M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION
B.TECH (Electronics & Communication Engineering)
SEMESTER 5th AND 6th
Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE301G	Electromagnetic Waves	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE303G	Computer Organization & Architecture	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ECE305G	Communication Engineering	3	1	0	4	4	25	75		100	3
4	Professional Core Course	PCC-ECE307G	Digital Signal Processing	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective –I	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure I	Open Elective-I	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE323G	Electromagnetic Waves Lab	0	0	3	3	1.5	25		25	50	3
8	Professional Core Course	LC-ECE325G	Digital Signal Processing Lab	0	0	3	3	1.5	25		25	50	3
9	Training	PT-ECE327G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
			TOTAL CREDIT					**25**				**700**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.
2. Choose any one from Elective-I
3. Choose any one from open Elective-I
   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Elective –I

PEC-ECE309G	Power Electronics
PEC-ECE311G	Nano electronics
PEC-ECE313G	Linear IC Applications
PEC-ECE315G	Scientific computing

Open Elective-I

OEC-ECE317G	Object Oriented Programming with C++
OEC-ECE319G	Additive Manufacturing
OEC-ECE321G	Measurements and Instrumentation

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE302G	Control Systems	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE304G	Computer Network	3	1	0	4	4	25	75		100	3
3	Humanities/ Basic Science	HUM-ECE-306G	Engineering Ethics	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-ECE308G	CMOS Design	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure II	Program Elective –II	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE322G	Computer Network Lab	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-ECE324G	Control System Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-ECE326G	Mini Project/Electronic Design workshop	0	0	4	4	2	25		25	50	3
		TOTAL CREDIT						27.5				750	

Note:

1. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.
2. Choose any one from Elective-II
3. Choose any one from Open Elective-II

Annexure II

Elective –II

PEC-ECE310G	Bio-Medical Electronics
PEC-ECE312G	VHDL and Digital Design
PEC-ECE314G	Introduction to MEMS
PEC-ECE316G	Speech and Audio Processing

Open Elective-II

OEC-ECE318G	Python Programming
OEC-ECE320G	Probability and Stochastic Processes

PCC-ECE301G **ELECTROMAGNETIC WAVES**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II

Maxwell's Equations - Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. Uniform plane wave, Propagation of plane wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection.

Unit III

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit IV

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

References:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, latest edition
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, latest edition, Prentice Hall, latest edition
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Characterize uniform plane wave
4. Calculate reflection and transmission of waves at media interface
5. Analyze wave propagation on metallic waveguides in modal form
6. Understand principle of radiation and radiation characteristics of an antenna

PCC-ECE303G   **COMPUTER ORGANIZATION & ARCHITECTURE**

L T P   Theory: 75 Marks
3 - -   Class work : 25 Marks
                                                                Total: 100 Marks
                                                          Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I
Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit II
Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit III
Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl's Law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.

Unit IV
Input-output Organization: I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

References:

1) "Computer System Architecture", latest edition by M.Morris Mano, Pearson.
2) "Computer Organization and Design: The Hardware/Software Interface", latest edition by David A. Patterson and John L. Hennessy, Elsevier.
3) "Computer Organization and Embedded Systems", latest edition by CarlHamacher, McGraw Hill Higher Education.

4) "Computer Architecture and Organization", latest edition by John P. Hayes, WCB/McGraw-Hill
5) "Computer Organization and Architecture: Designing for Performance", latest edition by William Stallings, Pearson Education
6) "Computer System Design and Architecture", latest edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1 Understand the basics structure of computers, operations and instruction
2 Design arithmetic and logic unit.
3 Understand pipelined execution and design control unit.
4 Understand parallel processing architectures.
5 Understand the various memory systems and I/O communication.

PCC-ECE305G   **COMMUNICATION ENGINEERING**

L T P   Theory : 75 Marks
3 1 -   Class work : 25 Marks
                                                                      Total : 100 Marks
                                                          Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I
Spectral Analysis:
Fourier series, Fourier transforms, Convolution Theorem, Correlation, Cross-Correlation and autocorrelation.

Unit -II
Information Theory:
Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundance coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit -III
Random Signal Theory:
Representation of random signals, concept of probability, probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function, joint probability density functions.

Unit -IV
Random Signal Theory:
Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes

References:

1. Principles of Communication Systems : Taub Schiling; TMH
2. Communication Systems : Singh and Sapre ; TMH
3. Communication Systems : A Bruce Carlson; TMH

Course Outcomes:
   At the end of this course students will demonstrate the ability to
     1. To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.

2. To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.

3 Design a digital communication system by selecting an appropriate error correcting codes for a particular application.

4 To learn about Probability of Random signal theory and process.

5 Formulate the basic equations of linear block codes and a cyclic code.

6 Compare the performance of digital communication system by evaluating the probability of error for different error correcting codes

PCC-ECE307G   **DIGITAL SIGNAL PROCESSING**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                              Total: 100 Marks
                                                 Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I
Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit II
Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

Unit III
Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit IV
Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

   1   John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles,

Algorithms And Applications, Prentice Hall, latest edition
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.

LC-ECE323G   **ELECTROMAGNETIC WAVES LAB**

L T P   Practical Exam: 25 Marks
- - 3   Lab work : 25 Marks
                                                 Total: 50 Marks
                                    Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE301G

LC-ECE325G   **DIGITAL SIGNAL PROCESSING LAB**

L T P   Practical Exam: 25 Marks
- - 3   Lab work : 25 Marks
                                                 Total: 50 Marks
                                    Duration of Exam: 3 Hour

List of Experiments

Experiments to be performed:

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals

PCC-ECE302G   **CONTROL SYSTEMS**

L T P

3 1 -

Theory : 75 Marks

Class work : 25 Marks

Total : 100 Marks

Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Systems Components and Their Representation

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II

Time Response Analysis And Stability Concept

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit III

Frequency Domain Analysis

Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV

Control System Analysis Using State Variable Methods

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

1. Gopal. M., " Control Systems: Principles and Design" , Tata McGraw-Hill, latest edition
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, latest edition
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, latest edition
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Characterize a system and find its steady state behaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigate stability of a system using different tests
4. Illustrate the state space model of a physical system.

PCC-ECE304G   **COMPUTER NETWORK**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                                     Total: 100 Marks
                                                       Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I
Introduction and Physical Layer
Networks – Network Types LAN –MAN – WAN – Protocol Layering – OSI Model - TCP/IP Protocol suite – Network Hardware, Internetworks – Network Software – Protocol hierarchies — Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II
Data-Link Layer & Media Access
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – ALOHA protocols - Overview of IEEE standards – Media Access Control – Sliding Window protocols, Error Handling - Bridges - Switches – High Speed LANs - Gigabit Ethernet - Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices - Multiplexing.

UNIT III
Network Layer
Network Layer Services –Performance – IPV4 Addresses –Network Layer Protocols: IP, Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP-ICMP v4 – IP Addressing – Classless and Classfull Addressing - Sub-netting - Congestion control– QoS.- Overview of IPv6

UNIT IV
Transport Layer and Application Layer
Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol –Connectionless   vs Connection-oriented transport - Remote Procedure Call.
WWW and HTTP – FTP –Telnet –SSH – DNS –Electronic mail, MIME, SNMP.

References:

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, latest edition
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, latest edition
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, latest edition
5. Andrew Tanenbaum, "Computer networks", Prentice Hall
6. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall

7. William Stallings, "Data and computer communications", Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:
1. Visualise the different aspects of networks, protocols and network design models.
2. Examine various Data Link layer design issues and Data Link protocols.
3. Analyse and compare different LAN protocols.
4. Compare and select appropriate routing algorithms for a network.
5. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

HUM-ECE306G   **ENGINEERING ETHICS**

L T P   Theory: 75 Marks
3 - -   Class work : 25 Marks
                                                                   Total: 100 Marks
                                                         Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I
Ethics and Professionalism: Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes of Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

UNIT II
Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.

UNIT III
Truth and Truthfulness: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.
Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy,Additional Issues.

UNIT IV
Environmental Ethics: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.
Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, "When in Rome", International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

References:

1. Mike W. Martin and Roland Schinzinger, "Introduction to Engineering Ethics", Second Edition, McGraw Hill, New Delhi, latest edition

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, latest edition
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, latest edition
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, latest edition
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, latest edition
6. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, latest edition
7. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi latest edition
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition
9 Web sources:
   i. www.onlineethics.org
   ii. www.nspe.org
   iii. www.globalethics.org
   iv. www.ethics.org

Outcomes:
Upon completion of the course, the student should be able to
1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development

PCC-ECE308G **CMOS DESIGN**

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I
Introduction of MOS Transistor
MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II
Combinational Circuit Design
Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.
Interconnect: Interconnect Modelling and Impact

UNIT III
Sequential Circuit Design
Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification of Digital System, Synchronous Design

UNIT IV
Design of Arithmetic Building Blocks and Subsystem
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

References:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, latest edition
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, latest edition
3. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, latest edition
4. P. Douglas, VHDL: programming by example, McGraw Hill, latest edition
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Examine the CMOS circuit's behaviour and its characteristics.
2. Design and realization of combinational & sequential digital circuits.
3. Interpret different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
4. Design the Arithmetic blocks and Memory structures

LC-ECE322G **COMPUTER NETWORK LAB**

L T P   Practical Exam: 25 Marks

- - 4   Lab work : 25 Marks

                                               Total: 50 Marks

                                               Duration of Exam: 3 Hours

List of Experiments

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messaged over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of "Connection Establishment" in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.

LC-ECE324G   **CONTROL SYSTEM LAB**

L T P   Practical Exam: 25 Marks
- - 3   Lab work : 25 Marks
                                                                      Total: 50 Marks
                                                         Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE307G

LC-ECE326G   **MINI PROJECT/ELECTRONIC DESIGN WORKSHOP**

L T P   Practical Exam: 25 Marks
- - 4   Lab work : 25 Marks
                                                                  Total: 50 Marks
                                                     Duration of Exam: 3 Hours

Guidelines:

1. The mini- project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within two week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used   for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3 . Write comprehensive report on mini project work.

PROGRAM ELECTIVE COURSES

PEC-ECE309G   **POWER ELECTRONICS**

L T P   Theory: 75 Marks

3 1 -   Class work : 25 Marks

                                      Total: 100 Marks

                             Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Role of Power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction & working principle of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT and their V-I characteristics. Basic idea about the selection of Heat sink for thyristors.

Unit -II

Controlled Rectifiers: Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier (Half Bridge and Full Bridge with R, R-L Load), Single phase full wave centre tapped rectifier, Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)

Inverters: Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications.

Unit -III

Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step-down choppers.

Cyclo-converters: Dual Converters and cyclo- converters: Introduction, types & basic working principle of dual converters and cyclo- converters & their applications.

Unit -IV

Thyristorised Control of Electric drives

DC drive control: Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers)

AC drive control: Phase control, Constant V/F operation, Cyclo-converter /Inverter drives, Slip control AC drives

Applications of power devices:

light intensity control, speed control of universal motors, fan regulator, battery charger. Uninterrupted power supplies (UPS online, off line), SMPS Application of Power Electronics in Electrical vehicles controls. UJT as relaxation oscillator.

References:

1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.

3. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
4. V.R.Moorthi, "Power Electronics", Oxford University Press.
5. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

PEC-ECE311G   **NANO ELECTRONICS**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                         Total: 100 Marks
                                                   Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I
Introduction to nanotechnology, applications of nano electronics. Basics of Quantum Mechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations, Density of States, Band Theory of Solids, Particle in a box Concepts

Unit -II
Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III
Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -IV
Nano electronis devices : Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

References:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, latest edition
3. K.E. Drexler, Nanosystems, Wiley, latest edition
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, latest edition
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

PEC-ECE313G   **LINEAR IC APPLICATIONS**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                                              Total: 100 Marks
                                                                    Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Differential and cascade amplifiers: Balanced, unbalanced output differential amplifiers, FET differential amplifier, current mirrors, level Translators, cascade configuration of amplifiers, operational amplifiers, Introduction to ideal OP-AMP, characteristic parameters, Practical OP-AMP, its equivalent circuit and op-amp circuit configurations.

Unit-II
Op-amp with negative feedback and frequency response: Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback differential amplifiers, frequency response compensating network, frequency response of internally compensative op-amp and non compensating op-amp. High frequency op- amp equivalent circuit, open loop gain V/s frequency, closed loop frequency response, circuit stability, slew rate.

Unit-III
Op-amp application: DC, AC amplifiers, peaking amplifier, summing, scaling, averaging and instrumentation amplifier, differential input output amplifier, voltage to current converter, current to voltage converter, very high input impedance circuit, integration and differential circuit, wave shaping circuit, active filters, oscillators.

Unit-IV
Specialized liner IC applications: 555 timer IC (monostable & astable operation) & its applications, Universal active filter, PLL, power amplifier, 8038 IC.

References:
   1. R.A. Gayakwaed , OP-amps and Linear Integrated circuits .
   2. K.R.Botkar , Integrated circuit

Course Outcomes:

   At the end of this course students will demonstrate the ability to
        1.   Design linear and non-linear applications of op-amps.
        2.   Design the applications using Timer and PLL.
        3.   Design the applications using Voltage regulator and Function generator ICs
   .

PEC-ECE315G   **SCIENTIFIC COMPUTING**

L T P   Theory: 75 Marks

3 1 -   Class work : 25 Marks

                                                                       Total: 100 Marks

                                                              Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-II

System of liner equations: Linear   Systems,   Solving   Linear   Systems,   Gaussian elimination,Pivoting,   Gauss-Jordan,   Norms   and   Condition   Numbers,   Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization   Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method

Optimization: One-Dimensional   Optimization,   Multidimensional   Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function,   Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation

Unit-1V

Initial Value Problems for ODES,   Euler's   Method,   Taylor   Series   Method,   Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES,   Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

References:

1.   Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, latest edition

2.Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, latest edition

3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., latest edition

4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, latest edition

5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyse the various system using Linear and Non Linear methods.
4. Understand application of these methods in various areas.

BIO-MEDICAL ELECTRONICS

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                               Total: 100 Marks
                                                               Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Physiology and Transducers

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

UNIT II

Electro – Physiological Measurements

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

UNIT III

Non-Electrical Parameter Measurements

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

UNIT IV

Medical Imaging

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

UNIT V

Assisting And Therapeutic Equipments

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

References:
1. W.F. Ganong, Review of Medical Physiology, latest edition, Medical Publishers
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, latest edition
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, latest edition
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, latest edition
5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:
1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handling bio- substances.
3 Evaluate and analyze the biological processes like other electronic processes.
4 Familiar the various Bio Medical Measuring Instruments and therapeutic equipments.
5 Aware of electrical safety of medical equipments

PEC-ECE312G   **VHDL AND DIGITAL DESIGN**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                                  Total: 100 Marks
                                                        Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

Unit-II
VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

Unit-III
Combinational & Sequential   Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Unit-IV
Design of Microcomputer & Programmable Device: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

References:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual latest edition
3. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society   Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall latest edition
5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS latest edition
6. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH latest edition
8. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley latest edition
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH latest edition
10. Modern Digital Electronics- III Edition: R.P Jain; TMH latest edition
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome

At the end of the course, students will demonstrate the ability to:
1. Understand the need & application of hardware description language.
2. Modelling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

PEC-ECE314G   **INTRODUCTION TO MEMS**

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                                                    Total: 100 Marks
                                                                          Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws in miniaturization: Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer, Overview of Micro/Nano Sensors, Actuators and Systems.

Unit -II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -III

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods

Unit -IV

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: electrostatics, coupled electro mechanics.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, latest edition
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano- and Microengineering (Vol. 8). CRC press, latest edition
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, latest edition
4. M. Madou, Fundamentals of Microfabrication, CRC Press, latest edition
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, latest edition
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems

PEC-ECE316G　　　　　**SPEECH AND AUDIO PROCESSING**

L T P　　　　　　　　　　　　　　　　　　　　　Theory: 75 Marks

3 1 -　　　　　　　　　　　　　　　　　　　Class work : 25 Marks

　　　　　　　　　　　　　　　　　　　　　　　　Total: 100 Marks

　　　　　　　　　　　　　　　　　　　Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Unit-II

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

References:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students　*Edition)* latest edition
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C.Chu, WileyInter science, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

OPEN ELECTIVE COURSE

OEC-ECE317G   **OBJECT ORIENTED PROGRAMMING WITH C++**

L T P   Theory: 75 Marks
3 - -   Class work : 25 Marks
                                                                  Total: 100 Marks
                                                        Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I
Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, data abstraction, encapsulation, inheritance, polymorphism.
Basic Concepts of C++: Structure of C++ Program, Basic Data Types, Expressions and Control Structures, Functions in C++: Call by Value, Call by Reference, Recursion, Function Overloading.

Unit - II
Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static data members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes.
Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, destructors.

Unit - III
Inheritance: Introduction, defining derived classes, forms of inheritance, virtual base classes.
Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Unit - IV
Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

References:

1. E. Balagurusamy,"Object Oriented Programming with C++", 7th edition, Mc Graw Hill Education(2018)
2. Bjrane Stroustrup, "C++ Programming language",3rd edition, Pearson education Asia(1997)
3. Lafore R."Object oriented Programming in C++",4th Ed. Techmedia,New Delhi(2002).
4. Yashwant Kenetkar,"Let us C++",1stEd.,Oxford University Press(2006)
5. B.A. Forouzan and R.F. Gilberg,CompilerScience,"A structured approach using C++" Cengage Learning, New Delhi.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Students will able to understand and implement real-world entities like inheritance, data hiding, polymorphism, etc in programming.
2. Students will aware about C++ Programming concepts.
3. Students will implement the function overloading and operator overloading concepts.
4. Students will understand the concept of Exception handling.

OEC-ECE319G **ADDITIVE MANUFACTURING**

L T P   Theory: 75 Marks
3 - -   Class work : 25 Marks
                                                                        Total: 100 Marks
                                                              Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Introduction and basic principles: Definition , Generic Additive Manufacturing (AM) Process, Terms related to AM, Benefits of AM, Distinction between AM and CNC machining, Additive manufacturing process chain: Variation between different AM machines, Metal systems, Maintenance of Equipment, Material Handling Issues.

Unit-II
Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Unit-III
Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Unit-IV
Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2- D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Unit-V
Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE– scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

References:

1. Ian Gibson, David W. Rosen, Brent Stucker , "Additive Manufacturing Technologies" ,Springer, latest edition

2. Chua C. K., Leong K. F., and Lim C. S., "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific Publishers latest edition

3. Patri K. Venuvinod, Weiyin Ma "Rapid Prototyping: Laser-Based and Other Technologies" Springer , latest edition

4. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", CRC Press, latest edition

5. Burns. M, "Automated fabrication", Prentice-Hall, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Apply the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
2. Understand the applications in various fields, reverse engineering techniques.
3. Understand about mechanical properties and geometric issues relating to specific rapid prototyping applications.

OEC-ECE321G   MEASUREMENTS AND INSTRUMENTATION

L T P   Theory: 75 Marks
3 1 -   Class work : 25 Marks
                                                                                            Total: 100 Marks
                                                                                            Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Science of Measurement
Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards
Transducers
Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors.

Unit-II
Signal Conditioning and Signal Analyzers
DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III
Digital Instruments
Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

Unit-IV
Data Display Recording and Systems
Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

References:

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition
2. Ernest o Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, latest edition
3. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai & Sons.
4 Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Discuss about the principles of various measurement techniques.
2. Analyze the transducers and its impact.
3. Explain about the signal conditioning system and signal analyzers.
4. Illustrate the digital measurement equipments.
5. Emphasize the need for data acquisition, recording and display systems.

OEC-ECE318G **PYTHON PROGRAMMING**

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

UNIT II

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

UNIT III

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

UNIT IV

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

References:

1. "Fundamentals of Python: First Programs" Kenneth Lambert, Course Technology, Cengage Learning, latest edition

2. "Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", By Charles Dierbach, John Wiley & Sons, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.

2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language

OEC-ECE320G   PROBABILITY AND STOCHASTIC PROCESSES

L T P   Theory: 75 Marks
3 - -   Class work : 25 Marks
                                                            Total: 100 Marks
                                                     Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;

UNIT II

Joint distributions, functions of one and two random variables, moments of randomvariables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

UNIT III

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT IV

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

References:

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

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Understand representation of random signals
2. Investigate characteristics of random processes

3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.