlsresearch.com/Modes/Acoustics Toolbox

Scheme of Continuous Internal Evaluation:
CIE consists of two phases
Phase 1: Test + Assignment = 20 + 5 = 25
Phase 2: Test + Assignment = 20 + 5 = 25
Total : 25 + 25 = 50 marks

Scheme of Semester End Examination:
There is no SEE for this course.

TERAHERTZ COMMUNICATION

Course Code	**:**	**12TEE653**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S: 2:0:0:0**			
Credits	**:**	**02**			

Prerequisites: The student should have the knowledge of the following subjects:

1. Fields and Waves [12TE44]
2. Communication Channels and Microwave Engineering [12TE52]
3. Analog and Digital Communication[12TE53]

Course Learning Objectives (CLO):

1. To review the terahertz technology and its associated scientific achievements.
2. To Design and Analyze the terahertz and infrared sources and photo detectors.

UNIT I

An Overview of the Technological and Scientific Achievements of the Terahertz **12 Hrs**

Introduction, Terahertz Terminology, Terahertz Applications and Opportunities, Terahertz Components - THz Detectors, THz Sources.

Terahertz-Pulse Generation and Detection

THz Pulse Generation and Detection Using Photoconductive Antenna (PC), THz Pulse Generation and Detection Using Other Methods, THz Radiation from Bulk Semiconductor Micro cavities. Terahertz and Infrared Quantum Photo detectors ,Detector Principles, Noise Affects, Background Limited IR Performance

UNIT II

12 Hrs

Terahertz and Infrared Quantum Photo detectors

Quantum Cascade Detectors , Effects of Number of Periods and Doping Density on the Detector Parameters, Quantum Dot Infrared Photo detectors, Terahertz and Infrared Quantum Cascade Detectors , Dual Color Mid-Infrared Quantum Cascade, Photodetector in a Coupled Quantum Well Structure , Terahertz Quantum Well Photodetector Based on Two-Photon Absorption.

Terahertz and Infrared Quantum Cascade Lasers

Quantum Cascade Laser Principles, Radiative and Non-radiative Transitions in Semiconductor Hetero structures ,Resonant Tunnelling Transport , Quantum Cascade Lasers , Optical Gain, Threshold Current , Losses, slope Efficiency, Terahertz Quantum Cascade Lasers , Distributed Feedback QCLs , Analysis of Transport Properties of THz QCLs.

Course Outcomes:

After completion of the course the student would be able to:

CO1:Understand Terahertz Terminology and its applications
CO2:Design Quantum lasers and photo detectors for Terahertz communication systems
CO3: Evaluate the performance of Tera Hertz systems.

Reference Books:

1. Ali Rostami Hassan Rasooli Hamed Baghban, "Terahertz Technology-Fundamentals and Applications"
2. Lee, Yun-Shik, "Principles of Terahertz Science and Technology", ISBN 978-0-387-09540-0 2009 Edition**.**

Scheme of Continuous Internal Evaluation:
CIE consists of 2 phases
Phase1: Test+Assignment=20+5=25
Phase2: Test+Assignment=20+5=25
Total = 25 + 25 = 50 marks

Scheme of Semester End Examination:
There is no SEE for this course

E BAND COMMUNICATION

Course Code	**:**	**12TE654**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S: 2:0:0:0**			
Credits	**:**	**04**			

Prerequisites: The student should have the knowledge of the following subjects:

1. Communication Channels and Microwave Engineering[12TE52]
2. Radiating Systems[12TE64]

Course Learning Objectives (CLO):

1. To Describe knowledge on latest technologies in Telecommunication Engineering.
2. To Explain different territorial microwave radio propagation characteristics, Radio Technologies and Technology compression.

UNIT I

Introduction to Radio, Overview of SDR, SDR architecture, Overview of SDR protocols, Introduction to cognitive radio, Advantages and disadvantages of SDR. Fundamentals of Microwave Radio communication, Radio Horizon and LOS, Radio wave Propagation, Introduction to E Band , Bandwidth, Licensing and regulatory issues in E-Band, Channel and Propagation characteristics of E-Band, overview of E Band Trans receiver, Challenges in E Band communication and Applications. **17 Hrs**

UNIT II

Introduction to DOCSIS standards, Introduction to broadband communication, broadband access channel, Introduction to cable modem, architecture of data communication on cable media, overview of cable communication protocols, overview of physical layer interface and RF interface specifications, comparison of various communication technologies. **07 Hrs**

Course Outcomes:

After completion of the course the student would be able to:

CO1: Analyze difference between terrestrial radio communication and Non LOS radio propagation.
CO2: Differentiate different radio technologies.
CO3: Compare wireless communication and wire line cable communication technologies.

Reference Books:

1. Eugene Grayver, “Implementing Software Defined Radio”, Springer, 2013, ISBN 978-1-4419-9331-1 ISBN 978-1-4419-9332-8 (eBook)DOI 10.1007/978-1-4419-9332-8Springer New York Heidelberg Dordrecht London.Unit I.

Scheme of Continuous Internal Evaluation:

CIE consists of two phases
Phase 1: Test + Assignment = 20 + 5 = 25
Phase 2: Test + Assignment = 20 + 5 = 25
Total : 25+25 = 50 marks

Scheme of Semester End Examination:

There is no SEE for this course.

ELECTRO-OPTIC CONVERGENCE

Course Code	**:**	**10TE655**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L: T: P: S: 2:0:0:0**			
Credits	**:**	**02**			

Prerequisites: The student should have the knowledge of the following subjects:

1. Field and Waves[12TE44]
2. Channels and Microwave Engineering[12TE52]
3. Analog and Digital Communication[12TE53]

Course Learning Objectives (CLO):

1. To Describe the fundamental principle of light propagation in optoelectronic devices and new advancements in principles and technology involving electro optic convergence.
2. To Explain the Actives devices involved in electro optic convergence and its fabrication.

UNIT I

12 Hrs

Overview, Analysis of Optical Waveguides and devices:- Planar waveguides, channel waveguides, graded index waveguides, coupled mode theory, variational method, beam propagation method**, Materials and Fabrication Technology:-** materials, general fabrication steps, photolithography,Ti:LiNbO3 process, proton exchange process, silicon based IC Process, Compound Semiconductor process, Solgel and other processes.

UNIT II

12 Hrs

Dynamic and Active Devices:
Electro- optic Devices, Acousto-optic devices, thermo optic and magneto optic devices, integrated optical amplifiers.
Application Examples: fiber optic sensors, optical signal processing, optical computing.Nonlinear integrated optics, Opto-electronic integrated circuits; silicon based photonic integrated circuits, Nano photonic structures, Micro opto-electro mechanical systems.

Course Outcomes:
After completion of the course the student would be able to:

CO1: Explain the Design flow involved in fabrication of electro-optic devices.
CO2: Describe the behavior of actives devices involved in electro optic-convergence.
CO3: Analyze the light propagation using current and new concepts/methodology for designing optoelectronic devices.

Reference Books:

1. C R Pollock and M Lipson, “Integrated photonics”, Kluwer Pub, 2003.
2. T.Tamir, “Guided wave opto-electronics”, Springer Velag, 1990

Scheme of Continuous Internal Evaluation (CIE):
CIE consists of two phases
Phase 1: Test + Assignment = 20 + 5 = 25
Phase 2: Test + Assignment = 20 + 5 = 25
Total : 25+25 = 50 marks

Scheme of Semester End Examination:
There is no SEE for this course.

MULTIMEDIA COMMUNICATION

Course Code	**:**	**12 TE6C1**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S: 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36].
2. Digital Signal Processing [12TE45].

Course Learning Objectives (CLO):

1. To Explain different types of data - such as image data, video data and audio data for processing
2. To Describe data compression algorithms for multimedia compression techniques.
3. To Analyze lossless compression techniques applied in libraries, museums, film studios for converting data and archives into Digital form.
4. To Analyze and Apply quantizer and transform coding for data compression.
5. To Apply multimedia system standards such as JPEG and MPEG applications.

UNIT I

Multimedia Communications: **08 Hrs**

Multimedia information representation, multimedia networks, multimedia applications, Qos-Network QoS and application QoS.

UNIT II

Multimedia Information Representation: **08 Hrs**

Digitization principles, Text formats –Unformatted, formatted and hypertext; Images-Graphics, Documents; Audio and Video.

UNIT III

Text and image compression: **08 Hrs**

Compression principles, Text compression- Huffman coding, Arithmetic Coding, LZ, LZW coding; Image compression- GIF, TIFF, Digitized documents and pictures, JPEG.

UNIT IV

Audio and video compression: **08 Hrs**

Audio compression - DPCM, Adaptive DPCM, Adaptive and Linear predictive coding, CELP, MPEG and Dolby audio coders.

Video compression -video compression principles; Standards - H.261, H.263, MPEG, MPEG-1, MPEG-2, MPEG-4.

UNIT V

Multimedia Entertainment Networks: **08 Hrs**

Cable TV networks – HFC networks; Satellite TV networks – broadcast television principles, digital television, services; Terrestrial television networks – principles, digital television and interactive services; High speed PSTN access technologies – ADSL, VDSL.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome:
After completion of the course the student would be able to:

CO1: Understand and explain Multimedia information representation, networks, coding, image processing and compression techniques.

CO2: Apply the knowledge learnt about the various coding, image processing and compression techniques.

CO3: Analyze and Justify the impact of multimedia communication on society through various applications like interpersonal communication, interactive applications over the internet and Entertainment applications.

CO4: Design and Evaluate various coding, processing and compression techniques.

Reference Books:

1. Fred Halsall, " Multimedia Communications", Pearson Education, 2008.
2. Li and Drew, "Fundamentals of Multimedia", PHI, 2006.
3. K.R. Rao, Zoran S.Bojkovic, D.A.Milovanovic, "Multimedia Communication Systems", PHI, 2009

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

DIGITAL IMAGE PROCESSING

Course Code	**:**	**12 TE6C2**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T:P:S: 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisite: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36]
2. Digital Signal Processing [12TE45]

Course Learning Objectives (CLO):

1. To List various processes and steps employed in image processing.
2. To Illustrate different transforms used in image operations.
3. To Explain the importance of sampling and image acquisition.
4. To Summarize the performance measures for image quality.
5. To Analyze image enhancement and restoration processes.
6. To Judge the importance of color image processing.

UNIT I

Introduction

2D systems, Mathematical preliminaries – Fourier Transform, Z Transform, Optical & Modulation transfer function, Matrix theory, Random signals, Discrete Random fields, Spectral density function.

Image Perception

Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome vision models, Fidelity criteria, Color representation, Chromaticity diagram, Color coordinate systems, Color difference measures, Color vision model, Temporal properties of vision

UNIT II

Image Sampling and Quantization

Introduction, 2D sampling theory, Limitations in sampling & reconstruction, Quantization, Optimal quantizer, Compander, Visual quantization

UNIT III

Image Transforms

Two-dimensional orthogonal & unitary transforms, Properties of unitary transforms, two dimensional discrete Fourier transform, discrete cosine transform, sine transform, Hadamard transform, Haar transform, Slant transform, KL transform.

UNIT IV

Image Enhancement in Spatial domain

Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

Image Enhancement in the Frequency Domain

Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering. Exercises using MatLab.

UNIT V

Image Restoration

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, Geometric Transformations

Color Fundamentals, Color Models, Pseudo-color Image Processing, Basics of Full-Color Image Processing.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Understand and interpret the different steps and processes of image processing and its applications.

CO2: Analyze the importance of image sampling, image acquisition and representation.

CO3: Evaluate the properties of different transforms and their usage in image processing.

CO4: Apply and justify the use of image processing in modern multimedia communication, society and technology.

Reference Books:

1. Anil K. Jain, "Fundamentals of Digital Image Processing," Pearson Education/PHI, 2001.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education, 2nd edition, 2001.
3. Rafael C. Gonzalez, Richard E Woods and Steven, "Digital Image processing using MATLAB" Pearson Education , 2004.
4. William K. Pratt, "Digital Image Processing", John Wilely, 3rd Edition, 2004.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation or assignment for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

APPLICATION SPECIFIC INTEGRATED CIRCUITS DESIGN

Course Code	**:**	**12 TE6C3**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Digital Logic Design (12TE34).
2. CMOS Circuits Design (12TEA553)

Course Learning Objectives (CLO):

1. To illustrate the advanced concepts of modern VLSI system design including standard cells, cell libraries, data path elements, etc.
2. To explain ASIC methodologies and programmable logic cells to implement a function on an IC.
3. To analyze back-end physical design flow, including partitioning, floor-planning, placement, and routing.
4. To gain sufficient theoretical knowledge for carrying out FPGA and ASIC designs.
5. To design CAD algorithms and explain how these concepts interact in ASIC design.
6. To evaluate various design alternatives and make a compelling quantitative and qualitative argument.

UNIT I

07 Hrs

Introduction, Design flows, ASIC cell libraries.
Data Logic Cells: Data Path Elements, Adders, Multiplier (Booth encoding), Data path Operators, I/O cells

UNIT II

07 Hrs

ASIC Library Design: Logical effort: Predicting Delay, Logical area and logical efficiency, Logical paths, Multi stage cells, Optimum delay and number of stages

UNIT III

07 Hrs

FPGA Architectures:
Programmable ASIC Logic Cells: Actel ACT: ACT 1, ACT 2 and ACT 3 Logic Modules, Xilinx LCA: XC3000 CLB, Altera FLEX.
Programmable ASIC I/O Cells: Xilinx and Altera I/O Block.
Introduction to Logic Synthesis, Types of Simulators.

UNIT IV

07 Hrs

ASIC Construction-I: Physical Design, CAD Tools.
Partitioning: Goals and objectives, Constructive Partitioning, Iterative Partitioning Improvement: KL, FM and Look Ahead algorithms.
Floor planning: Goals and objectives, Floor planning Tools, Channel Definition, I/O and Power, Clock Planning.

UNIT V

07 Hrs

ASIC Construction-II:
Placement: Goals and Objectives, Min-cut Placement Algorithm, Iterative Placement Improvement, Physical Design Flow.
Global Routing: Goals and objectives, Global Routing Methods, Back-annotation
Detailed Routing: Goals and objectives, Measurement of Channel Density, Left-Edge Algorithm, Area-Routing Algorithms.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome:

After completion of the course the student would be able to:

CO1: Describe the concepts of ASIC design methodology, data path elements, logical effort and FPGA architectures.

CO2: Analyze the design of FPGAs and ASICs suitable for specific tasks and explain the physical design flow.

CO3: Design data path elements for ASIC cell libraries and compute optimum path delay.

CO4: Create floorplan for a VLSI subsystem with the use of CAD tools.

Reference Books:

1. Michael John Sebastian Smith, "Application - Specific Integrated Circuits" Addison-Wesley Professional; 1st edition, 1997, ISBN: 0-201-50022-1. Unit I-V
2. Rakesh Chadha**,** Bhasker J., "An ASIC Low Power Primer", Springer, ISBN: 978-1-4614-4270-7.
3. Vikram Arkalgud Chandrasetty, "VLSI Design: A Practical Guide for FPGA and ASIC Implementations", Springer, 2011, ISBN: 978-1-4614-1119-2. Unit I-V
4. N. Weste and D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th edition, Addison Wesley, 2011. Unit I

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

ERROR CONTROL CODING

Course Code	**:**	**12TE6C4**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L : T:P:S: 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Analog and Digital Communication [12TE53].
2. Digital Modulation & Coding[12TE63]

Course Learning Objectives :

1. To analyze different channel codes like linear block codes, cyclic codes and convolution code for error correction and detection.
2. To apply channel codes practically.
3. To classify errors and use Majority logic decodable Codes, Burst and Random error correcting codes and Concatenated codes for error correction.
4. To design encoder and decoder circuits for different channel coders.

UNIT I

Introduction to Algebra:
Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2m) and its basic properties, Computation using Galois Field GF (2m) Arithmetic, Vector spaces and Matrices.

Linear Block Codes:
Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes.

UNIT II

Cyclic Codes:
Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes – Encoding using Feedback shift register circuits, Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder, Error trapping decoding, Cyclic Hamming codes.

UNIT III

BCH Codes:
Binary primitive BCH codes, Implementation of Galois field Arithmetic, Implementation of Error correction: Primitive BCH codes over GF (q), Reed–Solomon Codes, Decoding of Non–Binary BCH and RS codes

Majority Logic Decodable Codes:
One – Step Majority logic decoding, one – step Majority logic decodable Codes, Two – step Majority logic decoding.

UNIT IV

Convolution Codes:
Encoding of Convolution codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms.

UNIT V

Burst – Error – Correcting Codes:
Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes, Convolution codes for Burst Error correction.

Concatenated Codes:
Single level Concatenated codes, Multilevel Concatenated codes, Turbo codes.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome :
After completion of the course the student would be able to:

CO1 : Analyze different types of channel codes, their error correcting capabilities and applications.
CO2 : Choose suitable burst random error correcting course for practical applications
CO3 : Develop advanced BCH, RS codes and majority logic decodable codes.
CO4 : Design encoder and decoder circuits for block codes, cyclic codes and convolution codes.

Reference Books :

1. Shu Lin & Daniel J. Costello, Jr. "Error Control Coding", Pearson / Prentice Hall, 2nd edition, 2004, *ISBN*:0130426725. Unit I,II, III, IV, V
2. Bernard Sklar, " Digital Communications", Pearson Education, 2nd edition, 2004, *ISBN* 0-13-147135-X. Unit II, V

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

VIDEO ENGINEERING

Course Code	**:**	**12 TE6D1**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36],
2. Digital Signal Processing [12TE44]
3. Analog and Digital Communication [12TE53].

Course Learning Objectives (CLO):

1. To describe the scanning principles used in television
2. To analyze the video broadcasting standards
3. To represent pictures in optical and analogous electrical representation using appropriate standards.
4. To analyze different video compression and transmission standards.

UNIT I

09 Hrs

Picture and scanning Principle:
Picture Characteristics (Monochrome and Color), Scanning types, Resolution and Bandwidth. Various standards. Need of synchronization. Building composite video signals for monochrome. Gamma correction. Characteristics of Human eye, Trichromatic Coloring , Color triangle, Conversion of color picture to primary colors, compatibility, Bandwidth requirement, Color difference signals , Generation of luminance and chrominance in NTSC, PAL and SECAM. Differential Phase error and Weighting factor, Encoders and Decoders. Building Composite Video in Each system. Standard Definition of Composite Video Parameters.

UNIT II

08 Hrs

Pickup and Display devices:
Pickup Tubes, MOS and CCDs Working Principle of each and their important Characteristics, Comparison of different devices. Video- Display Tubes, LCD and Plasma.

UNIT III

08 Hrs

Television Application of Video:
Mixing of various video and audio sources. Broadcast Television, Modulation and Bandwidth requirement. Transmitting system (NTSC, PAL, SECAM) corresponding Receiving Systems, HDTV & CCTV system.

UNIT IV

08 Hrs

Digitizing Video:
Advantages of Digital Video, Comparison of analog and digital video. Definition of Pixel, Pixel Arrays, Different standards used. Sampling of video, Bandwidth requirement. Sampling luma and chroma. Standards adopted. Need of compression, Compression strategies. Macro Blocks, Sampling formats. Composite and Component digital signals, I,B,P frames. Quantization, motion compensation, Synchronization, Encoding process in H.261, H.263 and MPEG 1. ATSC and HDTV, HD SDI, Interleaving in HD SDI.

UNIT V

08 Hrs

Digital recording, Direct to Home TV (Principles and Technology), IPTV.

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome:
After completion of the course the student would be able to:
CO1: Define and understand various characteristics of picture, scanning principle, processing, modulation techniques for video and broadcast.
CO2: Analyze bandwidth requirement, modulation techniques and processing of video, including set top boxes
CO3: Conceive and design video system blocks.
CO4: Appreciate study and implement video signals and front end.

Reference Books:

1. Dhake A.M.- "Television and Video Engineering", TMH, 1995.
2. Keith Jack, Video Demystified , 4th Edn, Elsevier, 2007.
3. Fred Harasall- "Multimedia Communication", Pearson Education, 2007.
4. John Watkinson- "The Art of Digital Video", Focal press, 4th Edition, 2008.
   http://www.smpte.org/ **,** http://www.atsc.org**,** http://www.dvb.org.

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

MULTIRATE SYSTEMS & FILTER BANKS

Course Code	**:**	**12 TE6D2**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36]
2. Digital Signal Processing [12TE44]
3. Digital Signal Processor Architecture[12TE5A2]

Course Learning Objectives (CLO):

1. To realize the digital filters in lattice form.
2. To design the up-sampler, down sampler, Decimator and Interpolator.
3. To design the filter banks and Quadrature Mirror Filter (QMF) bank.
4. To describe various applications of signal processing.

UNIT I

08 Hrs

Introduction: Review of Digital filters – IIR filters, FIR filters.

Realization of Digital filter: Direct form realizations. State Space equations and Canonical forms. State Space realization of IIR filters. Lattice implementation of IIR and FIR Filters.

UNIT II

Fundamentals of Multi rate signal processing: Concept of Multi rate signal processing; Analysis of Up-sampling: time domain and frequency domain. Analysis of down-sampling: time domain and frequency domain. Decimation and Interpolation; Examples for Spectrums. Sampling rate conversion by a rational factor; Multistage implementation of digital filters; Efficient implementation of multirate systems: Noble identities, Poly phase decomposition. **08 Hrs**

UNIT III

Filter Banks: Concept of Analysis and Synthesis banks, DFT filter banks and Transmultiplexers. DFT filter banks: Frequency response, poly phase structure. Non-decimated filter bank and M-band filters. Maximally Decimated DFT filter banks. Transmultiplexers, TDMA and FDMA. Application of Transmultiplexers to Communications Modulation. **08 Hrs**

UNIT IV

Maximally Decimated Filter banks: Vector spaces, Linear Independence and Basis vectors, Two Channel Perfect Reconstruction conditions; General approach to Filter Banks Design, Aliasing in PR filter banks, Design of PR filter banks with Real Coefficients, Linear phase Bi-orthogonal filters and Orthonormal MaxFlat filters, Lattice Implementation of Orthonormal Filter Banks, Applications of filter banks to an audio signal. **08 Hrs**

UNIT V

Wavelets: Introduction to Wavelet transform, Wavelets – Properties. **08 Hrs**

Applications: CD digital audio system; High quality ADC for digital audio, DAC for hi-fi systems, multirate narrow band digital filtering, high resolution narrow band spectral analysis. CD recording system; Transmultiplexers – TDM to FDM conversion, FDM to TDM conversion;

Self-Learning (1 Credit – 4Hrs/Week):
Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:
The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course outcomes:
After completion of the course the student would be able to:
CO1: Explain and Evaluate the various applications of multirate systems.
CO2: Use the fundamental concepts and mathematical skills to describe, illustrate, analyze and solve the problems in filter banks.
CO3: Develop a strong foundation in the fundamentals of multirate systems and wavelet transforms.
CO4: Design and simulate suitable structure of digital filters for required specifications.

Reference Books:

1. Roberto Cristi, "Modern Digital Signal Processing", Cengage Publishers, India, 2004.
2. ISBN-10: 81-315-0418-2
3. Proakis and Monolakias, " Digital Signal Processing", 4e, Pearson/PHI, 2006,
4. ISBN-10: 0131873741
5. Li Tan, "Digital Signal Processing – Fundamentals and Applications", Elsevier Publications, 2008. ISBN 978-81-312-1519-7.
6. E.C. Ifeachor and B.W. Jervis, "Digital Signal Processing – A Practical approach", 2nd edition, Pearson Education, 2002, ISBN: 1407-7345

Scheme of Continuous Internal Evaluation:
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

MICROWAVE INTEGRATED CIRCUITS

Course Code	**:**	**12 TE6D3**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Analog Electronic circuits [12TE33]
2. Communication Channels & Microwave Engineering [12TE52]
3. Analog & Digital Communication [12TE53]

Course Learning Objectives (CLO):

1. To recognize the effects of miniaturization of microwave devices.
2. To Analyze the design issues of RFICs
3. To Identify Passive Circuit Elements in RF systems
4. To Design RF active subsystems on RFICs.

UNIT I

07 Hrs

Introduction:

Lower Frequency Analog Design and Microwave Design Versus Radio Frequency Integrated Circuit Design, Review of Hybrids vs. MMICs, MMIC fabrication – Materials, processes and packaging.

Issues in RFIC design, noise, linearity and filtering:

Introduction, Noise, thermal Noise, Noise figure, The noise figure of an Amplifier circuits and components in series, Linearity and Distortion in RF circuits, Third-order and second order Intercepts point, the 1-db compression point, Broadband measures of linearity. Filtering issues, image signals and image reject filtering. Blockers and Blocker filtering.

UNIT II

07 Hrs

The use and design of passive circuit elements in IC technologies:

Introduction, sheet resistance and the skin effect, parasitic capacitance & inductance, Applications of On-chip spiral inductors and transformers, , On-chip Transmission lines, High frequency filter circuits – Band pass LC filters, power launching methods and transitions, Circuit elements - branch line directional couplers, hybrid rings and baluns,

UNIT III

07 Hrs

LNA Design:

Common-Emitter Amplifier, Noise in Amplifiers, Input-Referred Noise Model of the Bipolar Transistor, Noise Figure of the Common-Emitter Amplifier, Input Matching of LNAs for Low Noise, Relationship Between Noise Figure and Bias Current, Linearity in Amplifiers - Exponential Nonlinearity in the Bipolar Transistor, Nonlinearity in the Output Impedance of the Bipolar Transistor, High-Frequency Nonlinearity in the Bipolar Transistor.

UNIT IV

07 Hrs

Mixers :

Mixing with Nonlinearity, Basic Mixer Operation, Controlled Transconductance Mixer, Double-Balanced Mixer, Mixer Noise, Linearity, Improving Isolation, Image Reject and Single-Sideband Mixer,

Voltage-Controlled Oscillators :

The LC Resonator, Configuration of the Amplifier as Colpitts oscillator, Analysis of an

Oscillator as a Feedback System, Negative Resistance Generated by the Amplifier, The Effect of Parasitics on the Frequency of Oscillation, Large-Signal Nonlinearity in the Transistor, Phase Noise, Making the Oscillator Tunable.

UNIT V

Power Amplifiers : **07 Hrs**

Power Capability, Efficiency Calculations, Matching Considerations, Classification of Power Amplifiers, Amplifier Classes for RF Integrated Circuits, AC Load Line, Matching to Achieve Desired Power, Transistor Saturation, Current Limits, Power Combining, Thermal Runaway—Ballasting, Breakdown Voltage, Effects of Nonlinearity.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcome:

After completion of the course the student would be able to:

CO1: Explain design concepts and performance parameters in RFICs
CO2: Identify different Passive Circuit Elements on RF ICs
CO3: Analyze the characteristics of RF subsystems.
CO4: Design various RF subsystems for RF transceivers.

Reference Books

1. John Rogers, Calvin Plett, "Radio Frequency Integrated Circuit Design", Artech house, 2003
2. Bharati Bhat and Shiban K Koul, "Stripline like Transmission lines for Microwave Integrated Circuits", Willey Eastern; 2007.
3. Samuel Y Liao, "Microwave Devices and Circuits ", PHI, 3rd Edition, 2005

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

REAL TIME EMBEDDED SYSTEMS

Course Code	**:**	**12TE6D4**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**3**

Prerequisites: The student should have the knowledge of the following subjects:

1. Programming in C[12CS13]
2. Microprocessor and Microcontroller[12TE43]
3. Computer Organization and Architecture[12TE5A4]
4. Operating System [12TEB563]

Course Learning Objectives (CLO):

1. To describe the concepts and system components of embedded system.
2. To interpret embedded system, general computing systems and the issues that arises in designing real-time systems.
3. To illustrate the Design and Development of the Program model.
4. To analyze the concepts of hardware debugging.
5. To evaluate and apply the concepts of RTOS, IPC's and Semaphores in real time embedded system

UNIT I

08 Hrs

Embedded System :
Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Onboard Communication Interface, External Communication Interface, Embedded Firmware, Other System Components-Reset Circuit, Brown out Protection Circuit, Oscillator Unit, Real Time Clock, Watch Dog Timer.

Embedded System-Application and Domain Specific :
Washing Machine-Application Specific Case Study, Automotive-Domain Specific Case Study.

UNIT II

Characteristics and Quality Attributes of Embedded Systems : **08 Hrs**
Characteristics of Embedded system, Quality Attributes of an Embedded System, Non-Operational Quality attributes.

Hardware Software Co-Design and Program Modelling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade-offs.

UNIT III

08 Hrs

Embedded Firmware Design and Development :
Embedded Firmware Design Approaches, Embedded Firmware Development Languages.

The Embedded System Development Environment :
The Integrated Development Environment (IDE), Types of Files Generated on Cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

UNIT IV

RTOS -Tasks, Semaphores, Message Queues : **08 Hrs**
Introduction, defining an RTOS, the scheduler, objects, services, key characteristics of an RTOS ,defining a task, task states and scheduling, types of task operations, typical task structure, synchronization, communication and concurrency , defining Semaphore, typical Semaphore operations, typical Semaphore use.

UNIT V

08 Hrs

IPC and Synchronization

Defining message queues, message queues states, message queues content, pipes, event registers, signals, condition variables. Other building blocks, component configuration. Synchronization, Communication Resource Synchronization, Critical Section revisited.

Self-Learning (1 Credit – 4Hrs/Week):

Case Study, Design and emerging technologies to be discussed pertaining to the course and beyond syllabus.

Scheme for Self Learning Evaluation:

The self-learning must be presented in front of evaluation committee; Members of this committee will be Faculties handling the subject along with an observer appointed by Head of the Department. Students are required to present their work either in form of technical presentation or in form of live demonstration. At the end of the presentation the students are required to submit the report as per the format recommended by the Dept. or Dean Academics. The scheme of evaluation for **20 marks** is completely under the prerogative of the committee members or as suggested by HOD.

Course Outcomes:

After completion of the course the student would be able to:

CO1: Identify the concepts of system components to assemble small embedded systems.
CO2: Interpret the synchronization of system components in embedded systems.
CO3: Analyze the application based systems using embedded system.
CO4: Evaluate and apply the key concepts of Real time in Embedded system design.

Reference Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited; 2009, ISBN: 10: 0070678790, Unit I, Unit II & Unit III.
2. James K Peckol, "Embedded Systems – A contemporary Design Tool", John Weily, 2008, ISBN:0-444-51616-6, Unit I, Unit II & Unit III
3. Qing Li, "Real-Time Concepts for Embedded Systems", CMP publishers,Edition,2003, Unit IV & Unit V.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 40 marks (15 marks for Quiz + 25 marks for descriptive) out of which best of two will be considered. In addition self learning is evaluated for 20 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A is Quiz for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Rashtreeya Sikshana Samithi Trust

R. V. COLLEGE OF ENGINEERING

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V Vidyaniketan Post, Mysore Road

Bengaluru-560 059

Scheme & Syllabus
VII & VIII Semester B.E
Telecommunication Engineering

(2012 Scheme)

Department of Telecommunication Engineering
R V College of Engineering, Bengaluru

Vision

Imparting quality education in electronics and telecommunication engineering with a focus on fundamentals, research and innovation for sustainable development.

Mission

- Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.
- Create state-of-the–art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering education.
- Encourage students to be innovators to meet local and global needs.
- Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Center of Excellence with focus on affordable and sustainable innovation.
- Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.

Program Educational Objectives (PEOs):

PEO1: Acquire appropriate knowledge of the fundamentals of basic sciences, mathematics, engineering sciences, Electronics & Telecommunication engineering so as to adapt to rapidly changing technology

PEO2: Think critically to analyze, evaluate, design and solve complex technical and managerial problems through research and innovation.

PEO3: Function and communicate effectively demonstrating team spirit, ethics, respectful and professional behavior.

PEO4: To face challenges through lifelong learning for global acceptance.

Program Outcomes:

PO1: An ability to apply knowledge of mathematics, science and basic engineering to the area of Telecommunication engineering.

PO2: An ability to design and conduct experiments, analyze and interpret data obtained from devices, subsystems and systems of Electronics and Telecommunication Engineering.

PO3: An ability to identify, formulate and solve problems in the areas of wired communication, wireless communication, signal processing and system design.

PO4: An ability to use the computer techniques, skills and modern engineering tools necessary for investigating complex problems in wired communication, wireless communication, signal processing and system design.

PO5: Ability to conceive, design and implement as a team, demonstrating, organizing, managerial leadership and effective communication qualities with a focus on lifelong learning.

PO6: An ability to understand and derive engineering solutions for sustainability considering economics, environmental, social, ethical and safety issues with global perceptions.

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

(Autonomous Institution, affiliated to VTU, Belgavi)

DEPARTMENT OF TELECOMMUNICATION ENGINEERING

SEVENTH SEMESTER								
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self-Study**	
1	12TE71	Satellite and Cellular Communication	TE	4	0	0	0	4
2	12TE72	Wireless communication	TE	4	0	1	0	5
3	12HSC73*	Legal Studies & Professional Ethics for Engineers	HSS	2	0	0	0	2
4	12TE74	Minor Project	TE	0	0	2	0	2
5	12TE7EX	Elective E	TE	4	0	0	0	4
6	12GF7XX	Elective F	Respective BoS	4	0	0	0	4
7	12GG7XX	Elective G	Respective BoS	3	0	0	0	3
Credit Total				**21**	**0**	**03**	**0**	**24**
No. of Hrs.				**21**	**0**	**06**	**00**	**27**

12HSC73* is a mandatory Audit Course for lateral entry Diploma student.

Subject code	**Professional Elective 12TE7EX**	**Professional Elective 12GF7XX**	**Professional Elective 12GG7XX**
12TE7E1	MIMO Systems	To be opted from electives offered by other Departments, please see the list in following pages	To be opted from electives offered by other Departments , please see the list in following pages
12TE7E2	Wavelets and Applications		
12TE7E3	Mixed Signal Circuit Design		
12TE7E4	Wireless Sensor Networks		

R.V.COLLEGE OF ENGINEERING, BANGALORE – 560059

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DEPARTMENT OF TELECOMMUNICATION ENGINEERING

EIGHT SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Self-Study**	
1.	12TE81	Project Work	TE	0	0	18	0	18
2.	12TE82	Technical Seminar	TE	0	0	1	0	1
3.	12HSS83	Innovation and Social Skills	HSS	0	0	0	0	1
Credit Total				0	0	**19**	0	**20**
No. of Hrs.				-	-	**38**	-	**38**

Sl. No.	BoS	Group F			Group G		
		Course Code	Course Title	Credits	Course Code	Course Title	Credits
1.	BT	12GF701	Nanomaterials: Process and Applications	4	12GG701	Bioinformatics	3
2.	CH	12GF702	Green Technology	4	12GG702	Industrial safety & risk management	3
3.	CS	12GF703	Mobile Application Development	4	12GG703	Intelligent Systems	3
4.	CV	12GF704	Disaster Management	4	12GG704	Solid Waste Management	3
5.	EC	12GF705	Artificial Neural Networks	4	12GG705	Automotive Electronics	3
6.	EE	12GF706	Design of Renewable Energy Systems	4	12GG706	Industrial electronics	3
7.	IM	12GF707	Optimization Techniques	4	12GG707	Systems Engineering	3
8.	IM	12GF708	Project Management	4			
9.	IS	12GF709	Java & J2EE	4	12GG708	Cloud Computing	3
10.	IT	12GF710	Virtual instrumentation	4	12GG709	MEMS	3
11.	ME	12GF711	Automotive Engineering	4	12GG710	Mechatronics	3
12.	TE	12GF712	Telecommunication Systems	4	12GG711	Space Technology and Applications	3
13.				4	12GG712	Linear Algebra	3
14.		12GF713	Thin films and surface engineering	4			
15.		12GF714	Engineering materials for advanced technology	4			
16.		12GF715	Applied Psychology for Engineers	4			

SATELLITE AND CELLULAR COMMUNICATION

Course Code	**:**	**12 TE71**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Communication Channels and Microwave Engineering[12TE52]
2. Analog & Digital Communication[12TE53]
3. Switching and Networks[12TE54]

Course Learning Objectives (CLO):

1. To Identify and learn different types of satellites and their orbital parameters.
2. To explain the techniques used for telemetry and ground control.
3. To analyze and design satellite links.
4. To differentiate various assignment and multiple access techniques.
5. To understand land mobile concepts, radio link design and remember different generations of the cellular network.

UNIT I

Satellite Orbits: Laws governing satellite motion, Satellite orbits, Interpretation of laws and visibility, Perturbations in orbit satellites, Satellite subsystems and their reliability, Satellite telemetry tracking and command. **09Hrs**

UNIT II

Satellite Communication: Frequency bands, Transmission impairments, Propagation considerations, Satellite Network Configuration and subsystems. Communication link Design, Transmission equations, Noise considerations, Analog link Design Building base band and Digital Link design. **09Hrs**

UNIT III

Satellite Access: Assignement Techniques: Pre-Assignement (PAMA), Demand Assignement (DAMA), Random Assignement (RMA), Comparaison and Limitations **Multiple Access Techniques:** Frequency Division Multiple access (FDMA), Time Division Various Multiple Access (TDMA), Space Division Multiple Access (SDMA) and Code Division multiple Access (CDMA) techniques. **09Hrs**

UNIT IV

Cellular Wireless Networks: Principles of cellular Networks, Land Mobile concepts, enhancing user capacity operation of cellular systems. Frequency bands for mobile communication, Mobile radio link Design, hand off and Roaming, Power control. **09Hrs**

UNIT V

Second generation Cellular Networks: GSM architecture, CDMA, IS-95, EVDO, GPRS, EDGE, CDMA 2000, Characteristics and operation of 2G to 2.5G. **09Hrs**

Third generation cellular systems: Introduction to the architecture of WCDMA, IMT 2000 and LTE.

Course Outcome:

After completing the course the student will be able to:

CO1: Define Orbital Parameters and Explain Orbital Mechanics, Propagation Consideration, Noise Considerations, Analog and Digital Modulation Considerations, Multiple access techniques Considerations while designing the Satellite Link System and cellular Network.

CO2: Solve problems related to orbital mechanics, Satellite System and Cellular Network Design.

CO3: Analyze the performance of Satellite Link system Design considering modulation and multiple access techniques.

CO4: Compare Satellite multiple access techniques and different generations of cellular networks and Describe their performance

Reference Books:

1. K N Raja Rao, "Satellite Communication Concepts and applications", PHI, 2013, 2nd Edition, ISBN: 978-81-203-4725-0.
2. Theodore S Rappaport," Wireless Communications Principles and practice", 2nd Edition, Pearson, ISBN 97881-317-3186-4.
3. Timothy Pratt, Charles W. Bostian, "Satellite Communication", John Wiley & Sons, 2nd Edition, 2012, ISBN9814126845.

Scheme of Evaluation for CIE:

Theory (100):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for SEE:

Theory (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

WIRELESS COMMUNICATION

Course Code	**:**	**12 TE72**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:1:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Communication Channels and Microwave Engineering [12TE52].
2. Analog & Digital Communication [12TE53].
3. Switching and Networks [12TE54].

Course Learning Objectives (CLO):

1. To define the concepts of fading, wideband modulation and multiplexing technique.
2. To Explain the concepts of Radio wave and free space propagation model and path loss
3. To Analyze and compare the concepts of WPAN, WLAN and WMAN standards and their architecture.
4. To Design and demonstrate wireless networks for various applications.

UNIT I

09Hrs

Propagation: Introduction to radio wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Reflection, Diffraction, Scattering, Link Budget design using path loss models, Indoor Propagation models.

Small scale fading : Small scale fading Multipath Propagation, Impulse Response Model of multipath channel, Impulse response model of multipath channel, Small scale Multipath measurements, Parameters of Mobile Multipath Channels, types of Small scale fading, Fading effects due to Doppler spread.

UNIT II

09Hrs

Wideband modulation: Spread spectrum Modulation, Various pseudo-noise codes and Direct Sequence (DS) fundamentals, DSSS Transmitter and Receiver, FHSS Transmitter and Receiver. OFDM, MIMO, IR with respect to physical layer of WLAN.

UNIT III

09Hrs

Wireless Personal Area Networks: Zigbee, Bluettoth, WPAN and its Network architecture, WPAN components, WPAN technologies and protocols: IEEE 802.15.1, IEEE 802.15.2, IEEE 802.15.3, IEEE 802.15.4, WPAN Applications.

UNIT IV

09Hrs

Wireless local Area networks: Network components, Design requirements of WLAN, Network Architecture, WLAN Standards, WLAN Protocols, mobile IP, IEEE 802.11p, WLAN applications.

UNIT V

09Hrs

Wireless Metropolitan Area Networks: IEEE 802.16 standards, advantages, IEEE 802.11 Vs IEEE 802.16, WMAN Network architecture, Network Protocols, Broadband Wireless Networks, WMAN Applications.

Laboratory Experiments

PART A

1. Design and simulation of CDMA using MAT Lab.
2. Design and simulation of OFDM using MAT Lab.
3. Design and simulation of BER for BPSK in Rayleigh channel using MAT Lab.
4. Design and simulation of 2x2 MIMO without the detector using MAT Lab.
5. To study Gaussian minimum shift keying modulation technique for GSM.

PART B

1. Demonstrate operation of QPSK modulation using VSA/system vieu.
2. Demonstrate operation of 802.11 system using VSA/system vieu.
3. Demonstrate wide band modulation using VSA/system vieu.
4. Generate a pair of digitally modulated I and Q signals using arbitrary waveform generators and up convert the generated I/Q baseband signals into the RF band using an IQ modulator using ME1100 Kit and to measure the following parameters using an VSA software.
   - Maximum output power of the modulated RF signal
   - Occupied Bandwidth Measurement
5. Generate a pair of digitally modulated I and Q signals using arbitrary waveform generators and up convert the generated I/Q baseband signals into the RF band using an IQ modulator using ME1100 Kit and to measure the following parameters using an VSA software.
   - Error Vector Magnitude Measurement
   - Spurious and Harmonic Signal Measurement
6. Generate a pair of digitally modulated I and Q signals using arbitrary waveform generators and up convert the generated I/Q baseband signals into the RF band using an IQ modulator using ME1100 Kit and to measure the following parameters using an VSA software.
   - Adjacent Channel Power Ratio Measurement
   - Peak-to-Average Power Ratio and CCDF Measurement
7. Generate a pair of digitally modulated I and Q signals using arbitrary waveform generators and up convert the generated I/Q baseband signals into the RF band using an IQ modulator using ME1100 Kit and to measure the following parameters using an VSA software.
   [Spectrum Analyzer Required]
   - Error Vector Magnitude Measurement for GSM Signals
   - Adjacent Channel Power Ratio Verification for GSM Signals
8. Configuration of Wireless Access Points (D-Link)
9. Analysis of Throughput and Delay in wireless communication using NS-2/NS-3 Simulator.
   Demonstration: Configuration of Wireless Sensor Nodes namely 9x MoteIV TmoteSky and Telos B

Course Outcome:

After completing the course the student will be able to:

CO1: Define the problem and formulate the link budget design for the propagation models.

CO2: Explain the path loss models, fading types and also explain wideband modulation schemes.

CO3: Analyze and Apply the WPAN, WLAN and WMAN standards to a suitable application by understanding the architectures and their characteristics.

CO4: Analyze and compare, based on the advantages to use wireless communication standards for different applications and also to evaluate wide range of parameters in various modulation schemes.

Reference Books:

1. Theodore S Rappaport, "Wireless Communications Principles and practice", 2nd Edition, Pearson, ISBN 97881-317-3186-4.
2. Upena Dalal , "Wireless Communication" 1st Edition , Oxford higher Eductaion,2009 ISBN-13 :978-0-19-806066-6.
3. Dr. sunil Kumar s Manvi "Wireless and Mobile Networks Concepts and Protocols", Willey India Pvt. Ltd., 2010, ISBN:978-81-265-2069-5.

Scheme of Evaluation for CIE:

Theory (100):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Practical's (50):

The students have to execute the programs in the lab and a record is to be maintained. Each program is evaluated independently for 10 marks. Finally, total marks are reduced to 30. A lab test will be conducted at the end of the semester for the remaining 20 marks.

Scheme of Evaluation for SEE:

Theory (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

Practical's (50):

In the examination questions must be given from lots. The questions for the lab exam will be programs from the given list. After the students get a question, modification may be done by the examiner. Students can ask for a change only once. The penalty for change in question is 20%.

LEGAL STUDIES & PROFESSIONAL ETHICS FOR ENGINEERS

Course Code	**:**	**12HSC73**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L: T: P: S: 2: 0: 0: 0**	**SEE Marks**	**:**	**50**
Credits	**:**	**02**	**SEE Hrs**	**:**	**02**

Course Learning Objectives(CLO):

1. Understanding of ethical and legal aspects of advertising, consumer problems and their redressal mechanism related to product and service standards.
2. Discuss the knowledge of substantive Labor law and to develop skills for legal reasoning and statutory interpretations.
3. Apply the knowledge of the constitutional literacy to become aware of the fundamental rights and duties in their role as Engineers
4. Appraise the knowledge of consumer rights, responsibilities and socio-legal framework of protection of consumer interest.
5. Evaluate individual role, responsibilities and emphasize on professional/ engineering ethics in shaping professions.

UNIT I

Salient features of Indian Constitution: Preamble to the Constitution of India. Scope & Extent of Fundamental Rights under Part III. Constitutional Provisions relating to Right to Education under Article 21-A: Right to Information Act with Case studies **06Hrs**

UNIT II

Significance of Directive Principles of State Policy under Part – IV. Executive of the Union and State, Parliament & State Legislature. Anti-defection law, Union Judiciary & State Judiciary, Ombudsman-concept and need, Lokpal and Lokayukta. **06Hrs**

UNIT III

Consumer Protection Law- concept, definition and scope, object of C P Act, 1986, Rights of Consumers .Unfair Trade Practice, Restriction Trade Practice, Defect in goods, Deficiency in service: Medical, Lawyering, Electricity, Housing, Postal services etc. Enforcement of Consumer Rights- Consumer Forum **04Hrs**

UNIT IV

Introduction to Labour Legislations - Industrial Relation, Labour Problem and Labour Policy in India, Labour Welfare- Factories Act, 1948**,** Hazardous process, Safety and Welfare, Working Hours of Adults, Employment of young persons, Industrial Dispute Act, 1947**,** Reference of Disputes to Boards, Courts or Tribunals **04Hrs**

UNIT V

Scope and aims of engineering ethics (NSPE Code of Ethics), Responsibility of Engineers, Impediments to responsibility. Honesty, Integrity and reliability, Risks, Safety and Liability in Engineering. Corporate Social Responsibility. Statutory Provision regarding prohibition and prevention of Ragging and Sexual Harassment **04Hrs**

Course Outcome:

After completion of the course the student would be able to**:**

CO1: Understanding process of ethical and moral analysis in decision making scenarios and inculcate ethical behavior as a trait for professional development

CO2: Identify the conflict management in legal perspective and judicial systems pertaining to professional environment.

CO3: Apply engineering & ethical knowledge gained during their professional career to protect the interests of society and carry out their duties with integrity.

CO4: Demonstrate the consumer responsibility and capability to take affirmative action as an aware citizen, to defend their rights.

References Books:

1. Dr. J. N Pandey, "Constitutional Law of India, Central Law Agency", 44th Edition, 2010.
2. S.C. Srivastava, "Industrial Relation and Labour", Vikas Publishing House, 6th Edition, 2012, ISBN:9789325955400
3. Avtar Singh, "Law of Consumer Protection: Principles and Practice", 4th Edition, Eastern Book Company, 2005, ISBN 8170128544, 9788170128540
4. Jr. Charles E Harris, Michael. S. Pritchard and Michael J Rabins, "Engineering Ethics", Thompson Asia,5th Edition, 2003,ISBN-10:1-133-93468-4

Scheme of Continuous Internal Evaluation:(50 Marks)

CIE consists of five components: two quizzes (30%), two written test (60%) and one Assignment (10%). The written test is aimed at evaluating the interim knowledge gained in the subject by the students. The quizzes are aimed at assisting faculty in checking the progress of the students in the subject. Assignment develops the writing skill and acquired knowledge with scientific background in a well-organized way.

Scheme of Semester End Examination: (50 Marks)

The question paper consists of Part A and Part B. Part A is objective type for 10 marks covering the complete syllabus and is compulsory. Part B is for 40 marks, and shall consist of 5 questions carrying 08 marks each without any sub questions. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

MINOR PROJECT

Course Code	**:**	**12TE74**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S:0:0:4:0**	**SEE Marks**	**:**	**50**
Credits	**:**	**02**	**SEE Hrs**	**:**	**03**

Course Learning Objectives (CLO):

1. Create interest in innovative developments and preferably interdisciplinary field.
2. Apply the basic knowledge gained in previous semesters for hardware and software integrated design.
3. Inculcate the skills for good presentation and improve the Technical Report writing skills.
4. Demonstrate management principles and apply these to one's own work, as a member and leader in a team.
5. Recognize the need for, planning, preparation, management and financial budgeting.

Mini Project Guidelines:

1. Each project group will consist of minimum two and maximum of four students.
2. Each group has to select a current topic that will use the technical knowledge of their program of study after intensive literature survey.
3. Allocation of the guides is according with the expertise of the faculty.
4. The mini project would be implemented on hardware.
5. The implementation of the project must be preferably carried out using the resources available in the department/college.
6. The CIE evaluation will be done by the committee constituted by the department. The committee shall consist of respective guide & two senior faculty members as examiner.

Course Outcome:

After completion of the course the student would be able to**:**

CO1: Define specifications, Conceptualize, Design and implement a project.
CO2: Communicate the work carried out as a technical report and orally.
CO3: Work in a team and contribute to team work.
CO4: Prepare budgetary estimates and project management.
CO5: Indulge in self-learning and be motivated for lifelong learning.

Scheme of Continuous Internal Examination (CIE):

Evaluation will be carried out under three Phases:

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation	25%
II	Mid-term seminar to review the progress of the work and documentation	25%
III	Submission of project report , Final seminar and demonstration	50%

During CIE Evaluation following weightage will be given for the various components of the project.

- Selection of the topic & formulation of objectives 10%
- Design and simulation/ algorithm development 30%
- Implementation and testing 30%
- Demonstration & Presentation 20%
- Report 10%

Scheme of Semester End Evaluation (SEE):

- Write up depicting Design, Requirements & Specifications 20%
- Demonstration, Presentation & Results 60%
- Related Questions & Answers 20%

MIMO SYSTEMS

Course Code	**:**	**12 TE7E1**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Communication Channels and Microwave Engineering [12TE52].
2. Analog & Digital Communication [12TE53].
3. Switching and Networks [12TE54].

Course Learning Objectives (CLO):

Students will be able:

1. To appreciate the need to learn AWGN channel behavior, signal detection, filtering and noise equalization.
2. To differentiate and compare different modulation and multiplexing techniques in Wireless communication.
3. To learn different coding techniques and design of universal coding.
4. To analyze fast, slow fading, receiver architecture and diversity techniques.
5. To design a MIMO system for wireless communication based applications.

UNIT I

Channel Models: AWGN channel, Optimal signal detection in AWGN LTI channel using matched filter, Fading, Diversity Techniques, Diversity combining techniques, Multi user diversity, equalization techniques, Channel Prediction methods, opportunistic beam forming. **10Hrs**

UNIT II

Wideband modulation techniques: Principles of Orthogonality, Single Vs Multicarrier systems, OFDM block diagram, mathematical representation, selection parameters for modulation, , bandwidth requirement, pulse shaping and spectral efficiency, Synchronization in OFDM, Pilot Insertion in OFDM, Transmission and channel estimation, Amplitude limitation, FFT selection point constraints, CDMA Vs OFDM, Hybrid OFDM and other variants of OFDM. **09Hrs**

UNIT III

Spatial Multiplexing: Multiplexing capability of deterministic MIMO channels, Physical modeling of MIMO Channels, Modeling of MIMO Fading Channels. **09Hrs**

UNIT IV

Multiplexing Architectures: V- BLAST architecture, Fast fading MIMO Channel, Receiver architectures, Slow fading MIMO Channels, D- BLAST architecture. **09Hrs**

UNIT V

Diversity Multiplexing: Diversity multiplexing tradeoff, Space time coding Universal code design for optimal diversity- multiplexing tradeoff. **09Hrs**

Course Outcome:

After completion of the course the student would be able to**:**

CO1: Explain AWGN channel behavior, signal detection, filtering and describe noise equalization.

CO2: Design and evaluate OFDM MIMO system for wireless communication based applications.

CO3: Compare and Apply the knowledge of channel behavior and use effectively multiplexing, modulation, bandwidth utilization, transmission rate and access in various Wireless applications.

CO4: Demonstrate the different coding techniques and explain diversity techniques.

Reference Books:

1. David Tse, "Fundamentals of Wireless Communication", Cambridge University Press, 2005, ISBN 0-521-68749-7.
2. Upena Dalal, " Wireless Communication" 1st Edition , Oxford higher Eductaion Press, 2010, ISBN-13 :978-0-19-806066-6.
3. Theodore S Rappaport, "Wireless Communications Principles and practice", 2nd Edition 2003, Pearson Education, ISBN 97881-317-3186-4.

Scheme of Evaluation for CIE:

Theory (100):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for SEE:

Theory (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

WAVELETS AND APPLICATIONS

Course Code	**:**	**12TE7E2**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P: S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Signals and Systems [12TE36].
2. Digital Signal Processing [12TE45].
3. Digital Image Processing [12TE6C2].

Course Learning Objectives (CLO):

1. To Write the transform pair for CWT and DWT with their properties.
2. To Apply these transforms for image data and its MRA analysis.
3. To Analyze the use of DWT in image compression algorithms and standards development.
4. To Represent the wavelet packets and their properties.
5. To Create set of performance measures for image compression method.
6. To List the applications of wavelets and case studies.

UNIT I

09Hrs

Continuous wavelet transform :

Introduction, Continuous-Time Wavelets, Definition of the CWT, The CWT as a correlation. Constant Q Factor Filtering. Interpolation and Time- Frequency resolution, The CWT as an operator, Inverse CWT.

UNIT II

10Hrs

Introduction to the Discrete Wavelet Transform and Orthogonal Wavelet-Decomposition

Introduction, approximation of vectors in nested linear vectors sub spaces (i) example of approximating vectors in nested sub spaces of a finite dimensional linear vectors space (ii)example of approximating vectors in nested sub spaces of an infinite- dimensional linear vector space example of an MRA, (I) bases for the approximation sub spaces and Haar scaling function (II) bases for the detail subspaces and Haar wavelet (III) digital filter implementation of the HAAR Wavelet decomposition

UNIT III

09Hrs

Alternative wavelet representation :

Introduction, bi-orthogonal wavelet bases filtering relationship for bi-orthogonal filters, examples of bi-orthogonal scaling functions and wavelets, two dimensional wavelets and non separable multi dimensional wavelets, wavelet packages

UNIT IV

09Hrs

Wavelet transform and data compression :

Introduction transform coding DTWT for image compression (i) Image compression using DTWT and Run- length encoding (ii) Embedded tree image coding (iii)comparison with JPEG, audio compression (I) audio masking (ii) standards specifying sub band implementation ISO/MPEG coding for audio (iii) wavelet based audio coding. Video coding using multi resolution techniques; a brief introduction.

UNIT V

Wavelet Image applications :
Introduction, the Fourier transforms, the discrete wavelet transforms (DWT), multi resolution decomposition, Image decomposition, integer wavelet transform IWT, Laplacian pyramid, set partitioning in hierarchical trees (SPIHT) **,** compression with reversible embedded wavelet (CREW) , embedded zero tree wavelet (EZW), JPEG 2000, finger print compression.

Course Outcome:
After completion of the course the student would be able to**:**
CO1: Write the transform pair and their properties for various applications.
CO2: Apply the CWT/DWT in MRA Analysis.
CO3: Use wavelet representation and transformation in image processing applications.
CO4: Creation of different standards using DWT in signal processing domain.

Reference Books

1. Raguhuveer M Rao and Ajit S Bopadikar –"Wavelet transforms- Introduction to theory and applications ", Addison Wesley -1998.
2. Gilbert Stang and Truong Nguyen –"Wavelet and filter banks", Wellesly-1996.
3. David Salomon – "Data Compression – The complete reference"- Springer-Verlag London Ltd, 2007. K P Soman, K.I Ramachandran – "Insight in to Wavelets from Theory to Practice", PHI Second Edition,2006.

Scheme of Evaluation for CIE:
Theory (100):
CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for SEE:
Theory (100):
The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

MIXED SIGNAL CIRCUIT DESIGN

Course Code	**:**	**12 TE7E3**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Applied Mathematics-III and Applied Mathematics-IV [12MA31/41]
2. Analog Electronics Circuits [12TE33]
3. Network Analysis an Control Theory [12TE35]
4. CMOS Circuits Design [12TE5A3]

Course Learning Objectives (CLO):

1. To Define and analyze the specifications of data converters
2. To Describe working principle and SPICE modeling of data converter architectures.
3. To Design digital phase locked loops and filters
4. To Evaluate various data (DAC and ADC) converter architectures

UNIT I

Data Converters Fundamentals: **09Hrs**

Sample and Hold characteristics, DAC specifications: DNL, INL, offset, gain error, latency, SNR, dynamic range, ADC specifications: quantization error, DNL, INL, missing codes, offset, gain error, SNR, aperture error, Mixed signal layout issues.

UNIT II

DAC Architectures: **09Hrs**

Digital input code, Resistor string, R-2R ladder networks, Current steering, Charge scaling, Cyclic, Pipeline DAC.

UNIT III

ADC Architectures: **09Hrs**

Flash, Two step flash, Pipeline, Integrating: single and dual slope, Successive approximation ADC, Oversampling ADC: first order sigma-delta modulator (block diagram discussion).

UNIT IV

Digital Phase-Locked Loops: **09Hrs**

PLL, Phase Detector: XOR and phase frequency detector, Voltage-Controlled Oscillator: Current-Starved and Source Coupled, Loop Filter: PFD DPLL, Jitter.

UNIT V

Basic CMOS comparator design, Analog multipliers, **09Hrs**

SPICE modeling of the MOSFET, BSIM1 SPICE Model parameters, SPICE Models for DACs and ADCs. CMOS filters: Low pass filters.

Course Outcome:

After completion of the course student would be able to:

CO1: Define data converter specifications and apply basic concepts of analog electronics, network theory to analyze mixed signal circuits.

CO2: Create SPICE models for mixed signal circuits, data converter architectures and other mixed mode circuits.

CO3: Design data converters, digital phase locked loop and filters.

CO4: Evaluate data converters for different applications and choose specific data converter for system design.

Reference Books:

1. R. Jacob Baker, Harry W Li and David E Boyce, "CMOS circuit design, Layout and Simulation", PHI, 2004, ISBN: 81-203-1682-7. UNIT I-V.
2. R. Jacob Baker, "CMOS mixed-signal circuit design", Wiley-IEEE press, 2nd Edition, 2009, ISBN: 978-81-265-1657-5. UNIT V.

Scheme of Evaluation for CIE:

Theory (100):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for SEE:

Theory (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

WIRELESS SENSOR NETWORKS

Course Code	**:**	**12TE7E4**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: The student should have the knowledge of the following subjects:

1. Communication Channels and Microwave Engineering[12TE52]
2. Analog & Digital Communication[12TE53].
3. Switching and Networks[12TE54]

Course Learning Objectives (CLO):

1. To understand the architecture and applications of wireless sensor networks.
2. To appreciate the specifications of standards for WSN.
3. To analyze the need and structure of MAC protocol for WSN.
4. To develop a routing protocol and performance analysis for WSN.
5. To design of Transport Control Protocols and Middle wares for Wireless Sensor Networks
6. To explain the need and selection of operating system for WSN.

UNIT I

09Hrs

Introduction and Overview of Wireless Sensor Networks Introduction, Brief Historical Survey of Sensor Networks, and Background of Sensor Network Technology, Ah-Hoc Networks, Applications of Wireless Sensor Networks: Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Another Taxonomy of WSN Technology, Basic Sensor Network Architectural Elements, Home Control, Medical Applications, Basic Wireless Sensor Technology : Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Network Standards: IEEE 802.15.4, ZigBee, IEE 1451

UNIT II

09Hrs

Medium Access Control Protocols for Wireless Sensor Networks Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs: Schedule-Based Protocols, Random Access-Based Protocols, Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange (B-MAC,Box-MAC, Bit-MAC, H-MAC, I-MAC, O-MAC, S-MAC. Ri-MAC, T-MAC, Q-MAC (Querry MAC), Q-MAC (QoS MAC), X-MAC).

UNIT III

09Hrs

Routing Protocols for Wireless Sensor Networks: Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion, Geographical Routing.

UNIT IV

Transport Control Protocols and Middle wares for Wireless Sensor Networks: Traditional Transport Control Protocols: TCP (RFC 793), UDP (RFC 768), MobileIP, Introduction, WSN Middleware Principles, Middleware Architecture: Existing Middleware: MiLAN (Middleware Linking Applications and Networks), IrisNet (Internet-Scale Resource-Intensive Sensor Networks Services). **09Hrs**

UNIT V

Operating Systems for Wireless Sensor Networks: Introduction, Examples of Operating Systems: TinyOS,Mate, MagnetOS. **06Hrs**

Course Outcome:

After completion of the course student would be able to:

CO1: Describe the type of sensor networks, protocols and applications of WSN.
CO2: Analyze the design issues of MAC and Physical layers of WSN.
CO3: Create an architecture and identify the elements of WSN.
CO4: Identify need and selection of protocols for WSN.

Reference Books

1. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Network" Wiley, 2007 , ISBN: 978-0-471-74300-2.
2. Ananthram Swami, Qing hao, Yao-Win Hong, Lang Tong, "Wireless Sensor Networks Signal Processing and Communications", John Wiley & Sons, 2007, ISBN: 978-0-470-03557-3.
3. Murthy, "Ad Hoc Wireless Networks: Architectures And Protocols", Pearson Education, 2008, ISBN: 9788131706886.
4. C. S. Raghavendra, "Wireless sensor networks", Springer, 2007, ISBN: 978-0-387-35269-5.
5. Sridhar S.Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, "Fundamentals of Sensor Network Programming: Applications and Technology", Wiley, 2010, ISBN**:** 9780470876145

Scheme of Evaluation for CIE:

Theory (100):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one assignment/seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for SEE:

Theory (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily

MAJOR PROJECT

Course Code	**:**	**12TE81**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:0:0:36:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**18**	**SEE Hrs**	**:**	**03**

Course Learning Objectives (CLO):

1. **Knowledge Application:** Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2. **Communication:** Students will acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
3. **Collaboration:** Students will acquire collaborative skills through working in a team to achieve common goals.
4. **Independent Learning:** Students will be able to learn on their own, reflect on their learning and take appropriate action to improve it.
5. **Management and Finance:** Students will prepare schedules and budgets, they along with the guide keep track of the progress and expenditure.

Guidelines

1. Students are required to form a project team/batch before the end of 7th semester.
2. The departments must complete the Internal Guide allotment process before the end of 7th semester.
3. The project topic, title and synopsis has to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester.
4. The detailed Synopsis (approved by the department **Project Review Committee**) has to be submitted during the 1st week after the commencement of 8th semester

Batch Formation:

- Students are free to choose their project partners from within the program or any other program (as interdisciplinary projects are encouraged).
- Each student in the team must contribute towards the successful completion of the project. The project may be carried out In-house / Industry / R & D Institution.
- **The project work is to be carried out by a team of two to four students , in exceptional cases where a student is placed in a company and offered an internship through the competitive process or student is selected for internship at national or international level through competitive process,** the student can work independently.
- **The students are allowed to do either a project for full 5 days in the industry or full 5 days in the college.**
- **In case the project work is carried out outside Bengaluru, such students must be available during Project Evaluation process scheduled by the respective departments and they must also interact with their guide regularly through Email / Webinar / Skype etc.**

Project Topic Selection:

The topics of the project work must be in the **field of respective program areas or in line with CoE's(Centre of Excellence) identified by the college** or **List of project areas as given by industry/Faculty. The projects as far as possible should have societal relevance with focus on sustainability.**

Place of Project Work:

1. The project work should be carried out in the college.
2. The project work can also be carried out in the Industry, in case the project is given by the industry **as internship, provided the department Project Review Committee approves the project** and the facilities for carrying out such project work are not available in the college.
3. In case additional facilities are required for testing etc., students are permitted to visit research labs, where such facilities are available. The HoD should be informed in such cases and No objection obtained.

Attendance Requirement:

1. Students are required to satisfy minimum attendance criteria as prescribed by the Institution, i.e. (85%)
2. Students who are doing project work in the industries are required to go to the industry for full 5 days.
3. Students who are doing project work in the college, are required to come to the college for full 5 days (Monday- Friday) and attendance is mandatory.
4. Students are requested to adhere to the schedule of various phases of project work.
5. The guides shall be responsible to send attendance details every month through HoD, to the Dean(Student affairs)

Project Evaluation:

1. Continuous monitoring of project work will be carried out and cumulative evaluation will be done.
2. The students are required to meet their internal guides once in a week to report their progress in project work.
3. **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Internal Guide regularly.
4. In case of **Industry project**, during the course of project work, the internal guides will be in constant touch with external guides and will visit the industry at least thrice during the project period.
5. For CIE assessment the project groups must give a final seminar with the draft copy of the project report.
6. The presentation by each group will be for 20-30 minutes and every member of the team needs to defend the work done.
7. The project team is required to submit Hard copies of the detailed Project Report in the prescribed format to the department and a Soft copy on a CD, to the Central library.
8. For CIE 50% weightage should be given to the project guide and 50% weightage to the project evaluation committee.
9. The Project team is required to demonstrate the functioning of the modules and the integrated application along with a presentation on the details of the project carried out during the Semester End Examination (SEE) in the department.
10. Before the final evaluations the project group is required to produce a No dues certificate from Industry, Central Library and Department.

Course outcome:

After completion of the course the student would be able to**:**

CO1: Perform literature review, identify state of the art in that field and be able define the problem.

CO2: Establish a methodology using advanced tools / techniques for solving the problem including project management and finances.

CO3: Design, Develop Analytical models, Perform Numerical Analysis and Interpret the results.

CO4: Prepare quality document of project work for publications, patenting and final thesis

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Selection of the topic and formulation of objectives 10%
2. Design and Development of Project methodology 25%
3. Execution of Project 25%
4. Presentation, Demonstration and Results Discussion Report Writing 30%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

Calendar of Events for the project Work:

Week	Event
Beginning of 7th Semester	Formation of Project Committee in the Department. Formation of group and approval by the department committee.
7th Semester	Problem selection and literature survey
Last two weeks of 7th Semester	Finalization of project and guide allotment
II Week of 8th Semester	Synopsis submission and preliminary seminar
III to VI Week	Design and development of project methodology
VII to IX Week	Implementation of the project
X Week	Second visit by guide to industry (In case of project being carried out in industry) & submission of draft copy of the project report
XI and XII Week	Third visit by guide to industry for demonstration. Final seminar by Department project Committee and guide for internal assessment. Finalization of CIE.

Evaluation Scheme for CIE and SEE

Scheme of Evaluation for CIE		**Scheme of Evaluation for SEE**	
Particulars	**%Marks**	**Particulars**	**%Marks**
Project Evaluation I	10%	Project Synopsis (Initial Write up)	10%
Project Evaluation II	25%	Project Demo / Presentation	30%
Project Evaluation III	25%	Methodology and Results Discussion	30%
Project Evaluation Phase-IV (Submission of Draft Project Report for Verification**)**	30%	Project Work Report	10%
Project Evaluation Phase-V (Project Final Internal Evaluation**)**	10%	Viva-voce	20%
Total	100	Total	100

TECHNICAL SEMINAR

Course Code	**:**	**12EE82**	**CIE Marks**	**:**	**50**
Hrs /Week	**:**	**L:T:P:S:0:0:2:0**	**SEE Marks**	**:**	**00**
Credits	**:**	**01**	**SEE Hrs**	**:**	**NA**

Course Learning Objectives (CLO):

1. To create awareness to recognize recent developments in Electronics & Communication and in multidisciplinary fields.
2. To summarize the recent technologies and inculcate the skills for literature survey.
3. To demonstrate good presentation skills.
4. To plan and improve the Technical Report writing skills.
5. To support Group discussion and Team work.

General Guidelines for the Seminar

1. The seminar has to be presented by individual student.
2. The topic of the seminar should be from current thrust area. This is to be decided in consent with internal guide.
3. The topic can be based on standard papers (like IEEE/ACM/CSI etc.) in the thrust area for the selected topic.
4. Each student has to prepare a technical paper out of seminar topic.
5. Presenting/publishing this paper in conference/ Journal will be given weightage in CIE.
6. The student needs to submit both hard & soft copy of the seminar report.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand and interpret latest advancements through different technical papers, reports, Journals, Data sheets, books etc..

CO2: Communicate his/her ideas with his peers as audience, which will enhance both oral and written communication skills.

CO3: Learn to manage resources effectively.

CO4: Create interest to pursue lifelong learning.

Evaluation of CIE Marks:

1. Relevance of the topic :10%
2. Literature Survey :10%
3. Presentation : 40%
4. Report : 20%
5. Paper Publication : 20%

INNOVATION & SOCIAL SKILLS

Course Code : 12HSS83
Hrs /Week : L:T:P:S : 0:0:2:0
Credits : 01

Course Learning Objectives (CLO):

1. To provide a platform for the students to exhibit their organizational capabilities, team building, ethical values and extra mural abilities.
2. To encourage to carryout innovative ideas and projects.
3. Take part in societal and community building activities.
4. Make self learning, ethics and lifelong learning a motto..

Guidelines

The HSS will be evaluated individually based on the broad parameters which include the progress made by student during 3rd& 4th year in innovative projects, Seminar, Paper Presentation, Field activity & other Co-curricular activities. Students shall submit a report and documents as a proof his/her achievements.

R.V.COLLEGE OF ENGINEERING, BENGALURU-59 (Autonomous institution affiliated to VTU, Belgavi) Global Electives for 7th semester – 2012 Scheme							
Sl. No.	**BoS**	**Group F**			**Group G**		
		Course Code	**Course Title**	**Credits**	**Course Code**	**Course Title**	**Credits**
1	BT	12GF701	Nonmaterial: Process and Applications	4	12GG701	Bioinformatics	3
2	CH	12GF702	Green Technology	4	12GG702	Industrial safety & risk management	3
3	CS	12GF703	Mobile Application Development	4	12GG703	Intelligent Systems	3
4	CV	12GF704	Disaster Management	4	12GG704	Solid Waste Management	3
5	EC	12GF705	Artificial Neural Networks	4	12GG705	Automotive Electronics	3
6	EE	12GF706	Designof Renewable Energy Systems	4	12GG706	Industrial electronics	3
7	IM	12GF707	Optimization Techniques	4	12GG707	Systems Engineering	3
8	IM	12GF708	Project Management	4			
9	IS	12GF709	Java & J2EE	4	12GG708	Cloud Computing	3
10	IT	12GF710	Virtual instrumentation	4	12GG709	MEMS	3
11	ME	12GF711	Automotive Engineering	4	12GG710	Mechatronics	3
12	TE	12GF712	Telecommunication Systems	4	12GG711	Space Technology and Applications	3
13	BS				12GG712	**Linear Algebra**	3
14	BS	12GF713	Thin Films and Surface Engineering	4			
15	BS	12GF714	Engineering Materials for Advanced Technology	4			
16	HSS	12GF715	Applied Psychology for Engineers	4			

SYLLABUS FOR GLOBAL ELECTIVES GROUP: F

NANOMATERIALS : PROCESS AND APPLICATIONS
(Offered by BoS: Biotechnology)

Course Code	**:**	**12GF701**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: Basic knowledge of Physics, Chemistry, Biology, Mechanical engineering and electronics.

Course Learning Objectives(CLO):

1. Understand fundamentals of nanomaterials and the process.
2. Describe methods by which nanoscale manufacturing and characterization can be enabled.
3. Learn about Nano sensors and their applications in mechanical, electrical, electronic, Chemical Engineering
4. Bring awareness about the nanoscale products and their importance in multidisciplinary fields.

UNIT I

10Hrs

Introduction to Nanomaterials: History of Nanotechnology, Introduction & overview of Quantum concepts. Overview of 1st, 2nd and 3rd generation biomaterials, structures and properties of carbon based, metal based, bionanomaterails and hybrids: Bucky Ball, Nanotubes, Diamond like carbon(DLC),Quantum Dots, Magnetic, Nano Shells, Dendrimers, Nanocarriers, Nanocrystals, Nanowires, Nanomembranes, Thin films, hybrid biological/inorganic, protein & DNA based nanostructures. Nanosafety Issues: Toxicologyhealth effects caused by nanoparticles.

UNIT II

10Hrs

Characterization of Nanostructures: Spectroscopy: UV-Visible spectroscopy, Fourier Transform infrared spectroscopy (FTIR), Raman Spectroscopy, X-ray spectroscopy. **Electron microscopy**: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM).**Scanning probe microscopy**: Atomic Force microscopy (AFM), Scanning tunnel microscopy (STM).

Nano Synthesis and Fabrication: Introduction & overview of Nanofabrication: Bottom up and Top down approaches using processes like Ball milling, Sol-gel Process, Chemical Vapour deposition (CVD), Plasma or flame spraying synthesis, Ion-Bean sculpting, electrodeposition and various lithography techniques (Hard & Soft lithography).

UNIT III

08Hrs

Nanosensors: Overview of nanosensors, prospects and market. Types of Nanosensors and their applications. Electromagnetic nanosensors: Electronic nose and electronic tongue, Magnetic nanosensors. Mechanical nanosensors: Cantilever Nanosensors, Mechanics of CNTs, Biosensors: Biosensors in modern medicine.

UNIT IV

08Hrs

Micro & Nano-Electromechanical systems **and Microfluidics**: MEMS/NEMS: Magnetic, Chemical and Mechanical Transducers –Sensing and Actuators. Microfludics: Laminar flow, Hagen-Peouiselle equation, basic fluid ideas, Special considerations of flow in small channels, mixing, microvalves & micropumps.

UNIT V

Applications of Nanotechnology: Molecular electronics, molecular switches, mechanical cutting tools, machine components, magnets, DLC coated grinding wheels. Electrical, electronic, solar cells, Batteries, fuel cells, Nanofilters. Medical nanotechnology: in Diagnostics, Therapeutics, Drug delivery and Nanosurgery. **08Hrs**

Course Outcome:

After completion of the course student would be able to:

- **CO1:** Understand, and apply knowledge of nanomaterials, nanotransducers & NEMs for various engineering applications.
- **CO2:** Classify, analyze and validate Nanosensors, in electronics, mechanical, chemical, and biological systems.
- **CO3:** Evaluate and create nano Design, Devices and Systems in various disciplines.
- **CO4:** Interpret and experiment with implementation and characterization processes

Reference Books:

1. B.S. Murty., P. Shankar., B.Raj, B..B. Rath, and J. Murday, Textbook of Nanosciences and Nanotechnology, Springer, Co-publication with University Press (India) Pvt. Ltd. VCH, XII. 2013, ISBN- 978-3-642-28030-6.
2. V. K. Khanna, Nanosensors:, Physical, Chemical and Biological, CRC press, 2013, ISBN 9781439827123 .
3. C. C. Kock., Nanostructured materials, Nanostructured materials, William Andrew Publishing, 2007, ISBN 0-8155-1534-0.
4. M .Wilson., K. Kannangara., G.Smith., M.Simmons., B. Raguse., Nanotechnology, , overseas Press (India) Private Ltd., 2005,ISBN 81-88689-20-3.

Scheme of Continuous Internal Evaluation:

CIE will consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition 10 marks are reserved for laboratory work which will be considered for CIE only and there will be no SEE.

Scheme of Semester End Examination:

The question paper will consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

GREEN TECHNOLOGY
(Offered by BoS: Chemical Engineering)

Course Code	**:**	**12GF702**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Learn the tools of green technology
2. Know various forms of renewable energy
3. Study the environmental consequences of energy conservation
4. Understand energy audits, Environmental impact assessments and management systems
5. Understand the application of green technology in various industries

UNIT I

08Hrs

Introduction to Green Technology: Fundamentals of energy and its impact on society and the environment. The mechanics, advantages and disadvantages of current and future renewable, green and nonrenewable energy sources. Residential energy audits. Concept of Atom economy, Tools of Green technology, zero waste technology.

UNIT II

08Hrs

Solar Radiation and Its Measurement: Solar Constant, Solar Radiation at the Earth's Surface, Solar Radiation Geometry, Solar Radiation Measurements.

Applications of Solar Energy: Introduction, Solar Water Heating, Space-Heating (or Solar Heating of Buildings), Space Cooling (or solar Cooling of Building), Solar Thermal Electric Conversion, Agriculture and Industrial Process Heat, Solar Distillation, Solar pumping, Solar Cooking.

Geothermal Energy: Introduction, estimates of geothermal power, Nature of geothermal fields, Geothermal sources-hydrothermal convective systems-dry steam and wet steam fields Hot water fields Geopressure resources, Hot dry rocks, Magma resources, Volcanoes

UNIT III

06Hrs

Energy From Biomass (Bio-Energy) : Introduction, Biomass Conversion Technologies, Wet Processes, Dry Processes, Biogas Generation, Factors Affecting Biodigestion or Generation of Gas , Classification of Biogas Plants, Advantages and Disadvantages of floating Drum Plant, Advantages, Advantages and Disadvantages of Fixed Dome Type Plant. Types of Biogas plants (KVIC Model & Janata Model), Selection of site for biogas plant.

Bio Energy (Thermal Conversion): Methods for Obtaining energy from Biomass, Thermal Gasification of Biomass, Classification of Biomass Gasifiers, Chemistry of the Gasification Process, Applications of the gasifiers.

Bio Fuels- different types of Bio fuels-Biodiesel- Introduction, sources of biodiesel, production methods, Application of Biodiesel, Prospects of biodiesel in India

UNIT IV

06Hrs

Wind Energy: Introduction, Basic Components of WECS (Wind Energy Conversion system), Classification of WEC Systems, Types of Wind Machines (Wind Energy Collectors), Horizontal-Axial Machines, Vertical Axis Machines.

Energy From Tides: Basic Principles of Tidal Power, Components of Tidal power Plants, Operation Methods of Utilization of Tidal energy, Advantages and Limitation of tidal Power Generation.

Energy from waves: Operation Methods of Utilization of wave energy.

UNIT V

Hydrogen, Hydrogen Energy: introduction, methods of Hydrogen production (principles only), storage transportation, utilization of Hydrogen gas, Hydrogen as alternative fuel for motor vehicle, safety and management, Hydrogen technology development in India, **Fuel cell, (in brief)** **08Hrs**

Application of Green Technology in: Solid Waste Management, Electronic wastes, Power sectors, Bioprocesses, Fossil fuel Processes, Composite materials, Construction Technology

Course Outcome:

After completion of the course the student would be able to:

CO1: Remember various attributes of different forms of energy
CO2: Apply the concept of zero waste, atom economy for waste management
CO3: Analyze the various forms of energy and evaluate the apply for various applications
CO4: Formulate green methods of waste management in various industries

Reference Books:

1. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications, 4th Edition, Second Reprint, 1997.
2. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai and Sons, 10th Edition, 3rd Reprint, 1995.
3. Boyle, Godfrey, "Renewable Energy" Oxford University Press, 2nd Edition, 2004, ISBN: 0-19-926178-4.
4. Boyle, Godfrey, Bob Everett, and Janet Ramage, "Energy Systems and Sustainability: Power for a Sustainable Future". Oxford University Press, 1st edition, 2004,ISBN: 0-19-926179-2

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

MOBILE APPLICATIONS DEVELOPMENT

(Offered by BoS: Computer Science and Engineering)

Course Code	**:**	**12GF703**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisite: Fundamental Java / C++ programming, Clear understanding of all the Native application API, Basics on data communication and working model of various networks.

Course Learning Objectives(CLO):

1. Understand the working of the android and windows life cycle.
2. Write a simple and complex programs for android and windows OS.
3. Present different Google Map APIs.
4. Perform behavioural analysis of system under test and understand the Network, wi-fi API.
5. Introduce the Concept of sharing the data across network.
6. Establish adequate research interest in topics Device driver and developing the emulator.

UNIT I

09Hrs

An Overview of Android: Introducing Android, The Open Handset Alliance, Android Platform differences, Android Platform. Configuring Your Development environment, Exploring Android software development Kit, Writing first android application.

Understand the Anatomy of an android application: The life Cycle of android application, manifest file, Defining android application using the manifest file, Creating First android application, Type of Android application.

UNIT II

09Hrs

Managing Application Resources: Resources, Working with resources. Referencing the system resources, Managing multiple Application Configuration, Configurations.

Exploring User Interface Screen Elements : Introducing Android view ,Widgets and Layouts, Displaying Text to user, Getting the text from the user, Using Buttons, checkbox and Radio groups, Getting Dates and times user, Indicating the information to the user.

UNIT III

09Hrs

Working in the Background : Introducing Services, Creating and Controlling Services, Using background thread, introducingloaders, Manual thread creation and thread synchronization.

Using Android Data and Storage API: Working with application Prefernces, Working with files and Directories, Storing the Structured data using SQLlite Databases, Implementing query(),insert(),update() and getType (), Updating the Manifest file, Working with Live Folder.maps.

UNIT IV

09Hrs

Windows Mobile Programming: Introducing the Microsoft .NET Framework, Introducing the .NET Compact Framework ,.NET Compact Framework Type System.

Smartphone Application Development: Developing Your First Smartphone Application, UI Design with Forms and Controls ,Smartphone UI Design, Keyboard Input and Input Mode.

UNIT V

09Hrs

Data Access with SQL Server Mobile : Microsoft SQL Server 2005 Mobile Edition,Writing SQL Server Mobile Applications,Setting Up the SQL Server Mobile Server Environment .
Networking: Web Access,TCP Servers and Clients,NetworkSockets,Creating E-mail Applications with Managed APIs ,Accessing PIM Data,Using SMS

Course Outcome:
After completion of the course the student would be able to:

CO1: Develop mobile applications using third party application tools.
CO2: Modify and test existing applications for mobile use.
CO3: Design, customize and enhance mobile applications.
CO4: Modify existing mobile apps for better performance.

Reference Books:

1. Reto Meier, "Professional Android 4 Application Development", Wrox Publication, 3rd edition ,2012,ISBN : 978-1-1181-0227-5.
2. Baijian Yang, Pei Zheng, Lionel M. Ni, "Professional Microsoft Smartphone Programming", Wrox Publication,7th edition ,2007,ISBN : 978-0-471-76293-5.
3. Shane Conder, Lauren Darcey, "Android Wireless Application Development", Addison Wesley, 3rd Edition, 2009,ISBN-13: 978-0-321-61966-2.
4. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, "Programming Android", O'Reilly Publication, 2nd Edition, 2012, ISBN: 978-1-4493-1664-8.

Scheme of Continuous Internal Evaluation:
CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

DISASTER MANAGEMENT
(Offered by BoS: Civil Engineering)

Course Code	**:**	**12GF704**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S: 4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Study the environmental impact of natural and manmade calamities
2. Learn to analyses and assess risk involved due to disasters.
3. Understand the role of public participation.
4. Learn the management tools and mitigation techniques.

UNIT I

10Hrs

Natural disasters and Disaster management

Introduction to natural and Industrial Hazards- floods, landslides, earthquakes, volcanoes, avalanche, cyclones, drought, fire, release of effluents, harmful gases, Blast etc. Prediction and perception.

Environmental risk due to project activities. Preparation of on-site and off-site disaster management plans - Pre disaster, actual disaster, Post disaster plans. Relief camp organization. Role of voluntary organization and armed forces during disasters.

UNIT II

09Hrs

Risk analysis and assessment:

Basic concept. Purpose of risk analysis. Analytical techniques and tools of risk assessment. Toxicology. Significance of risk. Risk characterization. Risk communication and Management..

UNIT III

09Hrs

Environmental Impact Assessment (EIA):

Definition, Basic concepts and principles of EIA. Regulatory framework in India. Environmental inventory. Base line studies. Over view of EIA studies.

UNIT IV

10Hrs

Assessment and Methodologies:

Physical, Biological, Natural resources, Socio economic and cultural environmental assessment. EIA methodologies- Adhoc, Matrix, Checklist approaches. Economic evaluation of impacts- cost benefits of EIA. Public participation in environmental decision making. Procedures for reviewing EIA analysis and statement. Decision methods for evaluation of alternatives

UNIT V

10Hrs

Disaster Mitigation and Management:

Introduction, types, modes of disaster management, tools and techniques, primary and secondary data. Natural disasters its causes and remedies-Earthquake hazards-Causes and remedies, Flood and Drought assessment, causes and remedies, Landslides-causes and remedies. Fire hazards in buildings, Fire hazard management, Traffic management, Cyclones and hurricanes, inter department cooperation. Regional and global disaster mitigation.

Course Outcome:

After completion of the course student would be able to:

CO1: Explain the different types of disasters and manage the pre and post disaster situation.

CO2: Estimate and communicate the risk by conducting the risk assessment and Environmental Impact Assessment.

CO3: Identify the methods of disaster mitigation based on the basis of the risk assessment.

CO4: Analyze and evaluated the impact of measures adopted to mitigate the impacts.

Reference Books:

1. John G Rau and David C Wooten ―Environmental Impact Analysis Hand Book, McGraw Hill, Edition:2013, ISBN:978-0070512177.
2. John Glasson, RikiTherivel, Andrew Chadwick. Introduction to environmental Impact assessment, Research Press, Edition: 2012, ISBN:000-0415664705.
3. Girish K Mishrta, G C Mathew (eds) Natural Disaster Reduction. Reliance Publishing House, New Delhi,Edition:2005
4. Thomas M. Lillisand and R.W. Keifer, Remote Sensing and Image Interpretation, John Wiley, 6th edition: 2002, ISBN: 9780470052457.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily

ARTIFICIAL NEURAL NETWORKS

(Offered by BoS: Electronics and Communication)

Course Code	**:**	**12GF705**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Define neural network and model of a neuron.
2. Analyze learning tasks with and without teacher and implement learning algorithms.
3. Analyze and compare various types of perceptrons and develop MLP with 2 hidden layers.
4. Develop: Delta learning rule of the output layer and basis function network

UNIT I

Introduction to Neural Networks **09Hrs**

Neural Network, Human Brain, Models of Neuron, Neural networks viewed as directed graphs, Biological Neural Network, Artificial neuron, Artificial Neural Network architecture, ANN learning, analysis and applications, Historical notes.

UNIT II

Learning Processes **09Hrs**

Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.

UNIT III

Single layer Perception **09Hrs**

Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.

UNIT IV

Multi-Layer Perceptron Networks **09Hrs**

Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm.

UNIT V

Radial Basis Function Networks **09Hrs**

Introduction, Least square estimator, Linear neuron, Recursive least square algorithm, Basis function network, RBF techniques, Gaussian radial basis function, RBF as interpolation networks, RBF as approximation networks, GRBF network training. Application to approximation, MLP vs RBF

Reference Books:

1. Simon Haykins, "Neural Network- A Comprehensive Foundation", Pearson Prentice Hall, 2nd Edition, 1999, ISBN.-13: 978-0-13-147139-9, ISBN-10:0-13-147139-2
2. Zurada and Jacek M, "Introduction to Artificial Neural Systems", West Publishing Company, 1992, ISBN: 053495460X,9780534954604
3. Vojislav Kecman,"Learning & Soft Computing", Pearson Education, 1st Edition, 2004,ISBN.: 0-262-11255-8
4. M T Hagan, H B Demoth, M Beale, "Neural Networks Design", Thomson Learning, Edition: 2002, ISBN-10:0-9717321-1-6,ISBN-13: 978-0-9717321-1-7

Course Outcome:

After completion of the course student would be able to:

CO1: Ability to comprehend Neural Network, Neuron and to analyze ANN learning, and its applications.

CO2: Perform Pattern Recognition, Linear classification.

CO3: Develop different single layer/multiple layer Perception learning algorithms.

CO4: Develop detailed mathematical treatment of another class of layered networks: radial basis function networks.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

DESIGN OF RENEWABLE ENERGY SYSTEMS
(Offered by BoS: Electrical and Electronics Engg.,)

Course Code	**:**	**12GF706**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. To provide opportunity for students to work on multidisciplinary projects.
2. To familiarize the students with the basic concepts of nonconventional energy sources and allied technological systems for energy conversion
3. To impart skill to formulate, solve and analyze basic Non – conventional energy problems and prepare them for graduate studies.
4. To enable the student to design primarily solar and wind power systems.
5. To expose the students to various applications of solar, wind and tidal systems.

UNIT I

An introduction to energy sources: Industry overview, incentives for renewable , utility perspective, Relevant problems discussion, current positions of renewable energy conditions **09Hrs**

UNIT II

PV Technology: photovoltaic power, PV projects, Building-integrated PV system, PV cell technologies, solar energy maps, Technology trends, **Photovoltaic Power Systems**: PV cell, Module and Array, Equivalent electrical circuit, open-circuit voltage and short-circuit current, i-v and p-v curves , Array design(different methodologies), peak-power operation, system components **10Hrs**

UNIT III

Wind Speed and Energy: speed and power relations, power extracted from the wind, Air density, Global wind patterns, wind speed distribution(parameters calculations) , wind speed prediction, **Wind Power Systems :** system components , turbine rating , power vs. speed and TSR, maximum energy capture , maximum power operation , system-design trade-offs , system control requirements , environmental aspects**,** **10Hrs**
(already existed in the methodology)

UNIT IV

Geothermal and ocean energy: Geothermal power, geo pressured sources ,Geothermal well drilling ,advantages and disadvantages, Comparision of flashed steam and total flow concept **Energy from ocean**: OTEC power generation ,OPEN and CLOSED cycle OTEC Estimate of Energy and power in simple single basin tidal and double basin tidal system. **09Hrs**

UNIT V

Stand alone system: PV stand-alone, Electric vehicle, wind stand-alone , hybrid systems(case study) , system sizing , wind farm sizing , **10Hrs**
Grid-Connected Systems : introduction**,** interface requirements , synchronizing with the grid , operating limit ,
Energy storage and load scheduling**,** Grid stability issues **,** distributed power generation

Course outcome:

After completion of the course student would be able to:

CO1: Demonstrate an understanding of the scientific principles of methodology of Non-conventional energy.

CO2: Acquire working knowledge of different Renewable energy science-related topics.

CO3: Ability to analyze the system related concepts effectively in the wind energy designing.

CO4: Students will be able to decide the appropriate procedures to ensure that the working model has developed properly.

Reference Books:

1. Mukund R Patel "Wind and solar power systems Design, Analysis and operation" Taylor and Francis publishers ,2nd edition,2006, ISBN 978-0-8493-1570-1
2. G.D.Rai, "Non-Conventional sources of energy", Khanna Publishers, 4th edition, 2007.
3. Sukhatme, "Solar Energy", 2nd edition, TMH, 2006.
4. Renewable energy sources- Twiddle Elbs, 3rd Edition, 2006, ISBN-10: 0419253203.
5. Solar energy hand book – edited by William.C. Dikkinson ASISES, Network, ISBN -13: 978-0865716216.
6. Partain, L. D., "Solar Cells and Their Applications". John Wiley & Sons, 3rd edition, 2003, ISBN: 9780470539675.
7. Green, M.A., et al. Solar Cell Efficiency Tables (Version 30). 2007. Prog. Photovolt: Res. Appl. 15:425-430.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

OPTIMIZATION TECHNIQUES

(Offered by BoS: Industrial Engineering and Management)

Course Code	**:**	**12GF707**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Understand the concepts behind optimization techniques.
2. Explain the modelling frameworks for solving problems using optimization techniques.
3. Design and develop optimization models for real life situations.
4. Analyze solutions obtained using optimization methods.
5. Compare models developed using various techniques for optimization.

UNIT I

09Hrs

Introduction: OR Methodology, Definition of OR, Application of OR to Engineering and Managerial problems, Features of OR models, Limitations of OR.

Linear Programming: Definition, Mathematical Formulation, Standard Form, Solution Space, Types of solution – Feasible, Basic Feasible, Degenerate, Solution through Graphical Method. Problems on Product Mix, Blending, Marketing, Finance, Agriculture and Personnel.

Simplex methods: Variants of Simplex Algorithm – Use of Artificial Variables.

UNIT II

09Hrs

Duality and Sensitivity Analysis: Graphical sensitivity analysis, Algebraic sensitivity analysis - changes in RHS, Changes in objectives, Primal-Dual relationships, Economic interpretation of duality, Post optimal analysis - changes affecting feasibility and optimality, Revised simplex method

UNIT III

08Hrs

Transportation Problem: Formulation of Transportation Model, Basic Feasible Solution using North-West corner, Least Cost, Vogel's Approximation Method, Optimality Methods, Unbalanced Transportation Problem, Degeneracy in Transportation Problems, Variants in Transportation Problems.

Assignment Problem: Formulation of the Assignment problem, solution method of assignment problem-Hungarian Method, Variants in assignment problem, Travelling Salesman Problem (TSP).

UNIT IV

09Hrs

Queuing Theory: Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing models. Introduction to M/M/C and $M/E_k/1$ queuing models.

Game Theory: Introduction, Two person Zero Sum game, Pure strategies, Games without saddle point - Arithmetic method, Graphical Method, The rules of dominance

UNIT V

09Hrs

Markov chains: Definition, Absolute and n-step transition probabilities, Classification of the states, Steady state probabilities and mean return times of ergodic chains, First passage times, Absorbing states. Applications in weather prediction and inventory management.

Over view of OR software's used in practice.

Course Outcome:
After completion of the course student would be able to:
CO1: Understand the various optimization models and their areas of application.
CO2: Explain the process of formulating and solving problems using optimization methods.
CO3: Develop models for real life problems using optimization techniques.
CO4: Analyze solutions obtained through optimization techniques.
CO5: Create designs for engineering systems using optimization approaches.

Reference Books:

1. Taha H A, "Operation Research An Introduction", PHI, 8th Edition, 2009, ISBN: 0130488089.
2. Philips, Ravindran and Solberg, "Principles of Operations Research – Theory and Practice", John Wiley & Sons (Asia) Pte Ltd, 2nd Edition, 2000, ISBN 13: 978-81-265-1256-0
3. Hiller, Liberman, Nag, Basu, "Introduction to Operation Research", Tata McGraw Hill 9th Edition, 2012, ISBN 13: 978-0-07-133346-7
4. J K Sharma, "Operations Research Theory and Application", Pearson Education Pvt Ltd, 4th Edition, 2009, ISBN 13: 978-0-23-063885-3.
5. Prof. J Govardhan, "Principles, Methodology and Applications of Operations Research", JEM Consultants, 3rd Edition, 2012

Scheme of Continuous Internal Evaluation:
CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks

Scheme of Semester End Examination:
The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

PROJECT MANAGEMENT

(Offered by BoS: Industrial Engineering & Management Engineering)

Course Code	**:**	**12GF708**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Understand the principles and components of project management.
2. Appreciate the integrated approach to managing projects.
3. Elaborate the processes of managing project cost and project procurements.

UNIT I

Introduction: What is project, what is project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge. **06Hrs**

UNIT II

Organizational influences & Project life cycle: Organizational influences on project management, project state holders & governance, project team, project life cycle. **10Hrs**

Project Integration Management: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.

UNIT III

Project Scope Management: Project scope management, collect requirements define scope, create WBS, validate scope, control scope. **10Hrs**

Project Time Management: Plan schedule management, define activities, sequence activities, estimate activity resources, estimate activity durations, develop schedule, control schedule.

UNIT IV

Project Cost management: Project Cost management, estimate cost, determine budget, control costs. **08Hrs**

Project Quality management: Plan quality management, perform quality assurance, control quality.

UNIT V

Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk. **09Hrs**

Project Procurement Management: Project Procurement Management, conduct procurements, control procurements, close procurement.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the concepts, tools and techniques for managing large projects.

CO2: Explain various sub processes in the project management frameworks.

CO3: Analyze and evaluate risks in large and complex project environments.

CO4: Develop project plans for various types of organizations.

Reference Books:

1. Project Management Institute, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9
2. Prasanna Chandra, "Project Planning Analysis Selection Financing Implementation & Review", Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.
3. Harold Kerzner, "Project Management A System approach to Planning Scheduling & Controlling", CBS Publishers and Distributors, 10th Edition, 2009, ISBN 047027806.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

JAVA & J2EE

(Offered by BoS: Information Science & Engineering)

Course Code	**:**	**12GF709**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Comprehend the fundamentals of object-oriented programming in Java, including elements of Java programming such as variables, conditional and iterative execution, defining classes, invoking methods, using class libraries, etc.
2. Comprehend the essentials of the threads and exceptions, Event driven Graphical User Interface (GUI) programming and Applet Programming.
3. Understand and develop applications in java to access databases in java using JDBC driver.
4. Analyze the role of J2EE in development of enterprise software in Java language, and to understand how J2EE facilitates integration of java components with non-Java systems including databases using servlets and Java Server Pages(JSP).

UNIT I

Introduction **08Hrs**

An Overview of Java, Introduction to Class - object, A Closer Look at Methods and Classes, Inheritance, Packages and Interfaces. Enumerations, Autoboxing, and Annotations

UNIT II

Advanced features -I **09Hrs**

Exception Handling, Multithreaded Programming, String Handling, Introduction to streams classes.

UNIT III

Advanced features –II **09Hrs**

Applets: Architecture, Applet Lifecycle, repaint ( ), HTML APPLET Tags, passing parameters to Applets; Introduction to Swings

UNIT IV

09Hrs

Overview: J2EE and J2SE.

Java Database Connectivity:JDBC introduction, JDBC Driver Types, JDBC process, Creating and executing SQL statement - Statement Object, ResultSet Object

UNIT V

Server side programming **09Hrs**

Overview:JSP, Servlets and Tomcat, Model View Controller (MVC)

Servlets: Life Cycle of Servlet, Handling GET and POST requests, The Servlet API, The Javax.servlet Package, Reading Servlet Parameter, The Javax.servlet.http package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking

Course Outcome:

After completion of the course student would be able to:

- **CO1:** Understand the basic concepts of Java Standard Edition and Enterprise Edition.
- **CO2:** Use the Java SDK environment to create, debug and run Java standalone and applet programs.
- **CO3:** Design and build robust and maintainable web applications by creating dynamic HTML content with Servlets.
- **CO4:** Promote and be open to creative solutions applying Servlets.

References:

1. Herbert Schildt; "Java The Complete Reference"; McGraw Hill Osborne Media; 8th Edition**,** 2011; ISBN: 9781259002465
2. Y. Daniel Liang; "Introduction to Java Programming"; Prentice Hall; 8th Edition; 2010; ISBN: 0132130807.
3. Jim Keogh; "J2EE - The Complete Reference"; Tata McGraw Hill; 1st Edition; 2002; ISBN: 9780070529120.
4. Bruce Eckel; "Thinking in Java"; Pearson Education; 4th Edition, 2006; ISBN 0131872486

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

VIRTUAL INSTRUMENTATION

(Offered by BoS: Electronics & Instrumentation Engineering)

Course Code	**:**	**12GF710**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Understand the basic components and concepts of LabVIEW programming Language.
2. Apply the programming concepts to build virtual application.
3. Provide the concepts of interfacing Peripherals.
4. Create a virtual system for Real Time applications.

UNIT I

Fundamentals of Virtual Instrumentation: Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. **09Hrs**

Software Overview: Lab VIEW , Graphical user interfaces - Controls and Indicators Data types - Data flow programming - Editing - Debugging and Running Virtual instrument - Graphical programming pallets - and their configuration VIs and sub-VIs Typical examples-VIs.

UNIT II

Programming Structure: FOR loops, WHILE loop, CASE structure, formula node, Sequence structures **09Hrs**

Introduction to Arrays and Clusters: Array operations Cluster Functions, Graphs and charts, local and global variables.

UNIT III

File Input/Output: Introduction, File Formats, File I/O Functions, Sample VIs to Demonstrate File WRITE and READ Function **09Hrs**

String Handling: Introduction, String Functions, LabVIEW String Formats, Typical examples.

UNIT IV

09Hrs

Basics of Data Acquisition: Introduction to data acquisition Classification of Signals, Analog Interfacing Connecting signal to board , Analog Input/output techniques digital I/O.

DAQ Hardware configuration: Introduction, Measurement and Automation Explorer, DAQ Assistants, Analysis Assistants, Instrument Assistant.

UNIT V

Interfacing Instruments: GPIB and RS232 : Introduction, RS232 Vs. GPIB, Handshaking, GPIB Interfacing, Standard commands for Programmable Instruments, VISA**.** **09Hrs**

Use of analysis tools and application of VI: Fourier transforms Power spectrum, Correlation methods, windowing & flittering. Inter-Process Communication, Notifier, Queue, Semaphore, Data Sockets, Programmatically Printing Front Panel.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the fundamentals of Virtual Instrumentation

CO2: Apply the concepts to realize the theoretical design.

CO3: Create a VI system to solve real time problems.

CO4: Analyze and evaluate the performance of Virtual System.

Reference Books:

1. Sanjay Gupta & Joseph John**,** Virtual Instrumentation Using Lab View, Tata Mc Graw Hill Publisher Ltd. New Delhi, 2nd Edition, 2010, ISBN : 978-0070700284
2. Lisa. K. Wills**, "**LabVIEW for Everyone**"** Prentice Hall of India, 2nd Edition, 2008, ISBN : 978-0132681940
3. Garry Johnson, Richard Jennings, LabVIEW Graphical Programming, McGraw Hill Professional, 4thEdition , 2006 ,ISBN: 978-1259005336.
4. Jovitha Jerome, "Virtual instrumentation Using LabVIEW", PHI Learning Pvt.Ltd., 4th Edition, 2010, ISBN: 978-8120340305.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

MODERN AUTOMOTIVE ENGINEERING

(Offered by BoS: Mechanical Engineering)

Course Code	**:**	**12GF711**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Introduce different sub-systems in a automotive system
2. Describe the functions of each of the sub-systems and its effect on the complete system
3. Discuss fuel injection, transmission, braking, steering, suspension
4. Explain the importance of selection of suitable sub-system for a given performance requirement

UNIT I

08Hrs

Automotive Engines: Engine types and operation, Subsystems of automotive engines, Supercharger and turbo charges, Radiators and Cooling systems.
Fuels and Emission: Conventional fuels, alternative fuels:- LPG, CNG, Hydrogen and Biofuels, Solar, Electrical and hybrid drives, Engine emission and its controls.

UNIT II

08Hrs

Power Transmission: Clutches and its types, Torque converter and fluid coupling, Geared transmission and automatic transmission, Propeller shaft and differential.
Braking systems: Braking fundamentals, Brake system components, Antilock braking systems, Components and control logic, Electronic stability programs.

UNIT III

10Hrs

Steering systems: **Steering basics, Ackerman Steering Mechanism, conventional mechan**ism, Electronically controlled power steering,
Suspension Systems: Basics, types: Mcpherson Strut Independent suspension system and front & rear axle suspension system

UNIT IV

08Hrs

Vehicle body Engineering: Vehicle body details and classification (Car and Bus), visibility and method of improving visibility and space in car.
Seating and Safety system: Seating system, material for seating, Traction control system, Air bags and immobilizer system, Vehicle crashworthiness tests.

UNIT V

08Hrs

Automotive Electricals: Energy systems:-Starter,Generator and start-stop systems, battery.
Automotive Electronics: Electronic Control Unit, sensors and actuators, Panel display, Infotainment systems.

Course Outcome:

After completion of the course student would be able to:

CO1: Illustrate the basic knowledge of advanced automobile systems and subsystems
CO2: Apply the engineering technology to design automotive systems
CO3: Analyse the performance of automotive systems to match with present scenario
CO4: Adapt newer technology to develop efficient and nature friendly vehicles

References:

1. Dr N.K Giri, "Automotive Technology", Khanna Publishers, 5th Edition, 2000, BN.No.81-7409-178-5.
2. "Automotive Hand Book", SAE publications, 9th Edition, 2014. ISBN.No. 978-0-7680-8152-7
3. William B. Ribbens, Understanding Automotive Electronics, 6th Edition, 2014 ISBN. No-13: 978-0750675994
4. Barry Hollemback, "Automotive Electricity, Electronics & Computer Controls", 1st Edition, 1998, ISBN No. 13: 978-0827365667

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

THIN FILMS AND SURFACE ENGINEERING

(Offered by BoS: Basic Sciences)

Course Code	**:**	**12GF713**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Acquire the knowledge of thin film preparation by various techniques.
2. Analyse the behavior of the thin films by different characterization methods
3. Apply the knowledge to develop devices.

UNIT I

Vacuum Technology: Basics of Vacuum - Principles of different vacuum pumps (from atmosphere down to 10^{-11} torr), rotary pump, roots, rotary, diffusion, turbo molecular pump, cryogenic-pump, ion pump, and Ti-sub limitation pump - Measurement of vacuum, Concept of different gauges, bayet- albert gauge, pirani, penning, pressure control - Vacuum Systems & Applications **08Hrs**

UNIT II

UNIT III

Methods of thin film preparation **10Hrs**

Physical Vapor Deposition (PVD) Techniques: Thermal/resistive evaporation, Electron beam evaporation, Laser ablation, Flash evaporation, and Cathode arc deposition. Electrical Discharges used in Thin Film Deposition - Sputtering, Glow discharge sputtering, Magnetron sputtering, Reactive Sputtering, and Ion beam sputtering.

Chemical Vapor Deposition (CVD) Techniques: Different kinds of CVD techniques: Metal organic CVD (MOCVD), thermally activated CVD, Spray pyrolysis, etc., Atomic layer deposition (ALD) and its Importance.

UNIT IV

Characterization of Thin Film Properties : **09Hrs**

Film thickness measurement: Quartz crystal thickness monitor for process monitoring and control - Stylus method – Optical interference methods.

Film Adhesion: Testing and evaluation methods. Annealing and its influence on film properties.

Surface morphology and topography - Composition of thin films – Film structure by X-ray diffraction and Raman studies – Electrical characterization – Optical characterization – Spectrophotometers – Mechanical and tribological studies.

UNIT V

Thin Film Applications: Electrodes, Transparent conducting (electrodes) Oxides (TCO) Thin Film Transistors (TFT), Sensors, Sensors, Solar cells, Solar Thermal Absorbers, Integrated Circuits, MEMS,NEMS etc. - Decorative Coatings, Optical Coatings, Corrosion and Wear resistant coatings, **09Hrs**

Course Outcome:
After completion of the course the student would be able to:
CO1: Acquire adequate knowledge of thin film preparation and characterization
CO2: Develop various thin film based devices.

References:

1. Vacuum Technology by A. Roth, 3 rd Edition, Elsevier Publishers, ISBN-978-0-444-88010
2. Thin Film Phenomenon by K.L. Chopra, reprint, Mc Graw Hill, ISBN-10: 0070107998,
3. Materials Science of Thin Films by Milton Ohring, 2nd Edition, Acadmic Press, ISBN-10: 0125249756, ISBN-13: 978-0125249751.
4. Thin-Film Deposition: Principles and Practice by Donald Smith, Illustrated Edition, Mc Graw Hill Professional, ISBN-10: 0070585024, ISBN-13: 978-0070585027.

Scheme of Continuous Internal Evaluation:
CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:
The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

ENGINEERING MATERIALS FOR ADVANCED TECHNOLOGY

(Offered by BoS: Basic Sciences)

Course Code	**:**	**12GF714**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:4:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives (CLO):

1. Apply the basic concepts of Chemistry to develop futuristic materials for high-tech applications in the area of Engineering.
2. Impart sound knowledge in the different fields of material chemistry so as to apply it to the problems in engineering field.
3. Develop analytical capabilities of students so that they can characterize, transform and use materials in engineering and apply knowledge gained in solving related engineering problems.

UNIT I

08Hrs

Adhesives: Classification of Adhesives-Natural adhesives, synthetic adhesives-drying adhesives, pressure sensitive adhesives, contact adhesives, hot adhesives. One part adhesives, multi part adhesives. Adhesive Action. Development of Adhesive strength- Physical factors influencing Adhesive Action-surface tension, surface smoothness, thickness of adhesive film, elasticity and tensile strength. Chemical Factors Influencing Adhesive action - presence of polar groups, degree of polymerization, complexity of the adhesive molecules, effect of pH. Adhesive action- specific adhesive action, mechanical adhesive action, fusion adhesion. Development of adhesive strength- adsorption theory and diffusion theory. Preparation, curing and bonding Processes by adhesives-with reference to Epoxy, phenolics, Silicone, Polyurethane, Acrylic adhesives, Poly vinyl alcohol, Polyvinyl acetate .

UNIT II

07Hrs

Optoelectronic Materials: Photovoltaic Electricity: The Photon: Energy, Wavelength and Frequency. Classification of solar cells, Structure of an Inorganic Solar Cell, Characteristics of Solar Cells: Short Circuit Current, Open Circuit Voltage, Maximum Power, fill factor. Efficiency of Photovoltaic Solar Cell: Organic Solar Cells.

Light Emitting Diodes: Luminance, luminous intensity, luminous flux and luminous efficacy. Inorganic LEDs with device construction, examples and advantages. OLEDs: Introduction, OLED Emission Principle, types of OLEDS-Small molecule OLEDs and Polymer based OLEDs. Classification of OLEDS by Emission Layer Formation Process. OLED materials and their characteristics.

UNIT III

08Hrs

Optical fibre materials : Fiber Optics, Advantages of optical fiber communication over analog communication, Classification based on refractive index of the core- step index and graded index optical fibres, Classification based on core radius-single mode and multimode optical fibres, Fibre fabrication.-Methods to manufacture optical glass fibres. Double crucible method and preform methods. Manufacture of perform- Chemical Vapour Deposition (CVD), Modified vapour deposition (MCVD) Plasma activated vapour deposition (PCVD), Outside vapour deposition (OVD)-Vapour-phase axial deposition (VAD). Drawing the fibres from perform, coating and jacketing process.

Ion exchange resins and membranes: Ion exchange resins-Introduction, Types-cation and anion exchange resins, examples, physical properties, chemical properties-capacity, swelling, kinetics, stability, ion exchange equilibrium, regeneration. Applications of ion exchange resins-softening of water, demineralization of water, advantages and disadvantages of ion exchange

resins-calcium sulphate fouling, iron fouling, adsorption of organic matter, bacterial contamination. Ion exchange membranes, Types-anion and cation exchange membranes. Classification of ion exchange membranes based on connection way between charged groups and polymeric matrix-homogeneous and heterogeneous ion exchange membranes, examples. Fabrication of ion exchange cottons- anion exchange cotton and cation exchange cotton. Application of ion exchange membranes in purification of water by electro dialysis method.

UNIT IV

06Hrs

Coating and packaging materials: Surface Coating materials: Synthesis and applications of Polymer coating materials: Teflon, Silicone films Polyvinyl chloride & its copolymers, Poly vinyl acetate, Poly ethylene-HDPE, LDPE, Polyurethane.

Properties required in a pigment and extenders, Inorganic pigments-titanium dioxide, zinc oxide, carbon black, chromate pigments, molybdate orange, chrome green, ultramarine blue, iron blue, cadmium red.

Corrosion inhibiting pigments- zinc phosphate, zinc and barium chromate pigments, ceramic pigments, metal flake pigments, extenders.

Developments in new polymers such as dendrimers, biopoplymers & biodegradable polymers.

Packaging materials: Food products: Cellulosic and Polymeric packaging materials and their properties – including barrier properties, strength properties, optical properties. Glass, aluminium, tin, paper, plastics, composites.

Pharmaceutical products: Injectibles and tablet packaging materials.

UNIT V

15Hrs

Characterisation techniques for materials: Atomic absorption and emission spectroscopy including Raman spectroscopy, UV- visible spectra-photometry, NMR.

Raman spectroscopy. Theory of Rayleigh and Raman scattering, classical and quantum models. Rotational Raman effect and an analysis of molecular electric polarization tensor –vibrational Raman effect. Rotational-vibrational transitions from both IR spectroscopy and Raman spectroscopy.

UV- visible spectrophotometry :Introduction-Electronic transitions- factors influencing position and intensity of absorption bands-absorption spectra of dienes, polyene and α,β-unsaturated carbonyl compounds, Working of UV-Vis spectrophotometer, Theoretical calculation of λ_{max} by using Woodward-Fieser rules- for cyclic and α,β-unsaturated carbonyl compounds .

H^1 NMR Spectroscopy : Basic concepts- relaxation process. NMR spectrometer-FT NMR-Solvents used in NMR, internal standards-Chemical equivalence -Integrals and Integrations-chemical shift-Factors affecting chemical shifts- shielding and deshielding effects – chemical and magnetic equivalent –magnetic anisotropy-spin-spin splitting rules- Application of NMR on various compounds such as alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides & mono substituted aromatic compounds. Problems on prediction of structure of compounds. Application of NMR in magnetic resonance imaging (MRI).

Course Outcome:

After completion of the course student would be able to:

CO1: Identify sustainable engineering materials and understand their properties.

CO2: Apply the basic concepts of chemistry to develop futuristic materials for high-tech applications in different areas of engineering.

CO3: Analyze and evaluate the specific application of materials.

CO4: Design the route for synthesis of material and its characterization.

References Books:

1. Materials Science by G.K.Narula, K.S.Narula & V.K.Gupta. 38th edtion, 2015, ISBN: 9780074517963, Tata McGraw-Hill Publishing Company Limited.
2. Solar Lighting by Ramachandra Pode and Boucar Diouf, Springer e-book, 2011, ISBN: 978-1-4471-2133-6 (Print) 978-1-4471-2134-3 (Online),.
3. Spectroscopy of organic compounds by P.S.Kalsi, New Age Internatioal(P) ltd, 2005, ISBN 13: 9788122415438.
4. Mahadeviah M & Gowramma RV, Food Packaging Materials. Tata McGraw Hill Publishing Company Limited, 1996, ISBN :0074622382 9780074622384

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

APPLIED PSYCHOLOGY FOR ENGINEERS

(Offered by BoS: Humanities and Social Sciences)

Course Code	**:**	**12GF715**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L: T: P: S: 3:0:1:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Appreciate human behavior and human mind in the context of learner's immediate society and environment.
2. Understand the importance of lifelong learning and personal flexibility to sustain personal and professional development as the nature of work evolves.
3. Provide students with knowledge and skills for building firm foundation for the suitable engineering professions.
4. Prepare students to function as effective Engineering Psychologists in an Industrial, Governmental or consulting organization.
5. Enable students to use psychological knowledge, skills, and values in occupational pursuits in a variety of settings that meet personal goals and societal needs.

UNIT I

Introduction to Psychology: Definition and goals of Psychology: Role of a Psychologist in the Society: Today's Perspectives(Branches of psychology)., Psychodynamic, Behaviouristic, Cognitive, Humanistic, Psychological Research and Methods to study Human Behavior: Experimental, Observation, Questionnaire and Clinical Method **07Hrs**

UNIT II

Intelligence and Aptitude: Concept and definition of Intelligence and Aptitude, Nature of Intelligence. Theories of Intelligence – Spearman, Thurston, Guilford Vernon. Characteristics of Intelligence tests, Types of tests. Measurement of Intelligence and Aptitude, Concept of IQ, Measurement of Multiple Intelligence – Fluid and Crystallized Intelligence. **07Hrs**

UNIT III

Personality: Concept and definition of personality, Approaches of personality- psychoanalytical, Socio- Cultural, Interpersonal and developmental, Humanistic, Behaviorist, Trait and type approaches. Assessment of Personality: Self- report measures of Personality, Questionnaires, Rating Scales and Projective techniques, its Characteristics, advantages & limitations, examples. Behavioral Assessment. Psychological Stress: a. Stress- Definition, Symptoms of Stress, Extreme products of stress v s Burnout, Work Place Trauma. Causes of Stress – Job related causes of stress. Sources of Frustration, Stress and Job Performance, Stress Vulnerability-Stress threshold, perceived control. **08Hrs**

UNIT IV

Application of Psychology in Working Environment: The present scenario of information technology, the role of psychologist in the organization, Selection and Training of Psychology Professionals to work in the field of Information Technology. Distance learning, Psychological consequences of recent developments in Information Technology. Type A and Type B Psychological Counseling - Need for Counseling, Types – Directed, Non- Directed, Participative Counseling. **07Hrs**

UNIT V

Learning: Definition, Conditioning – Classical Conditioning, Basics of Classical Conditioning (Pavlov), the process of Extinction, Discrimination and Generalization. Operant Conditioning (Skinner expt). The basics of operant conditioning, Schedules of reinforcement. Cognitive – Social approaches to learning – Latent Learning, Observational Learning, Trial and Error Method, Insightful Learning. **07Hrs**

Experimental Psychology UNITVI (Practicals)

1. Bhatia's Battery of Performance and intelligence test Multidimensional Assessment of Personality
2. B.K.Passi test of Creativity Test of Non- Verbal Intelligence test (TONI-4)
3. David's Battery of Differential Abilities (Aptitude test)
4. Bilateral Transfer of Training Mirror drawing apparatus with Electronic Digital Reset Error Counter (Performance) Student Stress Scale.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the basic principles and concepts of applied psychology in. mental processes.
CO2: Develop psychological attributes such as intelligence, aptitude, creativity, resulting in their enhancement.
CO3: Apply effective strategies for SWOC, self-management and self-improvement.
CO4: Understand the application of psychology in engineering and technology and develop a route to accomplish goals in their work environment.

Reference Books:

1. Feldman R. S., "Understanding Psychology", McGraw Hill India, 4th edition, 1996
2. Robert A. Baron," Psychology", Prentice Hall India 3rd edition,1995.
3. Stephen P Robbins Organizational Behaviour , Pearson Education Publications, 13th Edition, ISBN – 81-317 – 1132 – 3
4. John W.Newstrem and Keith Davis. Organizational Behavior : Human Behavior at Work Tata McGraw Hill India, 10th edition, ISBN 0-07-046504-5

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. 10 marks are reserved for laboratory, out of which 05 marks for maintaining record and 05 marks for internal test.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

Sl.No.	Dept.	Group G		
		Course Code	**Course Title**	**Credits**
1	Biotechnology	12GG701	Bioinformatics	3
2	Chemical	12GG702	Industrial safety & risk management	3
3	Comp. Sc. & Engg.	12GG703	Intelligent Systems	3
4	Civil	12GG704	Solid Waste Management	3
5	Elns. & Comm.	12GG705	Automotive Electronics	3
6	Elns. & Elec.	12GG706	Industrial electronics	3
7	Indl. Engg. Mng.	12GG707	Systems Engineering	3
8	Info. Sc. & Engg.	12GG708	Cloud Computing	3
9	Instrumentation	12GG709	MEMS	3
10	Mech. Engg.	12GG710	Mechatronics	3
11	Telecommunication	12GG711	Space Technology and Applications	3
12	Mathematics	12GG712	Linear Algebra	3

BIOINFOMATICS

(Offered by BoS: Biotechnology Engg.)

Course Code	**:**	**12GG701**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**04**	**SEE Hrs**	**:**	**03**

Prerequisites: : Knowledge of Mathematics and Basics of programming

Course Learning Objectives(CLO):

1. Understand the principles of Bioinformatics and Programming.
2. Learn various Biological Databases and Tools that aid in the analysis.
3. Use tools such as Web & standalone tools to interface, analyze and interpret biological data
4. Use Perl and BioPerl for the analysis of Biological Data.

UNIT I

Biomolecules: Introduction to Biomolecules. Structure, Types and Functions of Carbohydrates, Lipids, Nucleic Acids and Proteins. Genetic code, Codon degeneracy, Genes and Genomes. **08Hrs**

Bioinformatics & Biological Databases: Introduction to Bioinformatics, Goals, Scope, Applications in biological science and medicine. Biological databases – Sequence, structure, Special Databases and applications: Genome, Microarray, Metabolic pathway, motif, and domain databases. Mapping databases – genome wide maps. Chromosome specific human maps.

UNIT II

Sequence Alignment: Introduction, Types - Pairwise and Multiple sequence alignment, Alignment algorithms, Scoring matrices, Database Similarity Searching- Basic Local Alignment Search Tool (BLAST), and FASTA. Next Generation Sequencing – Alignment and Assembly. **09Hrs**

Molecular Phylogenetics: Phylogenetics Basics. Molecular Evolution and Molecular Phylogenetics – Terminology, Forms of Tree Representation. Phylogenetic Tree Construction Methods - Distance-Based Methods, Character-Based Methods. Methods of Phylogenetic Tree evaluation. Phylogenetic analysis programs.

UNIT III

Predictive methods using Nucleic acid sequence: Predicting RNA secondary structure, Finding RNA genes, Detection of functional sites in the DNA and Gene Prediction Algorithms –Exon Chaining. Predictive methods using protein sequence – Algorithms used to predict Protein identity and Physical properties. Structure prediction - Prediction of Secondary and Tertiary structure of Protein. **10Hrs**

Molecular Modeling and Drug Designing: Introduction to Molecular Modeling, methods of Molecular Modeling and Force Fields used in Molecular Modeling. Drug designing process - deriving Pharmacophore, Receptor Mapping, Estimating biological activities, Receptor-Ligand interactions. Molecular Docking. QSAR, Application of QSAR in Drug Design

UNIT IV

Perl: Introduction to Perl, writing and executing a Perl program. Operators, Variables and Special variables. Data Types – Scalar, Array and Associative array. Regular Expressions (REGEX), Components of REGEX - Operators, Meta-characters and Modifiers. Subroutines – types of functions, defining and calling functions in Perl, calling function - call by value and call by reference. Perl Package – writing and calling package. Perl Module – writing and calling module **09Hrs**

UNIT V

BioPerl: Introduction to BioPerl, BioPerl Modules, Applications of BioPerl – Sequence retrieval from Database and submission of sequence to online Database, Indexing and accessing local databases, Transforming formats of database record, Sequence alignments BioPerl and Sequence Analysis - Pair wise and Multiple sequence alignment, Restriction mapping. , Identifying restriction enzyme sites, acid cleavage sites, searching for genes and other structures on genomic DNA, Parsing BLAST and FASTA results. BioPerl and Phylogenetic analysis, BioPerl and Phylogenetic tree manipulation, creating graphics for Sequence display and Annotation. **09Hrs**

Course Outcome:

After completion of the course student would be able to:

- **CO1:** Understand the Architecture and Scheme of online databases including structure of records in these databases.
- **CO2:** Explore the Algorithms, which are used to make prediction in Biology, Chemical Engineering, and Medicine.
- **CO3:** Apply the principles of Bioinformatics and Programming to the problems related to process simulation and process engineering in Biological system.
- **CO4:** Use Bioinformatics tools and Next Generation Technologies to model and simulate biological phenomenon.

Reference Books:

1. T. Christiansen, B. D. Foy, L. Wall, J. Orwant, Programming Perl: Unmatched power for text processing and scripting, O'Reilly Media, Inc., 4th edition, 2012, ISBN-13: 978-0596004927
2. B. Haubold, T. Weihe, Introduction to Computational Biology: An Evolutionary Approach, newagepublishers, Paperback Edition, 2009, ISBN-13: 978-8184890624
3. D.C.Young. Computational Drug Design: A Guide for Computational and Medicinal Chemists,Wiley-Interscience, 1st edition, 2009, ISBN-13: 978-0470126851.
4. JinXiong, Essential Bioinformatics. Cambridge University Press, 2nd Edition, 2006, ISBN-13: 978-0521600828.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

INDUSTRIAL SAFETY AND RISK MANAGEMENT

(Offered by BoS: Chemical Engg.)

Course Code	**:**	**12GG702**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S 3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Select appropriate risk assessment techniques and analyze public and individual perception of risk.
2. Relate safety, ergonomics and human factors.
3. Carry out risk assessment and protection in process industries.

UNIT I

General: Hazard identification methodologies, risk assessment methods-PHA, HAZOP, MCA, ETA, FTA, Consequence analysis, Profit analysis. Hazards in work places- Nature and type of Work places, Types of hazards, hazards due to improper housekeeping, hazards due to fire in multi floor industries and buildings, guidelines and safe methods in above situations **08Hrs**

UNIT II

Techniques: General, Risk adjusted discounted rate method, Certainty Equivalent Coefficient method, Quantitative Sensitivity analysis, Probability distribution, Coefficient of variation method, Simulation method, Crude Procedures, Payback period, Expected monetary value method, Refined procedures, Shackle approach, Hiller's model, Hertz model, Goal programming **08Hrs**

UNIT III

Risk Management: Emergency relief Systems, Diers program, Bench scale experiments, Design of emergency relief systems, Internal emergency planning, Risk management plan, mandatory technology option analysis, Risk management alternatives, risk management tools, risk management plans, Risk index method, Dowfire and explosion method, Mond index Method. **06Hrs**

UNIT IV

Risk Assurance and Assessment: Property Insurance, Transport insurance, Liability insurance, Precocious insurance, Risk Assessment, Scope Canvey study, Rijimond pilot study, Low Probability high consequence events. Fault tree analysis, Event tree analysis, Zero Infinity dilemma. **08Hrs**

UNIT V

Risk Analysis in Industries: Handling and storage, Process plants, Personnel protection equipments. Environmental risk analysis, International environmental management system, Corporate management system (Case study of a Chemical plant) **)8Hrs**

Course Outcome:

After completion of the course student would be able to:

CO1: Recall and use risk assessment techniques as well as tools for process industry.
CO2: Identify hazard identification tools for safety management.
CO3: Analyze and compare the various tools and safety procedures for protection in process industries.
CO4: Formulate the procedures to relate safety, ergonomics and human factors.

Reference Books:

1. Laird Wilson Dough Mc Cutcheon, "Industrial Safety & risk management", The University of Alberta pressw, 1 st edition,2003, ISBN:088864-394-2
2. Sincero, A. P. and Sincero, G. A., "Environmental Engineering – A Design Approach", Prentice Hall of India, 1996, ISBN:0024105643
3. Pandya, C. G., "Risks in Chemical Units", Oxford and IBH Publishers,1st edition ,1992, ISBN:8120406907
4. Fawcett, H. H., "Safety and Accident Prevention in Chemical Operations by John Wiley & Sons, 2nd edition,1982, , ISBN: 9780471024354

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

INTELLIGENT SYSTEMS

(Offered by BoS: Computer science and Engineering)

Course Code	**:**	**12GG703**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Prerequisite: Artificial Intelligence.

Course Learning Objectives(CLO):

1. Understand fundamental AI concepts and current issues.
2. Understand and apply a range of AI techniques including search, logic-based reasoning, neural networks and reasoning with uncertain information.
3. Recognize computational problems suited to an Intelligent system solution.
4. Identify and list the basic issues of knowledge representation, blind and heuristic search.
5. Analyze the design issues inherent in different Intelligent System approaches.

UNIT I

Introduction To Artificial Intelligence : Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms. **07Hrs**

UNIT II

Representation Of Knowledge: Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge **07Hrs**

UNIT III

Knowledge Inference: Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory. **07Hrs**

UNIT IV

Expert Systems : Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells **07Hrs**

UNIT V

Intelligent Decision Support Systems: Artificial Intelligence and Expert Systems: Knowledge-Based System - Knowledge Acquisition, Representation, and Reasoning - Advanced Intelligent Systems - Intelligent Systems over the Internet. **07Hrs**

Course Outcome:

After completion of the course student would be able to:

CO1: Describe and understand the basic concepts and challenges of Artificial Intelligence.

CO2: Analyze and explain basic intelligent system algorithms to solve problems.

CO3: Apply Artificial Intelligence and various logic-based techniques in research applications.

CO4: Assess their applicability by comparing different Intelligent System techniques.

Reference Books:

1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Tata McGraw-Hill Education Private Limited, 3rd edition, 2009, ISBN: 978-0070678163.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2nd edition,2007. ISBN, 0132097680
3. Peter Jackson, "Introduction to Expert Systems", Pearson Education, 3rd edition, 2007. ISBN-13: 978-0201876864
4. Stuart Russel, Peter Norvig , "AI – A Modern Approach", Pearson Education, 2nd edition, ISBN-13: 978-0137903955

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

SOLID WASTE MANAGEMENT
(Offered by BoS: Civil Engineering)

Course Code	**:**	**12GG704**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Impart the knowledge of present methods of solid waste management system and to analyze the drawbacks.
2. Understand various waste management statutory rules for the present system.
3. Analyze different elements of solid waste management and design and develop recycling options for biodegradable waste by composting.
4. Identify hazardous waste, e-waste, plastic waste and bio medical waste and their management systems.

UNIT I

Introduction: Land Pollution. Present solid waste disposal methods. Merits and demerits of open dumping, feeding to hogs, incineration, pyrolysis, composting, sanitary landfill. Scope and importance of solid waste management. Definition and functional elements of solid waste management. **08Hrs**

Sources: Sources of Solid waste, types of solid waste, composition of municipal solid waste, generation rate, Problems.

Collection and transportation of municipal solid waste: Collection of solid waste- services and systems, Municipal Solid waste (Management and Handling) 2000 rules with amendments. Site visit to collection system.

UNIT II

Composting Aerobic and anaerobic composting - process description, process microbiology, Vermicomposting, Site visit to compost plant, problems. **08Hrs**

Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Site visit to landfill site.

UNIT III

Hazardous waste management: Definitions, Identification of hazardous waste, Classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, hazardous waste (Management and handling) rules 2008 with amendments. Site visit to hazardous landfill site **06Hrs**

UNIT IV

Bio medical waste management: Classification of bio medical waste, collection, transportation, disposal of bio medical waste, Bio medical waste (Management and Handling) rules 1998 with amendments. Site visit to hospital to see the collection and transportation system and visit to biomedical waste incineration plant. **06Hrs**

UNIT V

E-waste management: Definition, Components, Materials used in manufacturing electronic **goods,** Recycling and recovery integrated approach. Site visit to e- waste treatment plant. **06Hrs**

Plastic waste management: Manufacturing of plastic with norms. Plastic waste management. Plastic manufacture, sale & usage rules 2009 with amendments.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the current solid waste management system.

CO2: Analyze drawbacks in the present system and provide recycling and disposal options for each type of waste.

CO3: Distinguish Hazardous waste, Biomedical waste,E waste and to provide scientific management system.

CO4: Evaluate and monitor the Biomedical waste,Hazardous waste, E waste, Plastic and Municipal waste management as per the rules laid by Ministry of Environment & Forest.

Reference Books

1. George.C. Tchobanoglous, "Integrated Solid Waste Management" – McGraw hill publication. International edition 1993, ISBN 978-0070632370
2. R.E. Hester, Roy M Harrison, "Electronic waste management", Cambridge, UK, RSC Publication, 2009, ISBN 9780854041121
3. Municipal Solid waste (Management & Handling Rules) , Ministry of Environment & Forest Notification, New Delhi, 25th Sept 2000 and amendments on 2013.
4. The Plastic Manufacture, Sale and usage Rules2009. Ministry of Environment and Forest Notification, New Delhi, amendment on February 4, 2011
5. Biomedical waste management (Management & Handling Rules) 20th July 1998. Ministry of Environment & Forest Notification, New Delhi, amendment on February 26, 2013.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

AUTOMOTIVE ELECTRONICS

(Offered by BoS: Electronics and Communications)

Course Code	**:**	**12GG705**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Understand fundamentals of Automotive electronics and application.
2. Comprehend principles of sensing technology in automotive field, smart sensors and the type of sensor.
3. Apply control systems in the automotive space resulting in application oriented learning with examples, criticality to real time embedded system like anti wind up function, actuator dithering, etc
4. Understand automotive specific communication protocols and techniques, their significance & benefits.
5. Analyze fault tolerant real time embedded systems, the basics of diagnostics, its method, reporting mechanism and error handling / fault reactions.

UNIT I

Power Train Engineering and Fundamentals of Automotive **07 Hrs**

Fundamentals of Petrol, diesel and gas engines, electric motors and control systems. Basic Automotive System, System Components, Evolution of Electronics in Automotive. Alternators and charging, battery technology, Ignition systems. Working principles of various electronic components and accessories used in Automotive. Developments in existing engine forms and alternatives. Hybrid designs (solar power, electric/gasoline, LPG, CNG, fuel cells). Basic Transmission systems.

UNIT II

Sensor Technologies in Automotive **07 Hrs**

In-vehicle sensors: Working principles, Characteristics, limitations and use within the automotive context of the following: Temperature sensing e g. coolant, air intake. Position sensing e.g. crankshaft, throttle plate. Pressure sensing e.g. manifold, exhaust differential, tyre. Distance sensing e.g. anti-Collision, Velocity sensing e.g. speedometer, anti-skid. Torque sensing e.g. automatic transmission. Vibration sensing e.g. Airbags. flow sensing and measurement e.g. fuel injection. Interfacing principles: Operation, topologies and limitations of all sensors covered in the above to in-vehicle processing or communications nodes. Use of Actuators: Types, Working principle, Characteristics, limitations and use within the automotive context of each type.

UNIT III

Automotive Control Systems **07 Hrs**

Control system approach in Automotive: Analog and Digital control methods, stability augmentation, control augmentation. Transmission control, System components and functions. Cruise control, traction control, actuator limiting, wind-up, gain scheduling, adaptive control. Special Control Schemes: Vehicle braking fundamentals, Antilock systems. Variable assist steering and steering control. Controls for Lighting. Wipers, Air conditioning /heating. Remote keyless Entry and Anti-theft System, Emission Course-system control. Control techniques used in hybrid system. Electronic Engine control: Motion equations, modeling of linear and non-linear systems, numerical methods, system responses Objective of Electronic Engine control. Spark Ignition and Compression Ignition Engines and their electronic controls. Engine management testing: Engine management system strategies and implementation. Simulation and implementation methods. Methods of improving engine performance and efficiency

UNIT IV

07 Hrs

Automotive Communication Systems

Communication interface with ECU's: Interfacing techniques and interfacing with infotainment gadgets. Relevance of internet protocols, such as TCP/IP for automotive applications. Wireless LANs standards, such as Bluetooth, IEEE802.11x. Communication protocols for automotive applications. Automotive Buses: Use of various buses such as CAN, LIN, Flex Ray. Recent trends in automotive buses (Such as OBDI1. MOST, IE, IELI.I, D2B and DSI). Application of Telematics in Automotive: Global Positioning Systems (GPS) and General Packet Radio Service (GPRS), for use in an automotive environment. Higher End Technology: Comparative Study and applications of ARM Cortex.-Aseries/M-series. ARM 9 and ARM11.

UNIT V

07 Hrs

Diagnostics and Safety in Automotive

Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system. Preliminary checks and adjustments, Self-Diagnostic system. Fault finding and corrective measures. Electronic transmission checks and Diagnosis, Diagnostic procedures and sequence. On board and off board diagnostics in Automotive. Safely in Automotive: Safety norms and standards. Passenger comfort and security systems. Future trends in Automotive Electronics.

Reference Books

1. Williams. B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier science, Newness publication, , 2003
2. Robert Bosch, "Automotive Electronics Handbook", John Wiley and Sons, 2004
3. Nitaigour Mahalik, "Mechatronics: principles, concepts and Applications", TMH, 2003
4. Uwekiencke and lars Nielsen, "Automotive Control Systems Engine, Driveline and vehicle", 2nd Edition, Springer, 2005

Scheme for Continuous Internal Evaluation (CIE):

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Evaluation for Theory (SEE) (100):

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

INDUSTRIAL ELECTRONICS

(Offered by BoS: Electrical and Electronics Engg.,)

Course Code	**:**	**12GG706**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Assimilate information and techniques for management of electrical energy.
2. Explain the working of power electronic components used in design of electronic circuits of conversion and control of electrical energy in Industry.
3. Apply the strong knowledge base acquired for analyzing and designing electronic circuits which handle the electrical energy efficiently and economically.
4. Sort-out design problems through the practical and industrial exposure acquired.
5. Use basic concepts of practical design and working of electronic circuits for conversion and control of electrical energy.
6. Make use of the opportunities to work as part of teams on multidisciplinary projects and to discuss industrial problems with regard to application of Power Elecronics.

UNIT I

Power semi conductor Devices and static characteristics: Construction, working & characteristics of MOSFET, SCR, IGBT. Comparison of Power BJT, MOSFET, SCR, IGBT. Turn on methods of Power BJT, MOSFET and IGBT. Design of R, R-C, and UJT (pulse train) Gate triggering methods of SCR. **07 Hrs**

UNIT II

Thyristor Dynamic characteristics, Specifications and Protection: Gate characteristics of SCR, Dynamic characteristics of SCR. Design of Snubber circuit for SCR, Line Commutation and Forced Commutation circuits with design, Gate protection & overvoltage protection of SCR. **07 Hrs**

UNIT III

Converters- Single Phase Controlled Convertor- Full wave Half and Fully controlled line commutated bridge converters, Three phase converters –Six pulse converters- with R, RL, RLE load- Active and Reactive power inputs to the convertors with and without Freewheeling diode, Derivation of average load voltage and current, Effect of source inductance, Converter Design. **08 Hrs**

UNIT IV

Converter applications: Industrial Applications of Half and Fully controlled converters to DC drives (Control of DC drives). Dual converters (both single phase and three phase). **07 Hrs**

Choppers – Step down, Step up Chopper, Step up/Down Chopper, Time ratio control and Current limit control strategies –Derivation of load voltage and currents with R, RL and RLE loads of Step down, Step up Chopper, Step up/Down Chopper – load voltage expression. Design of choppers according to applications.

UNIT V

Classification of Choppers and Applications: Type A, Type B, Type C, Type D, Type E choppers and their industrial Applications, Morgan's chopper, Jones chopper and Oscillation chopper (Principle of operation only) , AC Chopper –phase control type. **07 Hrs**

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter, bridge inverter – Voltage control techniques for inverters Pulse width modulation techniques. –

UPS-online, offline (Principle of operation only).

Reference Books:

1. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw – Hill Publishing company, 1998
2. M. H. Rashid, "Power Electronics : Circuits, Devices and Applications", Prentice Hall of India, 2nd edition, 1998
3. P.C.Sen, "Power Electronics", Tata McGraw-Hill Publishing, 1987.

Scheme of Continuous Internal Evaluation:

CIE consists of Three Tests each for 45 marks (15 marks for Quiz + 30 marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five from Part B will have internal choice and one of the two have to be answered compulsorily.

SYSTEMS ENGINEERING

(Offered by BoS: Industrial Engineering and Management)

Course Code	**:**	**12GG707**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Develop an appreciation and understanding of the role of systems engineering processes and systems management in producing products and services.
2. Document systematic measurement approaches for generally cross disciplinary development effort.
3. Discuss capability assessment models to evaluate and improve orgnizational systems engineering capabilities.

UNIT I

System Engineering and the World of Modem System: What is System Engineering?, Origins of System Engineering, Examples of Systems Requiring Systems Engineering, System Engineering viewpoint, Systems Engineering as a Profession, The power of Systems Engineering, problems. **07 Hrs**

Structure of Complex Systems: System building blocks and interfaces, Hierarchy of Complex systems, System building blocks, The system environment, Interfaces and Interactions.

The System Development Process: Systems Engineering through the system Life Cycle, Evolutionary Characteristics of the development process, The system engineering method, Testing throughout system development, problems.

UNIT II

Systems Engineering Management: Managing systems development and risks, Work breakdown structure (WBS), System Engineering Management Plan (SEMP), Risk Management, Organization of Systems Engineering, Systems Engineering Capability Maturity Assessment, Systems Engineering standards, Problem. **07 Hrs**

Needs Analysis: Originating a new system, Operations analysis, Functional analysis, Feasibility analysis, Feasibility definition, Needs validation, System operational requirements, problems.

Concept Exploration: Developing the system requirements, Operational requirements analysis, Performance requirements formulation, Implementation concept exploration, Performance requirements validation, problems.

UNIT III

07Hrs

Concept Definition: Selecting the system concept, Performance requirements analysis, Functional analysis and formulation, Concept selection, Concept validation, System Development planning, System Functional Specifications, problems

Advanced Development: Reducing program risks, Requirements analysis, Functional Analysis and Design, Prototype development, Development testing, Risk reduction, problems.

UNIT IV

Engineering Design: Implementing the System Building blocks, requirements analysis, Functional analysis and design, Component design, Design validation, Configuration Management, problems. **06 Hrs**

Integration and Evaluation: Integrating, Testing and evaluating the total system, Test planning and preparation, System integration, Developmental system testing, Operational test and evaluation, problems.

UNIT V

Production: Systems Engineering in the factory, Engineering for production, Transition from development to production, Production operations, Acquiring a production knowledge base, problems. **06 Hrs**

Operations and support: Installing, maintenance and upgrading the system, Installation and test, In-service support, Major system upgrades: Modernization, Operational factors in system development, problems.

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the Life Cycle of Systems.

CO2: Explain the role of Stake holders and their needs in organizational systems.

CO3: Develop and Document the knowledge base for effective systems engineering processes.

CO4: Apply available tools, methods and technologies to support complex high technology systems.

CO5: Create the frameworks for quality processes to ensure high reliability of systems.

Reference Books:

1. Alexander Kossoakoff, William N Sweet, "Systems Engineering – Principles and Practice" John Wiley & Sons, Inc, edition: 2012, ISBN: 978-81-265-2453-2
2. Andrew P. Sage, William B. Rouse, "Handbook of Systems Engineering And Management" John Wiley & Sons, Inc., edition:1999, ISBN 0-471-15405-9
3. Ludwig von Bertalanffy, "General System Theory: Foundation, Development, Applications", Penguin University Books, 1973, Revised, ISBN: 0140600043, 9780140600049.
4. Blanchard, B., and Fabrycky, W. Systems Engineering and Analysis, Saddle River, NJ, USA: Prentice Hall, 5th edition, 2010.
5. Checkland, P. Systems Thinking, Systems Practice. Hoboken, NJ, USA: Wiley,2nd edition, 1999, ISBN:0471986062, 9780471986065..
6. Rechtin, E. Systems Architecting. Upper Saddle River, NJ,USA: Prentice Hall, 1991, ISBN: 0138803455, 9780138803452.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

CLOUD COMPUTING

(Offered by BoS: Information Science & Engineering)

Course Code	**:**	**12GG708**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives (CLO):

1. Learn advanced and cutting edge state-of-the-art knowledge and implementation in cloud computing.
2. read and understand research publications in the technical area of cloud computing, beyond that of the traditional textbook level.
3. Get to know about advanced services and applications in stacks of cloud
4. Explore the cloud Infrastructure and understand Abstraction & Virtualization in cloud computing.

UNIT I

Cloud Computing Fundamental: Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications. **07 Hrs**

UNIT II

Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages. **07 Hrs**

UNIT III

Virtualized Data Center Architecture : Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas, Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures **07 Hrs**

UNIT IV

Information Storage Security &Design : Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments. Monitoring and management; security auditing and SIEM **07 Hrs**

UNIT V

Storage Network Design: Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations. **07 Hrs**

Working with Twitter API, Flickr API, Google Maps API. Advanced use of JSON and REST.
Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Course Outcome:

After completion of the course student would be able to:

- **CO1:** Develop the skills to gain a basic understanding of components in cloud computing showing how business agility in an organization can be created
- **CO2:** Explore the functional components of web services from cloud architecture
- **CO3:** Develop and implement a basic consistency of services deployed from a cloud architecture
- **CO4:** Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications.

References Book:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, **"**Mastering Cloud Computing", Indian Edition: Tata McGraw Hill, Feb 2013, ISBN-13: 978-1-25-902995-0,.
2. Venkata Josyula, "Cloud Computing: Automating the virtualized Data Center" , Pearson India 2012, ISBN:1-58720-434-7
3. George Reese, "Cloud application architectures", Wiley India 2011, ISBN: 978-0596156367
4. GautamShroff," Enterprise Cloud Computing Technology Architecture Applications"Tata McGraw Hill, 2011,ISBN: 978-0521137355

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

MICRO ELECTROMECHANICAL SYSTEMS

(Offered by BoS: Electronics & Instrumentation Engg.)

Course Code	**:**	**12GG709**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Learn the fundamentals and working principle of MEMs and Microsystem products like Sensors, Actuators etc.
2. Understand the Multidisciplinary nature of Microsystems.
3. Understand the Scaling Laws in MEMs and Microsystems.
4. Select materials for MEMs for fabrication techniques.

UNIT I

Over view of MEMS & Microsystems and Working Principles of Microsystems: MEMS and Microsystems, Typical MEMS and Microsystem Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystem, Design and Manufacture, Applications of Microsystems in Automotive, Health Care, Aerospace and other Industries. **07 Hrs**

Working Principle of Microsystems: Biomedical & Biosensors. Microsensors: Acoustic, Chemical, Optical, Pressure, Thermal

UNIT II

Microactuation: Using Thermal forces, Shape Memory alloys, Piezoelectric Crystals and Electrostatic forces. MEMS with Microactuators: Microgrippers, Micromotors, Microvalves and Micropumps. Microaccelerometers, Microfluidics. Introduction to Thermofluid Engineering, Overview of the Basics of Fluid Mechanics in Macro and Mesoscales: Viscosity of fluids, Streamlines and Stream Tubes, Control Volumes and Control Surfaces, Flow Patterns and Reynolds Number. Basic Equations in Continum Fluid Dynamics: The Continuity Equation, The Momentum Equation and the Equation of motion. **07Hrs**

UNIT III

Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Microconduits, Fluid Flow in Submicrometer and Nanoscale, Heatconduction in Multilayered Thin Films. Introduction to Scaling, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic Forces and Scaling in Fluid Mechanics. **07 Hrs**

UNIT IV

Materials for MEMS and Microsystems: Substrates and Wafers, Active Substrate Materials, Silicon as a Substrate Material, Silicon Compounds, Silicon Piezoresistors, Galium Arsenide, Quartz, Piezoelectric Crystals, Polymers and Packaging Materials. The three levels of Microsystem Packaging, Die level packaging, Device level packaging, System level packaging. Interfaces in microsystem Packaging. Essential Packaging Technologies: Die preparation, Surface Bonding, Wire Bonding, Sealing. Three dimensional Packaging. **07 Hrs**

UNIT V

Microsystem Fabrication Processes: Introduction to Microsystem Fabrication Process, Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Diposition (CVD), Physical Vapor Deposition-Sputtering, Deposition by Epitaxy, Etching, The LIGA Process: General Description of LIGA Process, Materials for Substrates and Photoresists, Electroplating and SLIGA Process. **07Hrs**

Course Outcome:

After completion of the course student would be able to:

CO1: Understand the basic fundamentals of MEMs and Microsystems.
CO2: Apply the concepts to design the MEMs sensors and actuators.
CO3: Analysis and Evaluate the MEMs sensors and actuators
CO4: Design a system with MEMs sensors and actuators using Various fabrication techniques

Reference Books:

1. Tai-ran tsu "MEMS & Microsystems: Design and manufacture." John Wiley and sons Inc, 2nd edition. 2008,
2. P.Rai-Choudhury "MEMS and MOEMS Technology and Applications "PHI,1st Edition 2009,.
3. K.J.Vinoy, G.K.Ananthasuresh, S.Gopalakrishnan, K.N.Bhat, "Micro and Smart Systems",
4. Stevens S. Saliterman. Fundamentals of Bio MEMS and Medical and Micro devices. Wiley Interscience division. 1st edition, 2006, first edition.

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily

MECHATRONICS

(Offered by BoS: Mechanical Engg.)

Course Code	**:**	**12 GG 710**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objective(CLO):

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Understand the applications of microprocessors in various systems and to know the functions of each element.
4. Identify main parts, hardware forms and internal architecture of PLC.
5. Demonstrate the integration philosophy in view of Mechatronics technology.

UNIT I

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics. **06Hrs**

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall effect sensors

UNIT II

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers. **06Hrs**

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor**.**

UNIT III

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC. **06Hrs**

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot.

UNIT IV

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection. **06Hrs**

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors**.**

UNIT V

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators. **08Hrs**

DCV & FCV- Principle & construction details, types of sliding spool valve, solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications

Course Outcome:

After completion of the course student would be able to:

CO1: Define and illustrate various components of Mechatronics systems.

CO2: Identify, categorize and apply transducers & sensors used in automation, control systems, and instruments

CO3: Assess various control systems used in automation.

CO4: Develop mechanical, hydraulic, pneumatic and electrical control systems.

References Books:

1. Nitaigour Premchand Mahalik , Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill 1st Edition, 2003 ISBN.No. 0071239243, 9780071239240
2. Mechatronics by HMT Ltd. – Tata McGrawHill, 1st Edition, 2000. ISBN:9780074636435
3. W.Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering,1st Edition, 2005 ISBN No. 81-7758-284-4
4. Anthony Esposito, Fluid Power , Pearson Education, 6th Edition, 2011, ISBN No. 9789332518544

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

LINEAR ALGEBRA

(Offered by BoS; Basic Sciences)

Course Code	**:**	**12GG712**	**CIE Marks**	**:**	**100**
Hrs /Week	**:**	**L:T:P:S:3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**	**SEE Hrs**	**:**	**03**

Course Learning Objectives(CLO):

1. Use basic terminology of linear algebra in Euclidean spaces, including linear independence, spanning, basis, rank, nullity, subspaces, and linear transformations;
2. Apply the abstract notions of vector spaces in analyzing system of equations;
3. Find the eigen values and eigenvectors of a matrix of a linear transformation, and using them to diagonalize a matrix;
4. Solve an over-determined system of equations via projection concept, analyze and extend the structure of orthogonal vectors required in signal processing.
5. Combine different concepts of Linear Algebra in designing new methods for solving complex engineering problems.

UNIT I

Vector Spaces: Vector Spaces and Subspaces, Linear Independence, Basis, Dimension, The Four Fundamental Subspaces: Row space, Null space, Column Space and Left-Null space. Rank Nullity Theorem (without proof) **08Hrs**

UNIT II

Linear Transformations: Linear Transformations, Geometric Meaning, Matrix Representations, Rank of a Matrix, Change of Basis, Kernel and Image of a Linear Transformation, Rotation, Projection and Reflection Transformations in 2 dimensions. Geometrical interpretations. **07Hrs**

UNIT III

Eigen Values And Eigen Vectors : Eigen values, The Characteristic Equation, Eigenvectors, Algebraic and Geometric Multiplicity of Eigenvalues, Diagonalizabilitly of a Matrix, Geometric meaning of Eigenvalues and Eigenvectors. Applications of Eigenvalues in Stability analysis of differential equations. **07Hrs**

UNIT IV

Orthogonality: Orthogonal Vectors and Subspaces, Orthogonal Projections, Orthogonal Bases, Orthogonal/Orthonormal Matrices, Gram–Schmidt Orthogonalization, QR Factorizations, Least Squares Problems **07Hrs**

UNIT V

Positive Definite Matrices: Minima, Maxima and Saddle Points.. Definite versus Indefinite. Higher Dimensions. Positive Definiteness. Tests for Positive Definiteness. Positive definite matrices and Least-squares. Semi-definite Matrices. Singular Value Decomposition. **07Hrs**

Course Outcome:

After completion of the course student would be able to:

CO1: Relate and interpret the concepts of Linear Algebra as applied to various branches of engineering using an axiomatic approach

CO2: Apply linear transformations in image processing, CAD and other areas of engineering and extending to higher dimensions

CO3: Analyze and correlate the concepts of eigenvectors and eigenvalues required for image processing and many other fields of engineering

CO4: Assess and evaluate the basis vectors as required in signal processing and many other areas of engineering

CO5: Combine and construct the SVD applied in image processing and principal component analysis

Reference Books:

1. Gilbert Strang, "Lineat Algebra and its Application", Cengage Learning India Edition, 4th Edition, 2006, ISBN:- 978-0980232714.
2. David C Lay, "Linear Algebra and its Application", Pearson Education, 3rd Edition, ISBN: 978-0321780720.
3. Kenneth M Hoffman and Ray Kunze , Linear Algebra, Prentice Hall,2nd edition, 2006, ISBN: 978-0135367971.
4. Howard Anton & Chris Rorres" Elementary Linear Algebra Applications Version",Wiley , 9th edition, 2011, ISBN: 978-0470432051

Scheme of Continuous Internal Evaluation:

CIE will consist of Three Tests each for 45 marks (15marks for Quiz + 30marks for descriptive) out of which best of two will be considered. In addition there will be one seminar on new topics / model presentation etc. for 10 marks.

Scheme of Semester End Examination:

The question paper will consist of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and will be compulsory. Part B will be for 80 marks and shall consist of five questions carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.