B.Tech (Electronics and Communication Engineering)

Programme Syllabus

Effective from the Academic Year 2018-19

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

FIRST SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
MABST 101	**Mathematics–I**	3	1	0	4	4	40	60	100
PYBST 102	**Modern Physics**	3	1	0	4	4	40	60	100
CSEST 103	**Programming for Problem Solving**	2	1	0	3	3	40	60	100
ECEST 104	**Electronic Devices**	3	1	0	4	4	40	60	100
MEESP 105	**Workshop / Manufacturing Practices**	0	0	3	3	1.5	40	60	100
CSESP 106	**Programming for Problem Solving Lab**	0	0	3	3	1.5	40	60	100
CEMCT 107	**Environmental Science**	4	-	-	4	-	100	-	100
	TOTAL	**15**	**04**	**06**	**25**	**18**	**340**	**360**	**700**

L – Lecturer hours; Tut. – Tutorials; P/D – Practical or Drawing; T - Total

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
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SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

SECOND SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
MABST 201	**Mathematics–II**	3	1	0	4	4	40	60	100
CYBST 202	**Engineering Chemistry**	3	1	0	4	4	40	60	100
ENHST 203	**English**	2	0	0	2	2	40	60	100
EEEST 204	**Basic Electrical Engineering**	3	1	0	4	4	40	60	100
MEEST 205	**Engineering Graphics & Design**	2	0	3	5	3.5	40	60	100
ENHSP 206	**English Communications Lab**	0	0	3	3	1.5	40	60	100
	Total	**13**	**03**	**06**	**22**	**19**	**240**	**360**	**600**

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B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

THIRD SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
MABST 301	**Mathematics-III**	3	1	0	4	**4**	40	60	100
EEPCT 302	**Network Theory**	3	0	0	3	**3**	40	60	100
ECPCT 303	**Electromagnetic Waves**	3	0	0	3	**3**	40	60	100
ECPCT 304	**Digital System Design**	3	0	0	3	**3**	40	60	100
EOHST 305	**Economics**	2	0	0	2	**2**	40	60	100
EOHST 306	**Accountancy**	2	0	0	2	2	40	60	100
ECPCP 307	**Electronic Devices Lab**	0	0	2	2	**1**	40	60	100
ECPCP 308	**Digital System Design Lab**	0	0	2	2	**1**	40	60	100
EEESP 309	**Basic Electrical Engineering Lab**	0	0	2	2	**1**	40	60	100
PAMCT 310	**Constitution of India**	2	0	0	2	**0**	100	-	100
	TOTAL	**18**	**01**	**06**	**25**	**20**	**460**	**540**	**1000**

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B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

FOURTH SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
ECPCT 401	**Analog Circuits**	3	1	0	4	4	40	60	100
ECPCT 402	**Signals and Systems**	3	0	0	3	3	40	60	100
ECPCT 403	**Probability Theory and Stochastic Processes**	3	0	0	3	3	40	60	100
ECPCT 404	**Analog and Digital Communication**	3	1	0	4	4	40	60	100
CSPCT 405	**Computer Organization and Architecture**	3	0	0	3	3	40	60	100
MGHST 406	**Management Science**	3	0	0	3	3	40	60	100
ECPCP 407	**Analog Circuits Lab**	0	0	2	2	1	40	60	100
ECPCP 408	**Analog and Digital Communication Lab**	0	0	2	2	1	40	60	100
	TOTAL	**18**	**2**	**4**	**24**	**22**	**320**	**480**	**800**

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Note: Industrial Internship for not less than 4 weeks, after 4th or 6th semester during summer

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B.Tech Electronics and Communication Engineering
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FIFTH SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
EEPCT 501	**Linear Control Systems**	3	0	0	3	3	40	60	100
ECPCT 502	**IC Applications**	3	0	0	3	3	40	60	100
ECPCT 503	**Microcontrollers**	3	0	0	3	3	40	60	100
ECPCT 504	**Digital Signal Processing**	3	0	0	3	3	40	60	100
ECPET 505	**Electronic Measurements**	3	0	0	3	3	40	60	100
ECPCP 506	**IC Applications Lab**	0	0	2	2	1	40	60	100
ECPCP 507	**Microcontrollers Lab**	0	0	2	2	1	40	60	100
ECPCP 508	**Digital Signal Processing Lab**	0	0	2	2	1	40	60	100
	TOTAL	**15**	**0**	**6**	**21**	**18**	**320**	**480**	**800**

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SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
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SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

SIXTH SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
		L	Tut	P/D	T		Sessional Marks	Sem End Exam Marks	
ECPCT 601	**Computer Networks**	3	0	0	3	3	40	60	100
ECPET 602	**Program Elective - I**	3	0	0	3	3	40	60	100
ECPET 603	**Program Elective - II (MOOCs / e_Learning)**	3	0	0	3	3	40	60	100
ECPCP 604	**Computer Networks Lab**	0	0	4	4	2	40	60	100
ECPCP 605	**Electromagnetic Waves and Microwaves Lab**	0	0	2	2	1	40	60	100
ECPCP 606	**Electronic Measurements Lab**	0	0	2	2	1	40	60	100
ECPCP 607	**Electronic Design Workshop**	0	0	4	4	2	40	60	100
ECOET 608	**Open Elective – I (online)**					3			100
ECOET 609	**Open Elective – II (online)**					3			100
-	**Open Elective –I & II MOOCs(online)**	Period of study during 3rd/4th/5th/6th/ Sem. Performance will be reflected in Sixth Sem.							
	TOTAL	**15**	**0**	**12**	**27**	**21**	**280**	**420**	**900**

L – Lecturer hours; Tut. – Tutorials; P/D – Practical or Drawing; T - Total

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
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SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

SEVENTH SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
							Internal	Sem End External	
		L	Tut	P/D	T		Marks	Marks	
ECPET 701	**Program Elective-III**	3	0	0	3	3	40	60	100
ECPET 702	**Program Elective -IV**	3	0	0	3	3	40	60	100
ECPET 703	**Program Elective - V**	3	0	0	3	3	40	60	100
MGHST 704	**Total Quality Management**	4	0	0	4	4	40	60	100
ECPCI 705	**Industry Internship**	Not less than 4 weeks				3	100		100
ECPCX 706	**Project Work Phase - I**	0	0	6	6	3	100		100
	TOTAL	**13**	**0**	**6**	**19**	**19**	**360**	**240**	**600**

L – Lecturer hours; Tut. – Tutorials; P/D – Practical or Drawing; T - Total

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SCHEME OF INSTRUCTION – CHOICE BASED CREDIT SYSTEM
B.Tech Electronics and Communication Engineering
Effective from 2018-19, Modified in 2020-21

EIGHTH SEMESTER

Course Code	Course Title	Scheme of Instruction hr / week				Credits	Scheme of Evaluation		Total
							Internal	Sem End External	
		L	Tut	P/D	T		Marks	Marks	
ECPET 801	**Program Elective - VI**	3	0	0	3	3	40	60	100
ECPET 802	**Program Elective - VII**	3	0	0	3	3	40	60	100
ECPCX 803	**Project Work Phase – II**	0	0	18	18	9	40	60	100
ECOET 804	**Open Elective – III(online)**					3			100
ECOET 805	**Open Elective – IV(online)**					3			100
-	**Open Elective – III & IV MOOCs(online)**	Period of study during $3^{rd}/4^{th}/5^{th}/6^{th}/7^{th}$/ Sem. Performance will be reflected in Eighth Sem.							
	TOTAL	**06**	**0**	**18**	**24**	**21**	**120**	**180**	**500**

L – Lecturer hours; Tut. – Tutorials; P/D – Practical or Drawing; T - Total

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B.Tech Electronics and Communication Engineering, Effective from 2018-19

PROGRAM ELECTIVE COURSES (ECPET - - -)

Sl.No.	**Program Elective Courses**	Sl.No.	**Program Elective Courses**
1.	Pulse and Digital Circuits	2.	Antennas and Propagation
3.	Microwave Theory and Techniques	4.	CMOS Design
5.	Information Theory and Coding	6.	Embedded Systems
7.	Satellite Communication	8.	Wireless Sensor Networks
9.	Neural Networks and Fuzzy Logic	10.	Introduction to MEMS
11.	Fiber Optic Communication	12.	Digital Design through HDLs
13.	Error Correcting Codes	14.	Mobile Communication and Networks
15.	Nano Electronics	16.	Scientific Computing
17.	Digital Image & Video Processing	18.	Bio-Medical Electronics
19.	Adaptive Signal Processing	20.	Speech and Audio Processing
21.	Wavelet Theory and Applications	22.	Machine Learning
23.	Power Electronics	24.	Mixed Signal Design
25.	High Speed Electronics	26.	Internet of Things and Applications

MABST 101 MATHEMATICS -I

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I
Differential Equations: Linear differential equations of second and higher order with constant coefficients-particular integrals-homogeneous differential equations with variable coefficients-method of parameters-simulation equations.

UNIT II
Laplace Transforms I: Laplace transforms of standard functions-inverse transforms-transforms of derivatives and integrals-derivatives of transforms-integrals of transforms.

UNIT III
Laplace Transforms II: Transforms of periodic functions-convolution theorem-applications to solution of ordinary differential equations.

UNIT IV
Calculus: Roll's and Mean value theorems - Taylor's and Maclaurins's series-maxima and minima for functions of two variables - Infinite series - Convergence Tests series of positive terms - comparison, Ratio tests - Alternating series - Leibnitz's rule - Absolute and conditional convergence.

UNIT V
Multiple Integrals: Curve tracing (both Cartesian and polar coordinate) - Evaluations of double and Triple integrals-change of order of integrations-change of variables of integrations-simple applications to areas and volumes.

Text/Reference Books

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
4. Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

Course Outcomes:

At the end of the course, students will be able to

1. analyze differential equations and solve them
2. apply differential equations to engineering problems.
3. use transformation to convert one type into another type presumably easier to solve.
4. use shift theorems to compute the Laplace transform, inverse Laplace transform and the solutions of second order, linear equations with constant coefficients.
5. solve an initial value problem for an n^{th} order ordinary differential equation using the Laplace transform.
6. expand functions as power series using Maclaurin's and Talor's series
7. optimize the problems related to OR, Computer science, Probability and Statistics

8. draw an approximate shape by the study of some of its important characteristics such as symmetry, tangents, regions etc using curve tracing method to find length, area, volume.
9. use multiple integral in evaluating area and volume of any region bounded by the given curves.

PYBST 102 MODERN PHYSICS

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I

Quantum Mechanics : Wave – Particle duality – de Broglie Concept of Matter Waves – Properties of Matter Waves – Davison and Germer Experiment – G.P. Thomson Experiment – Heisenberg's Uncertainty Principle – Schrödinger's Time Independent and Time Dependent Wave equation – Significance of Wave Function – Electron in an Infinite Square Potential Well – Probability Densities and Energy Levels.

UNIT II

Band Theory of Solids : Classical Free Electron Theory of Metals – Success and Failures – Quantum Free Electron Theory – Fermi Factor – Electron in Periodic Potential – Bloch Theorem – Kronig – Penney Model – Distinction between Metals , Insulators and semiconductors- Energy Band Structures.

UNIT III

Semiconductors – Introduction- Intrinsic and Extrinsic Semiconductors – Density of states – Carrier Concentrations at Equilibrium - Hall Effect. PN Junction Diode – Energy Band Diagram - Forward and Reverse Bias- Current – Voltage characteristics – Applications : Zener Diode - Light Emitting Diode- Photo diode -Solar Cell – Semiconductor Laser.

UNIT IV

Electromagnetism and magnetic properties of Materials:

Laws of Electrostatistics- Electric Current- Laws of Magnetism- Ampere`s, Faraday`s laws-Maxwells Equations – Polarization - Permeability and dielectric constant- Polar and non-polar Dielectrics, Clausius-Mossotti equation, Applications of Dielectrics.

Magnetization - Permeability and Susceptibility- Classification of Magnetic Materials, Ferromagnetism- Magnetic Domains and Hesteresis, Applications of ferromagnetic materials.

UNIT V

NanoPhysics and Nanotechnology : Introduction to Nanomaterials –Properties: Optical Properties – Quantum Confinement – Electrical properties. Synthesis of Nanomaterials: Ball milling, Arc deposition method – Chemical Vapour Deposition-Pulsed laser deposition. Characteristics of C^{60} (Zero dimensional), Carbon Nanotubes (One Dimensional) and Graphene(Two Dimensional). Applications of Nanomaterials. 10 hrs.

Text Books / Reference Books:

1. R. K. Gaur and S. L. Gupta "Engineering Physics" Sultan and Chand Pub., New Delhi
2. S. P. Basava Raju " A Detailed Text Book of Engineering Physics" Sole Distributors, Subhash Stores Book Corner, Bangalore
3. Hitendra K. Malik and A. K. Singh "Engineering Physics" Tata MC Graw Hill Education PVt. Ltd., New Delhi
4. M. N. Avadhanulu and P. G. Kshirsagar "A Text Book of Engineering Physics" S. Chand and Company Pvt. Ltd., New Delhi
5. John Allison, "Electronic Engineering Materials and Devices" Tata McGraw Hill Publications.
6. B.L Theraja, "Modern physics", S. Chand & Company.

7. V. Raghavan “Material Science”, Tata McGraw Hill Publications.
8. M. S. Ramachandra Rao and Shubra Singh, "Nanoscience and Nanotechnology" Wiley India Pvt. Ltd, New Delhi

Course Outcomes:

At the end of the course, students will be able to

1. develop appropriate competence and working knowledge of laws of modern Physics in understanding advanced technical engineering courses
2. understand the quantum mechanics and ultimately the quantum behavior of charged particles when they are in motion.
3. identify and apply appropriate analytical and mathematical tools of Physics in solving Engineering problems
4. apply knowledge of band theory in the area of electronics and understanding the basic electron transportation phenomenon in micro devices.
5. understand the principles in electrostatics and electromagnetics and magnetic properties of materials.
6. understand size depended properties of nanodimensional materials and their effective utilization in making nano- and micro-devices for further microminiaturization of electronic devices.
7. think and participate deeply, creatively, and analytically in emerging areas of engineering technology.
8. learn the basics of instrumentation, design of laboratory techniques, measurement, data acquisition, interpretation, and analysis.
9. provide multidisciplinary experiences throughout the curriculum.

CSEST 103 PROGRAMMING FOR PROBLEM SOLVING

Instruction : Hours/Week : **2L:1T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-I

Introduction to Programming -Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudocode with examples -From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code -Arithmetic expressions and precedence**.**

UNIT-II

Conditional Branching and Loops - Writing and evaluation of conditionals and consequent branching - Iteration and loops -Arrays (1-D, 2-D), Character arrays and Strings.

UNIT-III

Basic Algorithms -Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection) -Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT-IV

Functions -Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference - Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc - Quick sort or Merge sort.

UNIT-V

Structure -Structures, Defining structures and Array of Structures- Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
File handling.

Text Books / Reference Books :

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

ECEST 104 ELECTRONIC DEVICES

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I

Semiconductor Materials: Atomic structure, Electrons in periodic Lattices, Classifying Materials: Semiconductors, conductors and insulators, Semiconductor material groups, Covalent bonding, Energy Bandgaps, Energy bands in intrinsic and extrinsic silicon /Germanium, Density of Impurity States, Electrical Conductivity and Mobility, , Electronic Properties of N-type and P-type semiconductors, Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors. Generation and recombination of carriers; Poisson and continuity equation, P-N junction characteristics, I-V Characteristics, and small signal switching models, Diode resistances and diode capacitances.

UNIT II

Diode models, Avalanche breakdown, Zener diode, Schottky diode, Tunnel diode, Varactor diode and their applications, Testing a diode.

Rectifiers: Diode equivalent circuits, Analysis of diode circuits, Characteristics and comparison of Half-wave, Full-wave and Bridge rectifiers, Analysis of filters (C, L, LC, and CLC) used with Full-wave rectifiers, line regulation and load regulation.

UNIT III

Bipolar Junction Transistors: Bipolar Junction Transistor action, PNP and NPN transistors, CB, CE, and CC configurations and their I-V characteristics, Analytical expressions for transistor characteristics, Typical junction voltages and maximum ratings. Determination of h-parameters from BJT characteristics, Ebers-Moll Model, Multi Emitter transistor.

UNIT IV

Bipolar Junction Transistor Biasing: Operating point, stabilization, thermal runaway.

Field Effect Transistors: Characteristics and parameters of JFET, Pinch off and saturation regions, MOS capacitor, Depletion and Enhancement type of MOSFET, I-V characteristics, and small signal models of MOS transistor, UJT and its I-V characteristics, Metal Semiconductor FET, FET biasing schemes.

UNIT V

Optoelectronic Devices: Principle of operation and characteristics of LED. LCD, LDR, Photoconductor, Photodiode, Phototransistor, Solar cell, PIN photodiode, Charge-Coupled Devices, APD (avalanche photodiode) and their applications.

Power Semiconductor Devices: Device structure, equivalent circuit and characteristics of PNPN Diode, SCR, DIAC and TRIAC.

Text /Reference Books:

1. Ben G. Steetman and Sanjay Kumar Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson Publishers, 2015.
2. Jacob Millman, Christos Halkias, Chetan D Parikh, “**Integrated Electronics**: Analog and Digital Circuits and Systems”, 2nd Edition, Tata Mcgraw Hill Ed. Private Limited, 2011.
3. **Allen Mottershead, “Electronic Devices and Circuits:** An Introduction”, PHILearning , 2011.
4. D. Neamen , D. Biswas "Semiconductor Physics and Devices", McGraw-Hill Education.
5. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
6. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.
7. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford University Press, 2011.

Course outcomes:

At the end of this course, students will be able to

1. understand the principles of semiconductor physics of the intrinsic, *p* and *n* type materials.
2. understand the characteristics of the diode and some special function diodes and their application in electronic circuits.
3. use mathematics to analyze electronic devices typical of those in switching and rectifier circuits.
4. understand and utilize the mathematical models of semiconductor junctions and transistors for circuits and systems.
5. understand the characteristics of the Transistors and opto-electronic devices and their application in electronic circuits.
6. apply thyristors in power switching and control circuits.

MEESP 105 WORKSHOP/MANUFACTURING PRACTICE

Instruction : Hours/Week : **0L:0T:3P** **Credits: 1.5**

Sessional Marks : **40** End Semester Examination Marks: **60**

Workshop Practice:

1.Machineshop
2.Fittingshop
3.Carpentry
4.Electrical wiring
5.Weldingshop
6.Casting
7.Smithy
8.Plasticmoulding&GlassCutting

choose any of the above Five for practice

Examinations could involve the actual fabrication of simple components, utilizing one or More of the techniques covered above.

Detailed contents:

1.Manufacturing Methods-casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding(arc welding & gas welding), brazing

The above course content is learnt by online videos/ ppt presentations.

Text/Reference Books:

1. HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"Elementsof Workshop Technology", Vol. I 2008and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S.Schmid,"Manufacturing Engineering andTechnology", 4th edition, Pearson Education India Edition,2002.
3. Gowri P. Hariharanand A. Suresh Babu, "Manufacturing Technology–I" Pearson Education,2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture",4th edition, Prentice Hall India,1998.
5. Rao P. N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017

Laboratory Outcomes

Uponcompletion of this laboratory course, students will be able to fabricate components with their own hands.

Theywill also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

Byassembling different components, they will be able to produce small devices of their interest.

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

CSESP 106 PROGRAMMING FOR PROBLEM SOLVING LAB

Instruction : Hours/Week : **0L:0T:3P** **Credits: 1.5**

Sessional Marks : **40** End Semester Examination Marks: **60**

Assignments in C

Variable types and type conversions:
Simple computational problems using arithmetic expressions
Branching and logical expressions:
Problems involving if-then-else structures
Loops, while and for loops:
Iterative problems e.g., sum of series
1D Arrays: searching, sorting:
1D Array manipulation
2D arrays and Strings
Matrix problems, String operations
Functions, call by value
Simple functions
Numerical methods (Root finding, numerical differentiation, numerical integration):
Programming for solving Numerical methods problems
Recursion, structure of recursive calls
Recursive functions
Pointers, structures and dynamic memory allocation
Pointers and structures

Assignments in C and JAVA

File handling
File operations

Course Outcomes:

At the end of the course, students will be able to develop Programming concepts to

1. formulate simple algorithms for arithmetic and logical problems.
2. translate the algorithms to programs (in C language).
3. test and execute the programs and correct syntax and logical errors.
4. implement conditional branching, iteration and recursion.
5. decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. use arrays, pointers and structures to formulate algorithms and programs.
7. apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

and

to apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

CEMCT 107 ENVIRONMENTAL SCIENCE

Instruction : Hours/Week : 4**L:0T:0P** **Credits: 0**
Sessional Marks : **100**

UNIT I

Environmental Studies and Natural Resources

Definition, Scope and importance of Environment, Environmental studies, Need for public awareness

Components of Environment- Atmosphere, Hydrosphere, Lithosphere.

Renewable and **Non Renewable Resources and associated problems**

Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Land resources: Land as a resource, land degradation, Man induced landslides, soil erosion and desertification.

Mineral resources: Use and overexploitation, Environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity, Case studies.

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

Role of an individual in conservation of natural resources.

UNIT II

Ecosystem and Biodiversity

Ecosystem - Concept of an ecosystem. Structure and functions of an ecosystem.

Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession.

Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem.

(a) Forest ecosystem. (b) Grassland ecosystem

(c)Desert ecosystem. (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation:

Definition, genetic species and ecosystem diversity.

Biogeographically classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

Biodiversity at global, National and local levels.

India as a mega-diversity nation.

Hot-spots of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts.

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT – III

Environmental pollution and Global Effects

Definition, Causes, Effects, and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution. Pollution case studies.
Disaster management: Floods, earthquakes, cyclone, landslides, Tsunami.
Climate change-Global warming, Acid rain, Ozone depletion.

UNIT – IV

Environment Issues and Management

- Environment and Human health – Epidemic diseases, HIV/AIDS, Aviation Flue, Water Borne Diseases.
- Environmental Impact Assessment, Sustainable Development, Clean Production and Clean Development Mechanisms
- Environment Legislation: Environmental Protection Act, Water Act, Air Act, Wild Life Protection Act, Forest Conservation Act, Public Liability & Insurance Act, Issues involved in Enforcement of Environmental legislation.

UNIT – V

Social Issues and the Environment

- Population growth, Population Explosion, Population Control, Women and Child welfare.
- Urbanization, Industrialization, Development projects, Resettlement and Rehabilitation of people – Problems concerned, Case studies.
- Consumerism and Waste Products Conservation, Public Awareness, Water Conservation, Rain water harvesting, watershed management, Wasteland reclamation, Human Rights, Value education, Environmental ethics- Issues and possible solution.

Role of information Technology in Environment and Human Health.

Text Books / Reference Books :

1. Anubha Kaushik & C P Kaushik, Environmental studies, New age International Publishers, 2008
2. Benny Joseph, Environmental studies, Tata McGraw-Hill Publishers, 2005
3. M Chandra Sekhar, Environmental Science, Hi-Tech Publishers, 2004
4. Keerthinarayana and Daniel Yesudian, Principles of Environmental Sciences and Engineering , Hi-Tech Publishers, 2005
5. Amal K.Datta, Introduction to Environmental Science and Engineering, Oxford & IBH Publishing Co.Pvt.Ltd, 2000
6. Santhoshkumar Garg,RajeshawriGarg and Rajni Garg, Ecological and Environmental studies, Khanna publishers, 2006
7. Gilbert M, Introduction to Environmental Engineering and Science, Masters Publication by Prentice –Hall of India Private Ltd., 1991
   William P Cunningham and Mary Ann Cunningham, Principles of Environmental Science, Tata McGraw Hill Publishing Co. Ltd, 2002

Course Outcomes:

At the end of the course, students will be able to

1. acquire knowledge in
   - diverse components of environment and natural resources
   - ecosystem and biodiversity & its conservation methods
   - population growth and human health
   - green technology
2. identify and resolve the issues related to sources of different types of pollutions

3. provide solutions to individuals, industries and government for sustainable development of natural resources

apply environmental ethics in protection of diversified ecosystems.

MABST 201 MATHEMATICS II

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**

Sessional Marks : **40** End Semester Examination Marks: **60**

Unit I

Matrices: rank of a matrix-solution of system of linear equations-Eigen values, vectors –Canley-Hamilton theorem-quadratic forms-diagonalization.

Unit II

Vector Calculus: Gradient, Divergence, Curl of a vector and related properties-line, surface, volume integrals- Green's, Stokes's and Gauss Divergence theorems and its applications.

Unit III

Fourier Series: Fourier series-even and odd functions, periodic functions-half range sine and cosine series-harmonic analysis.

Unit IV

Special Functions I: Gamma and Beta functions-series solutions of differential equations-ordinary points.

Unit V

Special Functions II: Bessel function-recurrence formulae-generating function for $J_n(X)$ - Lengender polynomials-recurrence formulae-generating function for $P_n(X)$ - Rodriguez's formula - orthogonality of Lengender polynomials.

Text/Reference Books

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
4. Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

Course Outcomes:

At the end of the course, students will be able to

1. use ranks of matrices to decide whether the system of linear equations is consistent or not
2. use Cayley - Hamilton theorem to find inverses or powers of matrices.
3. use Eigen values and vectors to reduce Quadratic forms to normal form.
4. to analyze motion problems from real lines to curves and surfaces in 3-D and use tools such as divergence and curl of vector and gradient, directional derivatives that play significant roles in many applications.
5. use Green's theorem to evaluate line integrals along simple closed contours on the plane
6. use Stokes' theorem to give a physical interpretation of the curl of a vector field
7. use the divergence theorem to give a physical interpretation of the divergence of a vector field.

8. find the Fourier Series to represent a function as a series of constants times sine and cosine functions of different frequencies in order to observe periodic phenomenon.
9. Evaluate certain improper integrals to make them simple with introduction of Gamma and Beta functions.
10. study certain special functions that arise in solving certain ordinary differential equations to model many physical phenomena.

CYBST 202 ENGINEERING CHEMISTRY

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I
Atomic and molecular structure (**12 lectures**)
Postulates of quantum chemistry. Schrodinger equation. Particle in a box solutions Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene. Band structure of solids and the role of doping on band structures

UNIT II
Spectroscopic techniques and applications
Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques.

UNIT III
Chemical equilibria, Intermolecular forces and potential energy surfaces
Use of free energy in Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Use of free energy considerations in metallurgy through Ellingham diagram. Equations of state of real gases and critical phenomena.

UNIT IV
Periodic properties
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular
geometries, Born- Haber cycle, The use of reduction potentials, Properties of ionic and covalent compounds.

UNIT V
Stereochemistry, **Organic reactions and synthesis of a drug molecule**
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Reference/Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3.Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.
7. Principles of physical chemistry, Puri, Sharma and Pattania

Course Outcomes:

At the end of the course, students will be able to

1. analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. rationalise bulk properties and processes using thermodynamic considerations.
3. distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. list major chemical reactions that are used in the synthesis of molecules.

ENHST 203 ENGLISH

Instruction : Hours/Week : **2L:0T:0P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I

Vocabulary Building

The concept of Word Formation- Root words from foreign languages and their use in English- Acquaintance with prefixes and suffixes from foreign languages in English form derivatives- Synonyms, antonyms, and standard abbreviations.

UNIT II

Basic Writing Skills

Sentence Structures – Use of phrases and clauses in sentences –Importance of proper punctuation - Creating coherence – Organizing principles of paragraphs in documents -Techniques for writing precisely

UNIT III

Identifying Common Errors in Writing

Subject-verb agreement -Noun-pronoun agreement -Misplaced modifiers -Article -Prepositions - Redundancies -Clichés

UNIT IV

Nature and Style of sensible Writing

Describing - Defining - Classifying –Providing examples or evidence –Writing introduction and conclusion

UNIT V

Writing Practices

Comprehension - Précis Writing –Essay Writing

Reference/Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and Pushplata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts.I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes:

At the end of the course, students will be able to

1. learn the elements of grammar and composition of English Language.
2. Learn literary texts such as Short stories and prose passages.

3. maintain linguistic competence through training in vocabulary, sentence structures and pronunciation.
4. develop communication skills by cultivating the habit of reading comprehension passages.
5. develop the language skills like listening, speaking, reading and writing.
6. make use of self-instructed learner friendly modes of language learning through competence.

EEEST 204 BASIC ELECTRICAL ENGINEERING

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT I
DC Circuits
Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and Voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II
AC Circuits
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III
Transformers
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase Transformer connections.

UNIT IV
Electrical Machines
Single-phase induction motor. Construction, working torque-speed characteristic-Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor - Construction, working, torque-speed characteristic-Construction and working of synchronous generators and speed control of separately excited dc motor.

UNIT V
Electrical Installations
Introduction to Converters and Inverters- Single phase and three phase voltage source Inverters- Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery Backup.

Text / References Books:
1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press,2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010

5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes:

At the end of this course, students will be able to

1. understand and analyze basic electric and magnetic circuits.
2. study the working principles of electrical machines and power converters.
3. introduce the components of low-voltage electrical installations.

MEEST 205 ENGINEERING GRAPHICS AND DESIGN

Instruction : Hours/Week : **2L:0T:0P** **Credits: 3.5**

Sessional Marks : **40** End Semester Examination Marks: **60**

Unit I

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Con sections including the Rectangular Hyperbola (General method only);Cycloid, Epi-cycloid, Hypo-cyclo and Involutes.

Unit II

Scales

Scales– construction of Plain &Diagonal Scales.

Projections of points, lines

Projections of Points and lines inclined to both planes, including traces;

Unit III

Projections of planes

Projections of planes (Regular surfaces only) inclined Planes-Auxiliary Planes;

Projections of Regular Solids (Simple solids - cylinder, cone, prism & pyramid) those inclined to both the Planes-Auxiliary Views;

Unit IV

Isometric Projections& Orthographic projections

Principles of Orthographic Projections-Conventions Draw simple objects, dimensioning and scale. Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric
Views to Orthographic Views and Vice-versa, Conventions;

Unit V

Introduction to CAD

CAD workstation and peripherals, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars Standard, Object Properties, Draw, Modify and Dimension, Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom used in CAD, Select and erase objects.;

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. &Ingle P.R., (2014), Engineering Drawing, Charotar Publ. House
2. Shah,M.B.&RanaB.C.(2008),EngineeringDrawingandComputerGraphics,PearsonEducation
3. Agrawal B. & AgrawalC.M.(2012),Engineering Graphics, TMH Publication

4. Narayana, K.L. &P Kannaiah (2008),Text book on Engineering Drawing, Scitech Publishers
5. Corresponding set of CAD Software Theory and User Manuals

Course Outcomes:

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

1. make a distinction between first angle projection and third angle projection of drawing.
2. draw hyperbola, parabola, Involutes and Cycloidal curves.
3. draw sections of solids including cylinders, cones, prisms and pyramids.
4. draw projections of lines, planes, solids and sections of solids.
5. draw orthographic projections of lines, planes, and solids.

ENHSP 206 ENGLISH COMMUNICATION LAB

Instruction : Hours/Week : **0L:0T:3P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Listening Comprehension - Pronunciation, Intonation, Stress and Rhythm - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace - Interviews - Formal Presentations

Reference/Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp – Lyons and Ben Heasly. Cambridge University press. 2006.
5. Communication Skills. Sanjay Kumar and Pushpalata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts I-III.CIEFL, Hyderabad. Oxford University Press

Course Outcomes:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MABST 301 MATHEMATICS - III

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT - I

Complex analysis - I: Analytical functions - Cauchy- Reimann equations – Construction of Analytic functions- Complex integration - Cauchy's theorem - Integral formula - Evaluation of integrals.

UNIT - II

Complex analysis - II**:** Taylor's and Laurents' series- Transformations- Conformal mapping - Bilinear transformations - Transformation of 1/z, z^2, sin z and cos z.

UNIT - III

Complex anaylasis –III: Singularities - Poles - Residues - Residue theorem – Contour integration- Evaluation of real integrals

UNIT - IV

Partial differential equations - I : Formation of differential equations - Classification - First order linear partial differential equations – Legranges' linear equation - Method of multipliers - first order non-linear partial differential equations - Charpits method.

UNIT- V

Partial differential equations - II: Method of separation of variables - One dimensional wave equation - Heat equation – Laplace's equation.

Text/Reference Books

1. Grewal B S, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. Venkataraman M K, Engineering Mathematics, Vol. I & II, National Publishing Company, 1993.
3. Venkataraman M K, Engineering Mathematics, National Publishing Company, 1995.
4. Grewal B S, Engineering Mathematics, 13th Edition, Khanna Publications.
5. Kreyszig E, Advanced Engineering Mathematics, 8th edition, Wiley, 1998.

EEPCT 302 Network Theory

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-1

Network Solution Methods: Graph, tree, Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactance's, source transformation and duality and dual circuits.

Network Theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.

UNIT-2

Trigonometric and Exponential Fourier Series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation, Wye-Delta transformation, Steady state sinusoidal analysis using phasors, Time domain analysis of simple linear circuits.

UNIT-3

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions. Transient behavior, concept of complex frequency.

UNIT-4

Network Functions: One-port and Two-port networks, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem. Concept of complex frequency, poles and zeros, Time domain response from pole-zero diagram, Restrictions on pole-zero locations.

UNIT-5

Two-port Network Parameters : Open circuit impedance and short circuit admittance parameters – Hybrid and inverse-hybrid parameters – Transmission and inverse transmission parameters – Inter relationships between parameter sets – Series, Parallel, and Cascade connection of two-ports – Conditions for reciprocity and symmetry of two-port networks. Terminated two-port networks – Image parameters. Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text/Reference Books

1. Jack E. Kemmerly, William H. Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education, 2013.
2. Van, Valkenburg.; "Network analysis"; Prentice Hall of India, 2000.

3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.

Course Outcomes:

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

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

ECPCT303 Electromagnetic Waves

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-1

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

UNIT-2

Time-Varying Fields and Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics: Biot-Savart Law, Ampe're's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Faraday's Law, Displacement Current, Maxwell's Equations in Point Form and in Integral Form, Boundary conditions at Media Interface.

UNIT-3

Uniform Plane Wave: Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

Plane Waves at a Media Interface: Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

UNIT-4

Waveguides: 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-5

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

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005.
2. William H. Hayt, Jr., John A. Buck, "Engineering Electromagnetics", 8th Edition, McGraw-Hill, 2010.
3. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

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 transmission lines.
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave.
5. Calculate reflection and transmission of waves at media interface.
6. Analyze wave propagation on metallic waveguides in modal form.
7. Understand principle of radiation and radiation characteristics of an antenna.

ECPCT304 Digital System Design

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-1

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT-2

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

UNIT-3

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudorandom Binary Sequence generator.

UNIT-4

Clock generation Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

UNIT-5

VLSI Design flow: Design entry, Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd Edition, 2006. 4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

Course outcomes: At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits.
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder.
3. Design & analyze synchronous sequential logic circuits.
4. Use HDL & appropriate EDA tools for digital logic design and simulation.

EOHST305 Economics

Instruction : Hours/Week : **2L:0T:0P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

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

UNIT – I

Introduction - Nature and Scope of Managerial Economics, Economic Theory and Managerial Economics, Managerial **Economist:** Role and Responsibilities. Demand Analysis and Forecasting – Demand Determinants, Demand Distinctions, Demand Forecasting: General Considerations, Methods of Demand Forecasting.

UNIT – II

Cost Analysis – Cost Concepts, Classifications and Determinants; Cost-Output Relationship, Economies and Diseconomies of Scale, Cost Control and Cost Reduction.
Production and Supply Analysis – Production Functions, Supply Analysis.

UNIT – III

Price and Output Decisions Under Different Market Structures – Perfect competition, Monopoly and Monopsony; Price Discrimination, Monopolistic Competition, Oligopoly and Oligopsony.

UNIT – IV

Pricing Policies and Practices – Pricing Policies, Pricing Methods, Specific Pricing Policies, Price Discounts and Differentials; Product-line Coverage and Pricing; Price Forecasting.

UNIT – V

Profit Management – Nature of Profit, Measuring Accounting Profit, Profit Policies, Profit Planning and Forecasting. Capital Management - Capital Budgeting, Cost of Capital, Appraising Project Profitability, Risk, Probability and Investment Decisions.

Text/ Reference Books:

1. Varshney R L and Maheshwari K L, Managerial Economics, 19th Edition, Sultan Chand and Sons, 2009.

2. Froeb L M, and McCann B T, Managerial Economics*:* A Problem Solving Approach, Cengage Learning, 2008.

EOHST306 Accountancy

Instruction : Hours/Week : **2L:0T:0P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Outcomes: Students will be able to

UNIT – I

Management Accounting: Definition, Objectives, Scope and Functions. Financial Accounting – Introduction, Process,
Principles and Concepts. Financial Statements – Trading Account, Balancing Process, Profit & Loss Account and Balance Sheet

UNIT – II

Financial Statement Analyses – Trend Percentage Analysis, Ratio Analysis, Fund Flow Statement Analysis, Cash Flow Statement Analysis.

UNIT – III

Methods of Depreciation – Straight line, Depletion, Machine Hour Rate, Diminishing Balance, Sum of Digits, Sinking Fund
and Insurance Policy Methods. Inventory Valuation Methods – FIFO, LIFO, Average Weighted Average, Base Stock and HIFO Methods.

UNIT – IV

Capital Budgeting – Pay Back Period, ARR, NPV, PI and IRR Methods. Unit Costing – Introduction, Direct Cost Classification and Indirect Cost Classification. Introduction to Process Costing, Job Costing and Activity Based Costing

UNIT – V

Marginal Costing – Introduction, Definition, Meaning and BEP Analysis and BEP in units. Standard Costing – Introduction, Variance Analysis Material Cost Variance, Material Price Variance, Labor Variance, and Sales Variance. Budgetary Control – Introduction and Classification of Budgets, Production, Material / Purchase, Sales, Sales Overhead, Cash and Factory Overheads Flexible Budget, Budgets.

Text Books:

Pandikumar M P, Management Accounting: Theory and Practice, 1st Edition, Excel Books, 2007.

ECPCP307 Electronic Devices Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT 104.

List of Experiments:

1. Study of Instruments
2. Study of Components
3. Soldering Practice
4. V-I Characteristics of Si and Ge Diodes
5. Zener Diode Characteristics and Zener Diode as Voltage Regulator
6. Half Wave and Full Wave Rectifiers
7. Rectifiers with Filters
8. BJT Characteristics
9. FET Characteristics
10. BJT Biasing
11. FET Biasing
12. BJT as an Amplifier

Prerequisites: None

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

CO1 Plot the characteristics of electronic devices to understand their behaviour.

CO2 Design, construct and test amplifier circuits and interpret the results.

CO3 Operate electronic test equipment and hardware/software tools to characterize the behaviour of devices and circuits.

CO4 Design and test rectifiers with filter.

ECPCP308 Digital System Design Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT304.

Prerequisites:

Course outcomes: After completion of the course student will be able to:

CO1 Write structural, behavioral and data flow models for digital circuits

CO2 Simulate VHDL models of digital circuits using CAD tool

CO3 Analyze the subsystems/ modules using CAD tool

CO4 Implement and test simple digital circuits on FPGA

Mapping of course outcomes with program outcomes:

List of Experiments:

1. Characteristics of TTL NAND gate (i) Sourcing (ii) Sinking (iii) Transfer Characteristics
2. Verify the functionality of Mux and Decoder ICs and their application.
3. Verify the functionality of Flip-Flop ICs and its application.
4. Mod-N counter using 7490 and 74190.
5. Mod-N counter using 7492 and 74192.
6. Shift register IC 7495.

VHDL Programming:

1. Write structural and dataflow VHDL models for a) 4-bit ripple carry adder. b) 4-bit carry Adder – cum Subtractor. c) 2-digit BCD adder / subtractor. d) 4-bit carry look ahead adder e) 8-bit comparator

2. Write a VHDL program in structural model for

a) 16:1 mux realization b) 3:8 decoder realization through 2:4 decoder

3. Write a VHDL program in behavioral model for

a) 16:1 mux b) 3:8 decoder c) 8:3 encoder d) 8 bit parity generator and checker

4. Write a VHDL program in structural and behavioral models for

a) 8 bit asynchronous up-down counter b) 8 bit synchronous up-down counter

5. Write a VHDL program for 4 bit sequence detector through Mealy and Moore state machines.

6. Write a VHDL program in behavioral model for 8 bit shift and add multiplier.

7. Write a VHDL program in structural model for 8 bit Universal Shift Register.

EEESP309 Basic Electrical Engineering Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

List of experiments/demonstrations:

1. Basic safety precautions, Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
7. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
8. Torque Speed Characteristic of separately excited dc motor.
9. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at supersynchronous speed.
10. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

11. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of power electronic converters.

PAMCT310 Constitution of India

Instruction : Hours/Week : **2L:0T:0P** **Credits: 0**
Sessional Marks : **100**

Course Objectives: Students will be able to

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit-I

History of Making of the Indian Constitution: History
Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble
Salient Features

Unit-II

- **Contours of Constitutional Rights & Duties:**
- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit-III

- **Organs of Governance:**
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit-IV

- **Local Administration:**
- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit-V

- **Election Commission:**
- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books/References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

4. Discuss the passage of the Hindu Code Bill of 1956.

ECPCT401 Analog Circuits

Instruction : Hours/Week : **3L:1T:0P** **Credits: 4**

Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-1

General Amplifiers Characteristics: Concept of Amplifier, Voltage gain, Current gain, Power gain, Input and Output resistances, Conversion efficiency, Frequency response, Bandwidth, Distortion,

BJT Amplifiers: Small signal low frequency model of the transistor, Analysis of CE, CB and CC amplifiers, Approximate model analysis, Effects of coupling and bypass capacitors on low frequency response, Hybrid-Π model at high frequencies, Calculation of High-Frequency parameters in terms of Low Frequency parameters, CE short circuit gain, CE current gain with resistive load.

UNIT-2

FET Amplifiers: Small signal model, Analysis of CS, CD and CG amplifiers, comparison of performance of the three configurations, High frequency FET circuits, CS amplifier at high frequencies, CD amplifier at high frequencies.

Multistage Amplifiers: Types of coupling, Choice of amplifier configuration, overall voltage gain and Bandwidth of n-stage amplifier, Darlington and Bootstrap circuits.

UNIT-3

Feedback amplifiers: Feedback concept, Classification, Effects of negative feedback on gain, Stability, Noise, Distortion, Bandwidth, input resistance and output resistance.

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), Crystal oscillators.

UNIT-4

Power Amplifiers: Series-Fed Class-A power amplifiers, Transformer coupled class-A power amplifiers, Push-pull amplifiers, Class-B amplifiers, Class-AB operation, Complementary symmetry Push-Pull class-B Power amplifiers

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (V_{ON}), maximum usable load.

UNIT-5

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR, circuits to improve CMRR, transfer characteristics.

Operational Amplifier: Ideal op-amp characteristics, Op-amp internal circuit, examples of IC op-amps, DC and AC characteristics, Inverting and non-inverting modes of operation, voltage follower.

Text/Reference Books:

1. Millman and Halkias, "Integrated Electronics", McGraw-Hill Co
2. Mottershed, "Electronic devices and circuits", PHI
3. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
4. Salivahanan, "Electronic Devices and circuits", TMH.
5. David A. Bell, "Electronic Devices and circuits", PHI
6. D.Roy Choudary, Shail Bala Jain, "Linear Integrated circuits", New Age International publishers, 2018.
7. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
8. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
9. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Saunder's College Publishing, IV Edition.
10. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.

Course Outcomes:

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

1. Design and analyze various amplifier circuits.
2. Design sinusoidal oscillators.
3. Understand the functioning of OP-AMP and design OP-AMP based circuits.

ECPCT402 Signals and Systems
(Common to EEE, ECE and CSE)

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Course Outcomes:

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

1. Analyze different types of signals
2. Understand the concepts of continuous time and discrete time systems.
3. Analyze systems in complex frequency domain.
4. Investigate whether the system is stable or not.
5. Understand sampling theorem and its implications.

UNIT I

Introduction to Signals and Systems:

Definition and classification of signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character, Elementary signals such as Impulse, step, ramp, sinusoidal and exponential signals, Operations on signals. Basic System Properties (Continuous-Time and Discrete-Time): linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability, Examples, Causal LTI Systems Described by Differential and Difference Equations.

Signal Analysis:

Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions.

UNIT II

Fourier series and Fourier Transform:

The Response of LTI Systems to Complex Exponentials. Fourier series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier series, Properties of Continuous-Time Fourier Series.

The Continuous-Time Fourier Transform – properties. Discrete-Time Fourier Transform – Properties, Basic Fourier Transform Pairs. Introduction to Hilbert Transform.

UNIT III

Convolution and Correlation of Signals:

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT IV

Behaviour of continuous and discrete-time LTI systems:

The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Distortion less transmission through a system, signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time, State-space Representation of systems, State-Space Analysis, Multi-input, multi-output representation.

Sampling and Reconstruction:

The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects. Relation between continuous and discrete time systems, Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

UNIT V

Laplace and z -Transform:

The Laplace Transform -The Region of Convergence - Properties, The Inverse Laplace Transform, Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, Unilateral Laplace Transform. The Z-Transform -Region of Convergence - Properties, The Inverse z-Transform, Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, Unilateral z-Transform.

Text / Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky, & S. Hamid Nawab, "Signals and Systems," Pearson Higher Education, 2nd Ed., 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. Simon Haykin and B. Van Veen, "Signals & Systems," John Wiley and Sons, 2nd Edition, 2007.
4. B.P. Lathi, "Principles of LINEAR SYSTEMS and SIGNALS," Oxford Univ. Press, Second Edition, International version, 2009.
5. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
6. Luis F. Chaparro, "Signals and Systems using MATLAB," Academic Press, 2011.
7. C. L. Philips, J. M. Parr and Eve A. Riskin, "Signals, Systems and Transforms," Pearson Education, 4th Edition, 2008.

ECPCT 403 Probability Theory and Stochastic Processes

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-1

Sets and set operations, Probability space, Conditional probability Total 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-2

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

UNIT-3

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, (Proof not expected), Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-4

Random Process: Classification of Processes, Stationary processes, Mean and covariance functions, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes,

Autocorrelation Function & Its Properties, Cross-Correlation Function & its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.
Power spectral density, Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT-5

Transmission of random process through LTI systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, properties of white noise, Band pass, Band-Limited and Narrowband Processes, Properties.

Text / Reference Books:

1. H. Stark and J. Woods, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education.
2. Athanasios Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.
3. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", Tata McGraw Hill, 4th Edition, 2001.
4. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers.
6. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.
7. 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. Able to Model of different Noise Sources.
5. To understand propagation of random signals in LTI systems.

ECPCT404 Analog and Digital Communication	
Instruction : Hours/Week : **3L:1T:0P**	**Credits: 4**
Sessional Marks : **40**	End Semester Examination Marks: **60**

UNIT-1

Frequency domain representation of signals, Principles of Amplitude Modulation Systems - DSB, SSB and VSB modulations. Angle Modulation, Representation of Frequency modulation (FM) and Phase modulation (PM) signals, Spectral characteristics of angle modulated signals. Super heterodyne receivers, circuits for analog communications.

Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

UNIT-2

Pulse Modulation: Sampling process, Quantization & Coding, Quantization error, Pulse Amplitude and Pulse Code Modulation (PCM), Line codes, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Noise considerations in PCM systems, Time Division multiplexing (TDM), Digital Multiplexers.

UNIT-3

Base-band Data Transmission: Elements of Detection Theory, Geometric representation of signals, Gram-Schmidt Orthogonalization Procedure, Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, Optimum detection of signals in noise, inter-symbol interference (ISI) and its mitigation, Timing and frequency synchronization, Nyquist criterion for distortion less baseband binary transmission, ideal Nyquist channel, Raised-Cosine pulse spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Baseband

M-array PAM transmission, Coherent communication with waveforms, Probability of Error evaluations, Eye diagrams.

UNIT-4

Digital Modulation Schemes: Method of generation and detection of coherent & noncoherent binary Amplitude, and Frequency Shift Keying (ASK, FSK), Phase Shift Keying (PSK), differential phase shift keying (DPSK), DEPSK, QPSK, M-ary PSK, Quadrature Amplitude Modulation (QAM), Continuous Phase Modulation and Minimum Shift Keying (MSK). M-array quadrature amplitude modulation (M-array QAM).

UNIT-5

Digital Modulation tradeoffs, Optimum demodulation of digital signals over band-limited channels-Maximum a posteriori (MAP) detection, Maximum likelihood (ML) sequence detection (Viterbi receiver), Equalization Techniques, Synchronization and Carrier Recovery for Digital modulation. Calculation of bandwidth, Comparison of power bandwidth requirements Signal to Noise Ratio (SNR) and Bit Error Rate (BER) for all digital modulation schemes. Basics of TDMA, FDMA and CDMA.

Text/ Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Michael Moher, Simon Haykin “An Introduction to Analog & Digital Communications, 2ed
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems”, Tata McGraw Hill, 2001.
5. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.

Course Outcomes:

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

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise.
3. Investigate pulsed modulation / band pass modulation system and analyze their system performance.
4. Analyze different digital modulation schemes and can compute the bit error performance.

CSPCT405 Computer Organization and Architecture
(Common to ECE and CSE)

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Objectives of the course:

To expose the students to the following:

1. How Computer Systems work & the basic principles.
2. Instruction Level Architecture and Instruction Execution.
3. The current state of art in memory system design.
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism.
6. To impart the knowledge on micro programming.
7. Concepts of advanced pipelining techniques.

Course Outcomes:

At the end of this course, student will demonstrate the ability to

1. Learn how computers work.
2. Know basic principles of computer's working.
3. Analyze the performance of computers.
4. Know how computers are designed and built.
5. Understand issues affecting modern processors (caches, pipelines etc.).

Unit 1:

Introduction to Computer organization: Basic Structure of Computers, Functional units, software, software performance issues, machine instructions and programs, Types of instructions, Instruction sets:

Instruction formats, Assembly language, Stacks, Ques, Subroutines, CISC Vs RISC, Data types. (8 hours)

Unit 2:
Processor organization: Multiplication, division, ALU design, data-path and Control unit, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit, Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit, Information representation, Number formats: Floating Point arithmetic, IEEE 754 floating point formats. (8 hours)

Unit 3:
Memory organization: System memory, RAM, ROM, Memory interleaving, concept of hierarchical memory organization, Concept of Cache memory & associative memories, Virtual memory and its implementation, Memory management unit, Semiconductor main memory, Advanced DRM organization, Optical Disks. (8 hours)

Unit 4:
Input – Output Organization: Accessing I/O devices, Standard I/O interfaces, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, I/O device interfaces – Parallel and serial port, Features of PCI and PCI Express bus, SCII, USB. (8 hours)

Unit 5:
Concept of parallel processing:
Pipelining: Basic concepts of pipelining, throughput and speedup, Instruction level pipelining (ILP), Compiler techniques for ILP, pipeline hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency. Different Architectures: VLIW Architecture, SoC architecture. (12 hours)

Text/Reference Books:

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S. Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M. M. Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. John P. Hayes, “Computer Architecture and Organization”, PHI, Second edition.
7. P. Barry and P. Crowley, “Modern Embedded Computing”, Morgan Kaufmann, 2012.
8. B. Govindarajalu, “IBM PC and Clones”, Tata McGraw Hill, 1991.
9. William Stallings, “Computer Organization and Architecture: Designing for Performance”, 10th Edition by Pearson Education.
10. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by Elsevier.
11. Vincent P. Heuring and Harry F. Jordan, “Computer System Design and Architecture”, 2nd Edition, Pearson Education.

MCHST406 Management Science

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Objectives of the course: To expose the students to the following:

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

1. Work more creatively, work in groups
2. Presenting ideas more effectively and efficiently in formal and informal ways.
3. Development of fundamental rethinking and radical redesign in the organizations.
4. Applying the ideas of the course to identifying and solving real world problems.
5. Development of Group Dynamic Skills

Unit -1

Concept of Management – Administration, Organization – Functions of Management, evolution of management thought – Organization, principles of organization – Types – Organization charts – Managerial objectives and social responsibilities.

Unit -2

Corporate planning – Mission, Objectives, and programs, SWOT analysis – Strategy formulation and implementation – Plant location and Plant layout concepts – Production control.

Unit -3

Human resources management – Manpower planning – Personnel management – Basic functions of personnel management job evaluation and merit rating – Incentive plans- Marketing, Functions of marketing.

Unit -4

Productivity - Batch and mass production – Work study – Basic procedure involved in method study - work measurement – Elements of cost – Methods of calculation of overhead charges – Depreciation

Unit -5

Network Analysis to project management – PERT/CPM – Application of network techniques to engineering problems. – Cost Analysis – Project crashing.

Texts/Reference Books:

1. Principles of Management by Koontz and O Donnel.
2. Industrial Engineering and Management by O.P.Khanna.
3. Marketing by Philips Kother
4. PERT/CPM by L.S.Srinath
5. Business policy by Gluck (TMH)

ECPCP408 Analog Circuits Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT401.

Prerequisites: Electronic Devices Laboratory ECPCP307.

Course Outcomes:

After completion of the course student will be able to:

CO1 Measure the h parameters of the given transistor.

CO2 Synthesize and evaluate single stage and two stage amplifiers

CO3 Realize the given performance using feedback amplifiers

CO4 Design and test Oscillator circuits using BJT and FET.

List of Experiments:

1. Measurement of h-parameters
2. Single stage BJT amplifier
3. Two stage BJT amplifier
4. FET amplifier
5. Differential amplifier

6. Voltage series feedback amplifier

7. Voltage shunt feedback amplifier

8. Current series feedback amplifier

9. Current shunt feedback amplifier

10. RC phase shift oscillator

11. Wien bridge oscillator

12. LC/ crystal oscillator.

ECPCP409 Analog and Digital Communication Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**

Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT404.

Pre-requisites:

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

CO1 Generate AM and FM signals and evaluate their performance

CO2 Perform signal sampling by determining the sampling rates for baseband signals and reconstruct the signals CO3 Generate digital modulation signals for ASK, PSK and FSK and perform their detection CO4 Simulate MSK, DPSK, QPSK and DEPSK schemes and estimate their BER

List of Experiments:

1. Fourier Synthesis

2. AM Transmitter & Receiver

3. FM Transmitter & Receiver 4. AM/FM Radio Receiver

5. Analog signal sampling & Reconstruction

6. Generation & Detection of PAM/PWM/PPM

7. Generation & Detection of PCM

8. Generation & Detection of DM/SIGMA DELTA/ ADM

9. Baseband digital data transmission

10. Data conditioning & Reconditioning

11. Generation & Detection of BPSK/DPSK/DEPSK

12. Simulation of digital modulation schemes

(i) Phase Shift Keying (PSK), differential phase shift keying (DPSK), DEPSK,

(ii) QPSK, M-ary PSK, Quadrature Amplitude Modulation (QAM),

EEPCT501 Linear Control Systems

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Unit-1

Introduction to control problem (10 hours):

Industrial Control examples, System Representation, Classification of systems, Feedback Control, Benefits of Feedback- Open-Loop and Closed-loop systems, Advantages and Disadvantages of control systems, Industrial Control examples.

Mathematical models of physical systems: Electrical, Mechanical and Electro-Mechanical, Transfer function models of linear time-invariant systems: Potentiometers, Synchros, LVDT, dc and ac servomotors, Tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems,, Block diagram algebra, Reduction techniques and Signal flow graph.

Unit-2

Time Response Analysis (10 hours):

Standard test signals, Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. Design specifications for second-order systems based on the time-response, Steady state errors and error constants, Performance specifications in time-domain error, Static and Generalized error constants, Concept of stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

Unit-3

Frequency-response analysis (8 hours):

Introduction to Frequency domain specifications -Relationship between time and frequency response, Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Performance specifications in frequency-domain, Frequency domain methods of design.

Unit4

Introduction to Controller Design (10 hours)

Compensation & their realization in time & frequency domain, Introduction to controllers (PI, PD, PID), Application of Proportional, Integral and Derivative Controllers, Need for Lead and Lag compensators, Applications of compensators, Comparison of controllers and compensators, Problems.

Unit-5

State variable Analysis (8 hours) :

Concepts of state, state variables, State space model for linear continuous time functions, Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability.

Text/Reference Books:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, Seventh edition, 1995.
3. K. Ogata, “Modern Control Engineering”, Prentice Hall, second edition, 1991.
4. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.

ECPCT502 IC Applications

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

Unit-1

Op-Amp Applications: Scale changer/inverter, Summing amplifier, Instrumentation amplifier, Instrumentation amplifier IC-AD620, DC and AC amplifiers, V to I and I to V converters, Precision rectifiers, Log and Antilog amplifiers, multiplier and divider, Analog multiplier IC-AD633, Differentiator, Integrator, Analog computation,

Unit -2

Comparators and waveform generators: Comparator, Regenerative comparator (Schmitt Trigger), Astable and mono-stable multi-vibrators using op-amp, Triangular wave generator, Sine wave generators using op-amp. IC waveform generator (8038).

Unit -3

Voltage regulators: Series op-amp regulator, IC voltage regulators, 723 General purpose regulator, Switching regulators.

Active filters: Low pass, high pass, band pass, band reject and all pass filters, transformation, State variable filter, Switched capacitor filters, Switched capacitor filter ICs.

Unit -4

555 Timer: Description of functional diagram, Monostable operation. Applications in monostable mode, Astable operation, Applications in astable mode, Schmitt trigger.

Phase Locked Loops: PLL- introduction, block schematic, principles and description individual blocks, IC PLL (565), Voltage controlled oscillator (566), PLL applications- Frequency multiplication, Frequency translation, FM & FSK demodulation.

Unit -5

D-A and A-D Converters: Basic DAC Techniques, Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R ladder, Monolithic DAC IC-1409, A-D converters, direct type ADCs, the parallel comparator(flash) A/D converter, The counter type A/D converter, Servo tracking A/D converter, Successive approximation converter, Integrating type of ADCs, Charge balancing ADC, Dual-slope ADC, DAC/ADC specifications.

Text/Reference Books:

1. D.Roy Choudary, Shail Bala Jain, "Linear Integrated circuits", New Age International publishers, 2018.
2. Ramakant A.Gayakward, "Op-amps and linear Integrated circuits", LPE, 4th edition, Pearson Education.
3. S.Salivahanan, V.S.Kanchana Bhaaskaran "Linear Integrated circuits", TMH, 2008.
4. David A. Bell, "Operational amplifiers and Linear ICs", PHI, EEE, 1997.
5. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.

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

1. Understand the functioning of OP-AMP and design OP-AMP based circuits.
2. Understand the functioning of voltage regulators and design IC based voltage regulators,
3. Understand the functioning of 555 timer and design 555 timer based circuits.
4. Understand the functioning of PLL and design PLL based circuits.
5. Design ADC and DAC circuits.

ECPCT503 Microcontrollers

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

Unit -1

Overview of microcomputer systems and their building blocks, Introduction to 8-bit microprocessor (8085) Architecture, Addressing modes, Instruction set, Machine cycles, instruction cycle and timing states, instruction timing diagrams, simple programs in 8085.

Unit -2

Semiconductor memories: RAM, ROM, SRAM, and DRAM. Memory interfacing, concepts of interrupts and Direct Memory Access.

I/O Interfacing with peripherals: Timer, serial I/O, parallel I/O, A/D and D/A converters, Arithmetic Coprocessors, System level interfacing design.

Unit -3

8051 Microcontroller: Architecture, Register set, Addressing modes, Instruction set, Interrupt structure, timer and serial port operations, Memory and I/O interfacing, External memory interfacing with 8051. Assembly language programming of 8051, Parallel I/O Ports, Interrupts, Timer and Counter, Serial Communication Programming.

Unit -4

Synchronous and Asynchronous Communication, RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. Interfacing of 8051 microcontroller with LED, LCD, keyboard, Stepper motor, DC Motor, and sensors etc., C language programs, Assemblers and compilers, Programming and debugging tools.

Unit -5

Introduction to RISC processors, ARM7 Processor: Architecture, Features, ARM microcontrollers interface designs.

Concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 8086, 286, 386, 486, Pentium.

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface", Morgan Kaufman Publishers.
3. Douglas V. Hall, "Microprocessors and interfacing: Programming and hardware", 2nd Edition. Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International Publishing/ Thomson Publishers, 2nd Edition, 2005.
5. Barry B.Brey, The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Prentice Hall of India Private Limited, New Delhi, 2003/ Pearson Education , 2004. (UNIT V).

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

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

ECPCT504 Digital Signal Processing

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

Unit -1

Discrete Fourier series:

Review of Discrete-time Fourier Transform, Z-Transform. Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transform - Properties, linear convolution of sequences using DFT, computation of DFT. Relation between Z-Transform and DFS.

Fast Fourier Transforms: Fast Fourier transforms (FFT)-Radix2 decimation in time and decimation in frequency FFT algorithms, inverse FFT and FFT for composite N.

Unit-2

Realization of Digital Filters:

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

Unit-3

IIR Digital Filters: Analog filter approximations-Butterworth and chebyshev, design of IIR digital filters from analog filters, design examples: analog-digital transformations.

FIR Digital Filters: Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques, frequency sampling technique, comparison of IIR and FIR filters.

Unit -4

Multirate Digital Signal Processing Fundamentals: Basic sample rate alteration devices, Multirate Structures for sampling rate Converters, Multistage design of decimator and Interpolator, Polyphase Decomposition, Nyquist filters.

Unit -5

DSP PROCESSORS: TMS 320X/ ADSP 21XX Architecture and Applications.

Text Books

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Education/PHI, 4th ed., 2007.
2. Sanjit K Mitra, "Digital Signal Processing: A computer based approach", Tata Mcgraw Hill, 3rd edition, 2009.
3. A.V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", Prentice Hall of India.
4. B. Venkataramani, M.Bhaskar, Digital Signal Processors: Architecture, Programming and Applications, Tata McGraw Hill, 2002.
5. Handouts on DSP Processors.

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

1. Represent signals mathematically in continuous and discrete time and frequency domain.
2. Get the response of an LSI system to different signals.

3. Design of different types of digital filters for various applications.

ECPET505 Electronic Measurements

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

UNIT-I

Measurement and Error: Definitions, accuracy and precision, types of errors. DC Ammeters, DC Voltmeters, Series type ohmmeter, Shunt type ohmmeter. AC Voltmeter using rectifiers, True RMS responding voltmeter.

UNIT-II

Cathode Ray Oscilloscopes : Motion of electron in electric field and in magnetic field – Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CROs – Measurements with CRO (voltage, current, time, frequency, phase angle, lissajous figures).

UNIT-III

Analog Instruments – Transistor voltmeter, micro voltmeter (chopper type) - DC differential voltmeter - AC voltmeters - Multimeter - Q meter and measurement methods.
Bridges: Wheatstone, Maxwell, Hay and Schering bridges.
Wave analyzers (AF & RF) - Harmonic distortion analyzers – Spectrum analyzer.

UNIT-IV

Digital instruments – Digital voltmeters(Ramp, Dual slope, stair case, successive approximation types) Digital multimeter, universal counter, Digital tachometer, Digital phase meter IEEE 488 Bus.

UNIT-V

Transducers – Classification and selection of transducers – strain gauges – Temperature measurement (resistance thermometer, thermo couples and thermisters) LVDT – Peizo electric transducer.

Text / References Books:

1. H.S.Kalsi, “Electronic Instrumentation” TMH, 1995.
2. Helfricand Cooper, “Modern Electronic Instrumentation and measurement techniques”, PHI, 1995.
3. A.K.Sawhney , " Electrical and electronic measurements and instrumentation", DanapatRai& Co.,18th edition., 2007.

ECPCP507 IC Applications Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT502.

Course Outcomes:
After the completion of the course the student will be able to:
CO1 Measure the parameters of IC 741 Op-amp.
CO2 Realize analog filters using Op-amp.
CO3 Design monostable and astable multivibrators using 555 IC.

List of Experiments:

1. Study and Operation of IC testers, pulse generator and digital trainer.
2. Frequency response of inverting and non-inverting amplifier.
3. Measurement of Op.amp parameters: (i) Offset voltage (ii) Offset current (iii) CMRR and (iv) Slew rate
4. Op-amp monostable and astable multivibrators.
5. Design 2's complement adder/subtractor using IC74283 and verify experimentally.
6. Low voltage regulator IC 723.
7. 555 timer: Monostable and astable multivibrators.
8. IC PLL (565) applications- Frequency multiplication, Frequency translation, FM & FSK demodulation.
9. Voltage controlled oscillator (566)

ECPCP508 Microcontrollers Laboratory

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT503.

Pre-requisites: None

Course Outcomes:

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

CO1 Write assembly language, C and C++ programs for arithmetic operations using Pentium processor based system

CO2 Write 8051 assembly language programs to control inbuilt timer and communication modules.

CO3 Interface ADC and DAC modules with microprocessor based system.

CO4 Implement DSP functions using ARM processor.

List of Experiments:

(8085 Microprocessor Assembly Language Programming)

1. Write a simple program for arithmetic operations – addition, subtraction, multiplication and division of 16 – bit number.
2. Write a simple program for string operations like string concatenation, swapping.
3. Write a program for interfacing LCD with 8085 and display a message.
   (8051 Microcontroller Assembly Language Programming)
4. Write a program for performing simple arithmetic operations.
5. Write a simple program for flashing LEDs using software delays, timers and interrupts.
6. Write a program for interfacing Seven Segment Display and LCD with 8051 and display messages.
7. Write a program for interfacing Keypad with 8051 and display keypad input on LCD.
8. Write a program for square waveform generation, with different frequencies and duty cycles.
9. Write a program for serial communication through UART using polling and interrupt methods.
10. Write a program for interfacing ADC with 8051.
11. Write a program for Pulse Width Modulation using on-chip PWM and analog I/O modules.
12. Write a program for interfacing Seven Segment Display and LCD to ARM processor.
13. Write a program to generate various waveforms
14. Write a program for flashing LEDs using timers and interrupts.

ECPCP509 Digital Signal Processing Laboratory	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40**	End Semester Examination Marks: **60**

Hands-on experiments related to the course contents ECPCT504.

Motivation: The lab worked in close conjunction with the theory course **ECPCT504**: Digital Signal Processing. It covered the applications of various filtering techniques in detail and their applications

Prerequisites: None

Course content: The lab was mostly related to implementing various filtering techniques like: FIR Filter implementation using linear and circular buffering, IIR filter and its implementation, FFT and spectrum analysis, fixed-point and floating point implementation, and similar.

There was also a bonus experiments on AM and DM of signals.

ECPCT601 Computer Networks

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**
Sessional Marks : **40** End Semester Examination Marks: **60**

Unit -1

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit -2

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connectionoriented transport – Transmission Control Protocol, Remote Procedure Call.

Unit -3

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit -4

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Unit -5

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, and Switches.

Text / Reference books:

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

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

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

ECPET602 Program Elective - I	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40**	End Semester Examination Marks: **60**

ECPET603 Program Elective – II (MOOCs / e-Learning)	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40**	End Semester Examination Marks: **60**

ECPCP606 Computer Networks Laboratory	
Instruction : Hours/Week : **0L:0T:4P**	**Credits: 2**
Sessional Marks : **40**	End Semester Examination Marks: **60**
Hands-on experiments related to the course contents ECPCT601.	

ECPCP607 Electromagnetic Waves and Microwaves Lab	
Instruction : Hours/Week : **0L:0T:2P**	**Credits: 1**
Sessional Marks : **40**	End Semester Examination Marks: **60**

Hands-on experiments related to the course contents **ECPCT303** and ECPEL 03.

Prerequisites:

Course Outcomes:

After completion of the course student will be able to:

CO1 Measure performance of simple microwave circuits and devices.

CO2 Perform microwave measurements with sophisticated instruments such as vector network analyzer and spectrum analyzer

CO3 Assess the performance of optical devices: light sources, fibers and detectors.

CO4 Plot the loss characteristics of optical fibers.

List of Experiments:

1. Antenna Demonstration
2. Mode characteristics of Reflex Klystron
3. Gunn oscillator characteristics and power measurement
4. Measurement of VSWR & impedance
5. Measurement of radiation pattern and gain of an antenna

6. Properties of circulators & Directional coupler
7. Properties of the Magic Tee Junction
8. Vector Network Analyser Demonstration
9. Measurement of Numerical Aperture
10. Integrated Voice and Data Optical Communication System

Study of Optical Sources, Detectors and Fiber Characteristics

ECPCP608 Electronic Measurements Lab

Instruction : Hours/Week : **0L:0T:2P** **Credits: 1**
Sessional Marks : **40** End Semester Examination Marks: **60**

List of Experiments:

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge).
2. Designing AC bridge Circuit for capacitance measurement.
3. Displacement measurement using capacitive transducer and resistive transducer.
4. Designing signal Conditioning circuit for Pressure Measurement.
5. Designing signal Conditioning circuit for Temperature Measurement.
6. Temperature measurement using a)Thermistor b) thermocouple.
7. Speed measurement using: Angular displacement measurement using capacitive pickup method.
8. Designing signal Conditioning circuit for Torque Measurement.
9. Designing signal Conditioning circuit for Strain Measurement using strain gauge.
10. Experimental study for the characteristics of ADC.
11. Experimental study for the characteristics of DAC.
12. Error compensation study using Numerical analysis using MATLAB (regression)
13. Calibration and Study of DMM Data Acquisition System

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

1. Design and validate DC and AC bridges
2. Analyze the dynamic response and the calibration of few instruments
3. Measure displacement using capacitive and resistive transducers.
4. Measure temperature and strain using appropriate transducers.
5. Learn about various measurement devices, their characteristics, their operation and their limitations
6. Understand statistical data analysis
7. Understand computerized data acquisition.

ECPCP609 Electronic Design Workshop

Instruction : Hours/Week : **0L:0T:4P** **Credits: 2**
Sessional Marks : **40** End Semester Examination Marks: **60**

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 first 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.

ECPET 701 Program Elective-III	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40**	End Semester Examination Marks: **60**

ECPET 702 Program Elective -IV	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40**	End Semester Examination Marks: **60**

ECPET 703 Program Elective-V	
Instruction : Hours/Week : **3L:0T:0P**	**Credits: 3**
Sessional Marks : **40**	End Semester Examination Marks: **60**

MGHST704 Total Quality Management

Instruction : Hours/Week : **4L:0T:0P** **Credits: 4**
Sessional Marks : **40** End Semester Examination Marks: **60**

Course Objectives: To facilitate the understanding of total quality management principles and processes

Course Outcomes: Upon completion of this course, the students will be able to use the tools and techniques of TQM in manufacturing and service sectors.

Unit -1

Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention, costs to quality.

Unit -2

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement, PDCE cycle, 5S, Kaizen, Supplier partnership, Partnering, Supplier rating & selection.

Unit -3

The seven traditional tools of quality, New management tools, Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.

Unit -4

TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function, TPM- concepts, improvement needs, performance measures.

Unit -5

Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000-concepts, requirements and benefits, TQM implementation in manufacturing and service sectors.

Text/Reference Books:

1. Besterfield D.H. et al., Total Quality Management, 3rd ed., Pearson Education Asia, 2006.
2. Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.
3. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.

4. Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.

ECPCI 705 Industry Internship

Instruction : Hours/Week : **Not less than 4 weeks** **Credits: 3**

Sessional Marks : **100**

Summer Industry Internship will be done minimum period of four to six weeks in an Industry in the area of Electronics and Communication Engineering. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report.

ECPXP 706 Project Work

Phase - I

Instruction : Hours/Week : **0L:0T:6P** **Credits: 3**

Total Marks : **100**

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee.

ECPET801 Program Elective-VI

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40** End Semester Examination Marks: **60**

ECPET802 Program Elective-VII

Instruction : Hours/Week : **3L:0T:0P** **Credits: 3**

Sessional Marks : **40**	End Semester Examination Marks: **60**

ECPCX803 Project Work

Phase – II

Instruction : Hours/Week : **0L:0T:18P** **Credits: 9**

Sessional Marks : **40** End Semester Examination Marks: **60**

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under **ECPJP 706 Project –I**, either fully theoretical/ practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under ECPJP **706 Project –I**.
2. Review and finalization of the Approach to the Problem relating to the assigned topic.
3. Preparing an Action Plan for conducting the investigation, including team work.
4. Detailed Analysis/ Modelling/ Simulation/Design/ Problem Solving/ Experiment as needed.
5. Final development of product/process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/Publication in Journals, if possible.
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Project based – Science, Technology, Social, Design & Innovation

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student which may result in development of a working system, a prototype, or a device or material, etc. They are not required or even expected to produce research or an innovation.

Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this (a) Exposure to social problems (which are amenable to technological solutions) (b) Design & Innovation (to address above problems).
After this students shall be encouraged to undertake technology projects of social relevance.

Program Elective Courses

ECPET01	Pulse and Digital Circuits	3L:0T:0P	3 credits

Unit -1

Linear Wave shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe.

Unit -2

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits.

Unit-3

Switching Characteristics of Devices: Diode as a switch, piecewise linear diode characteristics, Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor-switching times.
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors.

Unit -4

Time Base circuits : General features of Time-base signal, Methods of generating time base wave form, Exponential sweep circuit, sweep circuit using UJT, sweep circuit using a transistor switch, a transistor constant-current sweep, Miller and Bootstrap time-base generators-basic principles, transistor Miller time-base generator, bootstrap time-base generator.

Unit -5

Synchronization and Frequency Division: Principles of Synchronization, Frequency division in sweep circuit, Astable relaxation circuits, Monostable relaxation circuits, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit.
Realization of logic Gates using Diodes & Transistors: AND, OR and NOT gates using Diodes and Transistors.

Text/ Reference Books:

1. Pulse, Digital &Switching Waveforms- J.Millman, Herbert Taub and M.S. PrakashRao, Tata Mc-Graw Hill, 2nd Edition, 2007.
2. David a. Bell, "Solid state pulse circuits", Prentice Hall of India, 4thEdn, 2002.
3. A. Anand Kumar, "Pulse and Digital Circuits", Prentice Hall of India, 2ndEdn, 2009.
4. Ronald J.Tocci , "Fundamentals of Pulse and Digital Circuits", 3rd Edn., 2008
5. Mothiki S.Prakash Rao, "Pulse and Digital Circuits", TMG, 2006.
6. David A.Bell, "Pulse, switching and Digital circuits", Oxford University Press, 5th Edn, 2015.

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

1. Design RC low pass and high pass circuits for different RC time constants.
2. Design of non-linear wave shaping circuits like diode clippers and clampers.
3. Design different multivibrators using transistors and understand their applications.
4. Design different time base circuits and understand their operation.

5. Understand the operation of synchronization and frequency circuits and also realization of logic gates using diodes and transistors.

ECPET 02	Antennas and Propagation	3L:0T:0P	3 credits

Unit -1

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Unit -2

Aperture and Reflector Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Unit -3

Broadband Antennas: Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Micro strip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Unit -4

Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, and synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Unit -5

Basic Concepts of Smart Antennas: Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

Text/ Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGrawill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Outcomes:

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

1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications.

ECPET 03	Microwave Theory and Techniques	3L:0T:0P	3 credits

Unit -1

Introduction to Microwaves: History of Microwaves, Microwave Frequency bands, Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission: Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Analysis of RF and Microwave Transmission Lines: Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis: Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Unit -2

Passive and Active Microwave Devices

Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers.

Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Unit -3

Microwave Design Principles: Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas: Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Unit -4

Microwave Measurements: Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Unit -5

Microwave Systems: Radar, Terrestrial and Satellite Communication, Radio Aids to Navigation, RFID, GPS.

Modern Trends in Microwaves Engineering: Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RF MEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

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

1. Understand various microwave system components their properties.

2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

ECPET 04	CMOS Design	3L:0T:0P	3 credits

Unit -1

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Brief Introduction to MOS, PMOS, NMOS, CMOS & BiCMOS technologies. Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, $\mathbf{I_{ds} - V_{ds}}$ relationships, MOS transistor threshold Voltage, Transistor as a switch, Inverter characteristics.

Unit -2

Integrated Circuit Layout: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for CMOS Inverters and Gates, Scaling of MOS circuits.

Basic Circuit Concepts: Sheet Resistance R_s and its concepts to MOS, Area Capacitance calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

Unit -3

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic, Switch logic, Alternate gate circuits. Shifters, Adders, Parity generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multipliers, Counters, High Density Memory Elements.

Unit -4

Sequential Circuit Design: Static Circuits, Design of latches and Flip-flops.

Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

Unit -5

Physical Design: Floor-Planning, Placement, routing, Power delay estimation, Clock and Power routing.

Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

Text/Reference Books:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. John M. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. Jacob Backer, Harry W. Li and David E. Boyce, “CMOS Circuit Design, Layout and Simulation ", Prentice Hall of India, 1998.

5. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition.

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

1. Design different CMOS circuits using various logic families along with their circuit layout.

2. Use tools for VLSI IC design.

ECPET 05	Information Theory and Coding	3L:0T:0P	3 credits

UNIT I : INFORMATION ENTROPY FUNDAMENTALS

Uncertainty, Basics of information theory, Entropy for discrete ensembles, Source coding Theorem , Huffman coding, Shannon Fano coding, Discrete Memory less channels, channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II : DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub-band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III : ERROR CONTROL CODING

Techniques of coding and decoding, Huffman codes and uniquely detectable codes, Linear Block codes , Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional arithmetic codes.

UNIT IV : COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V : AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

Text/Reference Books:

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002.
3. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
4. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.
5. N. Abramson, Information and Coding, McGraw Hill, 1963.
6. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
7. R.B. Ash, Information Theory, Prentice Hall, 1970.
8. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course Outcomes:

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

1. Understand the concept of information and entropy.
2. Understand Shannon’s theorem for coding.
3. Calculation of channel capacity.
4. Apply coding techniques.

ECPET06	Embedded Systems	3L:0T:0P	3 credits

UNIT-1

Introduction to Embedded Systems: Understanding the Basic Concepts, The Typical Embedded System, Characteristics and Quality Attributes of Embedded Systems, Embedded microcontroller cores (hardware units and devices in a system), Embedded software in a system, Examples of embedded systems, Embedded system-on-chip (Soc), Design process in embedded systems, Formalization of embedded systems, Classification of embedded systems, Examples of embedded systems, Skills required for an embedded system designer.

UNIT-2

Technological aspects of embedded systems:

Power supply, clock, memory interface, interrupt, I/O ports, Buffers, Programmable Devices: FPGA, CPLD, ASICs etc., Interfacing with memory and I/O devices, Bus architectures like JTAC, I2C, SPI, AMBA, CAN etc., Embedded processor selection and trade-offs.

Hardware development cycles: Specifications, Component selection, Schematic Design, PCB layout, fabrication and assembly, testing – functional, manufacturing, parametric, Design tradeoffs due to process compatibility, thermal considerations, etc.

UNIT-3

High End RISC ARCHITECTURE ARM: Introduction to ARM processor, The ARM architecture , ARM organization and implementation , The ARM instruction set , The thumb instruction set , Basic ARM Assembly language program, ARM CPU cores.

UNIT-4

Software aspects of embedded systems:

Concept of Firmware, Operating system basics, Device drivers, Real Time Operating System: Fundamentals, Multitasking application – Threads, execution suspension, sharing, resources between tasks: timers, message queues. Concurrent programming concepts – Tasks and Events: Synchronization and communication, task scheduling: Time slicing: priority: pre-emption scheduling interrupts and background tasks. Main features of QNX, Vx WORKS and LynxOS, Real Time Embedded System design and development.12

UNIT-5

Embedded System Design: Embedded System product Development Life cycle (EDLC), Product enclosure Design and Development, Embedded System Development Environment: IDE, Cross compilation, Simulators/Emulators, Hardware Debugging, Hardware testing methods like Boundary Scan, In Circuit Testing (ICT) etc.

Text/Reference Books:

1. Jonathan W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Steave Furber, "ARM system on – chip architecture", Addison Wesley, 2000.
3. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

4. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinley , “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, 2nd Edition, Pearson Education.
5. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
6. David Simon, "An Embedded Software Primer", Perason Education, 2003.
7. Introduction to Embedded Systems – Shibu K.V, Mc Graw Hill.
8. F. Balarin et al., Hardware – Software Co-design of Embedded Systems: The POLIS approach, Kluwer, 1997

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

1. Learn basic of OS and RTOS and design embedded systems.
2. Suggest design approach using advanced controllers to real-life situations.
3. Design interfacing of the systems with other data handling / processing systems.
4. Understand embedded firmware design approaches.
5. Appreciate engineering constraints like energy dissipation, data exchange speeds etc.

ECPET07	Satellite Communication	3L:0T:0P	3 credits

Unit -1

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Unit -2

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit -3

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget.

Unit -4

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Unit -5

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002.
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009.
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009.

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

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

ECPET08	Wireless Sensor Networks	3L:0T:0P	3 credits

Unit -1

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

Unit -2

Overview of sensor network protocols: Routing / Network layer protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, Fundamentals of IEEE 802.15.4, ZigBee, Bluetooth, BLE (Bluetooth low energy), and UWB, Dissemination protocol for large sensor network.

Unit -3

Data dissemination and processing: Data dissemination, data gathering, and data fusion, Quality of a sensor network, differences compared with other database management systems, data storage, query processing, Real-time traffic support and security protocols.

Unit -4

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication, Single-node architecture, Hardware components & design constraints.

Unit -5

Programming tools: Operating systems and execution environments, introduction to TinyOS, C, and nesC, Performance comparison of wireless sensor networks simulation.

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Text/ Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications, 2011.
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications, 2004.
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009.

6. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.

Course Outcomes:

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

1. Design wireless sensor networks for different applications under consideration.
2. Understand emerging research areas in the field of sensor networks.
3. Understand MAC protocols used for different communication standards used in WSN.
4. Explore new protocols for WSN.
5. Handle special issues related to sensors like energy conservation and security challenges.

ECPET 09	NEURAL NETWORKS AND FUZZY LOGIC	3L:0T:0P	3 credits

Unit – 1

Artificial Neural Networks: Introduction to neural networks, biological neurons, artificial neurons, McCulloch-Pitt's neuron model, neuron modeling for artificial neural systems, feed forward network, perceptron network, Supervised and un-supervised learning.

Learning Rules: Hebbian learning Rule, Perceptron learning Rule, Delta learning Rule, Winner-take-all learning rule, Out-star learning rule.

Unit – 2

Supervised Learning: Perceptrons, exclusive OR problem, single layer perceptron network, multi-layer feed forward networks: linearly non separable patter classification, delta learning rule for multi perceptron layer, error back propagation algorithm, training errors , ADALINE, introduction to Radial Basis Function Networks(RBFN).

Unit – 3

Un-Supervised Learning: Hamming net, Max net. Winner–take–all learning, counter propagation network, feature mapping, self-organizing feature maps

Applications of neural Algorithms: elementary aspects of applications of character recognition.

Neural Network control applications: Process identification, Basic dynamic learning control architecture.

Unit – 4

Fundamentals of fuzzy logic and fuzzy sets: Definition of fuzzy set , a-level fuzzy set , cardinality, operations on fuzzy sets: union, intersection, complement, Cartesian product, algebraic sum, definition of fuzzy relation, properties of fuzzy relations, fuzzy composition.

Unit – 5

Design of Fuzzy Systems: Components of fuzzy systems, functions of fuzzification, Rule base patterns, Inference mechanisms.

Methods of de-fuzzification: COG, COA, MOM, Weighted average, height methods, Design of Fuzzy Systems for temperature setting of water heater, fuzzy system for control of air conditioner.

Text / References Books:

1. S.Rajasekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, and Genetic Algorithms", PHI, EEE, 2003.
2. FakhreddineO.Karrry&Clarance De Silva, " Soft Computing and Intelligent Systems, Design Theory, Tools and Applications", Pearson, 2009.
3. Jacek M Zurada, " Introduction to artificial Neural Systems", Jaico Publications.

4. Zimmerman, " Fuzzy Set Theory and its Applications" , Kluwer Academic Publishers.
5. Timothy J. Ross, " Fuzzy Logic with Engineering Applications" ,(McGrawHill).

Course Outcomes:

After successful completion of the course, the student will be In a position to

1. Understand the Biological neural systems and construction of artificial neural systems.
2. Understand and explain different learning rules
3. Understand the concept of pattern classification.
4. Identify the different types of supervised and unsupervised training algorithms.
5. Have a detailed knowledge of the components of fuzzy logic system.
6. Design fuzzy logic system and will address the real time applications.

ECPET 10	Introduction to MEMS	3L:0T:0P	3 credits

Unit -1

Introduction and Historical Background, Scaling Effects, Micro/Nano Sensors.

Unit -2

Actuators and Systems overview: Case studies.

Unit -3

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.

Unit -4

Micromachining: Surface Micromachining, sacrificial layer processes, Stiction, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -5

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Text/Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier,
New York, 2000.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

ECPET 11	Fiber Optic Communication	3L:0T:0P	3 credits

Unit -1

Overview of Optical Fiber Communication The evolution of fiber optic systems, elements of an optical fiber transmission link, block diagram, advantages of optical fiber communication, applications.

Introduction to vector nature of light, propagation of light, Ray theory transmission, total internal reflection, acceptance angle, numerical aperture and skew rays, propagation of light in a cylindrical dielectric rod, Ray model, wave model., Modes, electromagnetic mode theory and propagation, single mode and multimode fibers, linearly polarized modes.

Unit -2

Different types of optical fibers, Fiber material, fiber cables and fiber fabrication, fiber joints, fiber connectors, splicer, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation, Fabrication of fibers and measurement techniques like OTDR.

Unit -3

Optical Sources and Detectors: Coherent and non-coherent sources, quantum efficiency, modulation capability of optical sources, LEDs: Working principle and characteristics, Laser diodes: Working principle and characteristics , Working principle and characteristics of Photo-detectors: PIN-diodes, APDs, detector responsivity, noise analysis in detectors, coherent and non-coherent detection, receiver structure, bit error rate of optical receivers, and receiver performance, Optical link design - BER calculation, quantum limit, power penalties.

Unit -4

Optical switches - coupled mode analysis of directional couplers, electro-optic switches.

Optical amplifiers - EDFA, Raman amplifier.

Unit -5

Optical Networks: SONET and SDH standards, architecture of optical transport networks (OTNs), network topologies, Operational principle of WDM and DWDM systems, WDM network elements and Architectures, Principles of WDM networks, Solutions.

Nonlinear effects in fiber optic links: Concept of self-phase modulation, group velocity dispersion and solution based communication.

Text/Reference Books:

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.

4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Course Outcomes:

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

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors.
4. Analyze system performance of optical communication systems.
5. Design optical networks and understand non-linear effects in optical fibers.

ECPET 12	Digital Design through HDLs	3L:0T:0P	3 credits

Unit-1

VHDL Background: VHDL History, Existing Languages, VHDL Requirements, The VHDL Language. Design Methodology Based On VHDL: Elements of VHDL, Top down Design, Top down Design with VHDL, Subprograms, Controller Description, VHDL Operators, Conventions and Syntax. Basic Concepts In VHDL: Characterizing Hardware Languages, Objects and Classes, Signal Assignments, Concurrent and Sequential Assignments.

Unit-2

Design Organization and Parameterization: Definition and Usage of Subprograms, Packaging, Parts and Utilities, Design Parameterization, Design Configuration, Design Libraries. Utilities For High-Level Descriptions: Type Declarations and Usage, VHDL Operators, Subprogram Parameter Types and Overloading, Other Types and Type Related Issues, Predefined Attributes, User Defined Attributes.

Dataflow Descriptions In VHDL: Multiplexing and Data Selection, State Machine Description, Three State Bussing. Behavioral Description of Hardware: Process Statement, Assertion Statement, Sequential Wait Statements, Formatted ASCII I/O Operations, MSI Based Design. Implementation of Combinational and sequential circuits, Datapaths and control unit design , multiplier, ALU design

Unit-3

Verilog HDL: Overview of Digital design with Verilog HDL, Hierarchical modeling concepts, , Identifiers, operators, Data types, types of model, expressions, assignments, behavioral, Structural gate and switch level modeling, tasks and functions. Design using HDL- Adders, Multiplexers, decoders, Flip-flops, Counters, Shift registers, RTL coding guidelines , Coding organization and writing a test bench.

Unit- 4

Verification Basics: Technology challenges, Verification methodology options, Verification methodology, Test bench creation, test bench migration, Verification languages, Verification IP reuse, Verification approaches, Verification and device test, Verification plans, reference design of Bluetooth SoC, Verification Guidelines.

Unit-5

Testing & verification: Fault Modeling and Simulation, Functional testing, Design for testability-Scan based designs, Boundary scan standards (JTAG), Built in Self test (BIST).

Text/ Reference Books:

1. J. Bhaskar, "VHDL Primer", Third Edition, Published by PHI Learning, 2009.
2. Chris Spear, "System Verilog for Verification: A guide to learning the testbench language features", Springer, 2nd Edition
3. Stuart Sutherland, Simon Davidmann, and Peter Flake, "System Verilog for Design: A guide to using system verilog for hardware design and modeling", Springer, 2nd Edition.

4. Samir Palnitkar Verilog HDL A Guide to Digital Design and Synthesis, By Publication: Pearson Education

List of Open Source Software/learning website:

1) www.xilinx.com, Xilinx project navigator evaluation tools version.
2) www.altera.com, Altera Quartus evaluation software tool.

Course Outcomes: After learning the course the students should be able to:

1. Work with Hardware Descriptive Language like Verilog/VHDL.
2. Work with various EDA tools used in chip design process.
3. Work with EDA tools of VLSI.
4. Test and analysis of digital design on simulator that support HDL compiler.
5. Verification of soft code implemented in HDL through verification tools.
6. Implement various digital logic blocks on FPGA/CPLD boards.
7. System design and implementation on FPGA/CPLD boards.
8. Develop project based on FPGA/CPLD through HDL language.

ECPET 13	Error Correcting Codes	3L:0T:0P	3 credits

Unit – 1

Mathematical Preliminaries: Introduction, Groups, Rings, Fields, Galois Fields(GF), Arithmetic of Galois Field, Integer Ring, Polynomial Rings, Polynomials and Euclidean algorithm, primitive elements, Construction and basic properties of Finite Fields, Computations using Galois Field arithmetic, sub fields, Minimal polynomial and conjugates, Vector space, Vector Subspace, Linear independence. (9 hours)

Unit – 2

Linear Block Codes: Block codes, Properties, Minimum Distance, Error detection and correction, Standard Array and Syndrome decoding, Hamming codes, Perfect and Quasi-perfect codes, Extended codes, Hadamard codes, Maximum likelihood decoding, Hard decision decoding and soft decision decoding. (10 hours)

Unit – 3

Cyclic Codes: Basic theory of cyclic codes, Generator and Parity check matrices , Encoding and Decoding of Cyclic codes, sequential decoding of convolutional codes, Error detection & correction, Cyclic Hamming codes,Binary Golay codes, Bose Chaudhury & Hocquenghem(BCH) codes, Decoding of BCH codes,The Berlekamp- Massey decoding algorithm, Euclids algorithm, Reed Solomon codes, Generalized Reed Solomon codes, MDS codes. (9 hours)

Unit – 4

Convolutional Codes: Generator matrices and encoding, state, tree and trellis diagram, Transfer function , Maximum Likelihood decoding Hard versus Soft decision decoding, The Viterbi Algorithm, Free distance, BCJR algorithm, FanoMetric, Stack Algorithm, Fano Algorithm decoding, Error Analysis of convolution codes, Puctured Convolution codes. Trellis Coded Modulation- Encoding and Decoding. (9 hours)

Unit – 5

Low-density Parity-check (LDPC) Codes: Constructing LDPC codes, Decoding of LDPC Codes, Hard and Soft decoders, Message-passing decoders, Threshold phenomenon and density evolution.

Soft Decision and Iterative Decoding: Soft decision Viterbi algorithm, two-way APP decoding.

Turbo codes: Turbo algorithm, convergence properties of the turbo algorithm, Distance properties of turbo codes. (9 hours)

Text / References Books:

1. L.H.Charles Lee, "Error – Control block codes for communication Engineers", Artech House, 2000.
2. L. H. Charles Lee, "Convolutional Coding: Fundamentals and Applications, Artech House, Boston
3. Shu Lin and Daniel J. Costello Jr., Error Control Coding: Fundamentals and applications", 2nd edition, Pearson, Prentice Hall, 2004.
4. W.C. Huffman and Vera Pless, "Fundamentals of Error correcting codes", Cambridge University Press, 2003.
5. Rolf Johannesson, Kamil Sh. Zigangirov, "Fundamentals of Convolutional Coding", Universities Press (India) Ltd. ,2001.
6. Ezio Biglieri – coding for wireless channels, Springer International edition (SIE), 2005.

Course Outcomes: After successful completion of the course, the student will be In a position to

1. Find solutions to the problems associated with Galois fields.
2. Acquainted with basic block codes, cyclic codes, convolutional codes and BCH codes.
3. Able to gain knowledge of hard decision, soft decision codes, Turbo codes and LDPC codes.
4. Easily differentiate the specific application of specific code.
5. Able to apply encoding techniques for Mobile applications and Space communication.

ECPET 14	Mobile Communication and Networks	3L:0T:0P	3 Credits

Unit-1

Cellular Concept and System Design Fundamentals: Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications.

Cellular concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control.

Wireless Standards: Overview of 2G and 3G cellular standards.

Unit-2

Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, inter system Handoff, Introduction to Dropped Call Rates and their Evaluation, Interference and system capacity, trunking and grade of service, Improving Coverage and capacity in Cellular systems.

Signal propagation: Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing.

Unit-3

Fading channels-Multipath and small scale fading: Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate, Capacity of flat and frequency selective channels.

Unit-4

Antennas: Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.

Multiple access schemes: FDMA, TDMA, CDMA and SDMA.

Modulation schemes: BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Unit-5

Receiver structure: Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. **Performance measures**: Outage, average SNR, average symbol/ bit error rate.

System examples: GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/ Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

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

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

ECPET 15	Nano Electronics	3L:0T:0P	3 credits

UNIT I: Introduction: Evolution of science and nanotechnology,Introduction to nanotechnology, Difference between Nanoscience and nanotechnology, Feynman predictions on nanotechnology , Role of up and top down approaches in nanotechnology,challenges in nanotechnology. **(12Hrs)**

UNIT II: Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope –scanning tunneling microscope – nanomanipulator – nanotweezers – atom manipulation – nanodots – self assembly – dip pen nanolithography. (12Hrs)

UNIT III: Nanopowders-Synthesis and processing of nanopowders-process for producing ultrafine powders-mechanical milling,wet chemical synthesis, gas condensation process, chemical vapour condensation, laser ablation, Design and synthesis of self assembled nanostructured materials. **(12Hrs)**

UNIT–IV:Nano Materials: History of Materials, Definition, classification of Nanostructured Materials, cause of interest in Nanomaterials,Nanomaterials preparation-present and future applications of Nanomaterials,special nanomaterials,characterization and tools: carbon nanotubes, nano composites, carbon fullerenes: An overview of preparation,properties,Electron microscopy techniques:scanning Electron Microscopy,Transmission Electron Microscopy,scanning probe Microscopy-X ray Methods **(12Hrs)**

UNIT-V: NanoElectronics-Introduction to micro, nano fabrication: optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy, MEMS-Introduction,principles,Types of MEMS:-Mechanical, Thermal, Magnetic MEMS, Fabrication of MEMS.

Text /Reference Books:

1. Nano Materials by A S Edelstein& R C Cammarata,Institutee of physics publishing,Bristic and Philadelphia
2. 2.Nanotechnology by Mark Ratner &Danier Ratner ,Prentice Hall.
3. 3.Micro Manufacturing and Nanoteecnology by N.P.Mahalik.
4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
5. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
6. K.E. Drexler, Nanosystems, Wiley, 1992.

E-resources and other digital material

nptel.iitm.ac.in/courses.php?branch=Ece , www.cdeep.iitb.ac.in

Course outcomes

Upon successful completion of the course, the student will be able 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 theprocesses involved in making nano components and material
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

ECPET 16	Scientific Computing	3L:0T:0P	3 Credits

Unit-1

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-2

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

Unit-3

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

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.

Unit-4

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, 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, Eigenvalue Problems Partial Differential Equations,Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods

Unit-5

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers and Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.

Text/ Reference Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002.
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008.
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006.
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB and Octave", Springer, 3rd Ed., 2010

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.

ECPET 17	Digital Image & Video Processing	3L:0T:0P	3 Credits

Unit-1

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Image Transforms: Introduction. ,Need for image transforms, Fourier transform, 2 D Discrete Fourier transform and its properties, Walsh transform, Hadamard transform, Haar Transform, slant transform, Discrete cosine transform , Karhunen-loeve transform transform, singular value Decomposition, Radon transform, comparison of different image transforms.

Unit-2

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain.

Sharpening filters: first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Unit-3

Image compression : Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Lossless compression – predictive, entropy; Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression. Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Unit-4

Color Image Processing: Color models– RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening, Color Segmentation.

Video Processing: Video Formation, Perception and Representation, Video capture and display, Analog video raster, Analog color television systems, Digital video.

Unit-5

Fundamentals of Video Coding: Inter-frame redundancy, motion estimation techniques – full search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation: Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Text/ Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.
4. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, “Digital Image processing, Tata Mc Graw Hill publishers, 2009 .
5. Yao Wang,Jorn Ostermann and Ya Qin Zhang “Video processing and Communications” Prentice Hall Publishers, 2002, ISBN 0-13-017547-1.
6. nptel.iitm.ac.in/courses.php?branch=Ece
7. www.cdeep.iitb.ac.in

Course Outcomes:

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

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding.
4. Apply basic operations on video and Estimate the motion of two dimensional video.

ECPET 18	Bio-Medical Electronics	3L:0T:0P 3 credits

Unit-1

Brief introduction to human physiology.-Structure of cell – Function of each components of the cell – Membrane potential – Action potential – Generation and Conduction- Anatomy and Physiological aspects of respiration.

Unit-2

Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

Unit-3

Bio-electrodes and bio-potential amplifiers ---Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – non-polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes. Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, isolation amplifiers, Chopper amplifier.

Unit-4

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators, heart-lung machine, Artificial kidney, aids for the handicapped.

Unit-5

Safety aspects: – devices to protect against electrical hazards – Ground fault interrupter, isolation transformer, line isolation monitor, receptacle tester, electrical safety analyzer equipment, preventive maintenance.

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Course Outcomes:

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

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

ECPET 19	Adaptive Signal Processing	3L:0T:0P	3 Credits

Unit -1

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit -2

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

Unit -3

Variants of the LMS algorithm: The sign LMS families, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Signal space concepts: introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Unit -4

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit -5

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Course Outcomes:

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

1. Understand the non-linear control and the need and significance of changing the control parameters with respect to real-time situation.
2. Mathematically represent the 'adaptability requirement'.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

ECPET 20	Speech and Audio Processing	3L:0T:0P	3 credits

Unit -1

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.

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

Unit -2

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.

Unit -3

Speech Quantization: **Scalar quantization**: uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers.
Vector quantization: distortion measures, codebook design, codebook types.

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.

Unit -4

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

Code Excited Linear Prediction: CELP speech production model, Analysis-by-synthesis, Generic CELP encoders and decoders.

Unit -5

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.

Text / Reference Books:

1. A.M. Kondoz, "Digital Speech" Second Edition (Wiley Students Edition), 2004.
2. W.C. Chu, "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", Wiley Inter science, 2003.

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.

ECPET 21	Wavelet Theory and Applications	3L:0T:0P	3 credits

Unit I - Introduction:

Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Wigner-Ville transform, Time-frequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

Unit II - Continuous Wavelet Transform:

Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain.

Unit III - Discrete Wavelet Transform and Filter banks:

Orthogonal and biorthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

Unit IV - Multi Resolution Analysis:

Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packet analysis, Construction of wavelets.

Unit V - Applications:

Signal and Image compression, Detection of signal changes, analysis and classification of audio signals using CWT, Wavelet based signal de-noising and energy compaction, Wavelets in adaptive filtering,

Adaptive wavelet techniques in signal acquisition, coding and lossy transmission, Digital Communication and Multicarrier Modulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

Text/Reference Books:

1. A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press, 1999.
2. M. Vetterli and J. Kovacevic, Wavelets and Sub band Coding, Prentice Hall, 1995.
3. Raghuveer rao and Ajit S.Bopardikar, Wavelet transforms: Introduction, Theory and applications, Pearson Education Asia, 2000.
4. J.C. Goswami and A.K. Chan,Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd ed., Wiley, 2011.
5. Michel Misiti, Yves Misiti, Georges Oppenheim, Jean Michel Poggi, Wavelets and their Applications, John Wiley & Sons, 2010 .
6. J S Walker, A premier on Wavelets and their scientific applications, CRC press, 2002.
7. Stark, Wavelets and signal processing: An application based introduction, Springer, 2005.
8. Gerald keiser, A friendly guide to Wavelets, Springer, 2011.
9. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2004.
10. Desanka.P. Radunovik, Wavelets: from math too practice, Springer, 2009.
11. K P Soman and KL Ramachandran, Insight into wavelets from theory to practice, PHI, 2008.

Course Outcomes:

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

1. Understand time-frequency nature of the signals.
2. Apply the concept of wavelets to practical problems.
3. Mathematically analyze the systems or process the signals using appropriate wavelet functions.

ECPET 22	**Machine learning**	**3L:0T:0P**	**3 credits**

Course Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Unit 1:

Supervised Learning (Regression/Classification)

- Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes.
- Linear models: Linear Regression, Logistic Regression, Generalized Linear Models
- Support Vector Machines, Nonlinearity and Kernel Methods.
- Beyond Binary Classification: Multi-class/Structured Outputs, Ranking. 10

Unit 2

Unsupervised Learning

- Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA
- Matrix Factorization and Matrix Completion
- Generative Models (mixture models and latent factor models). 7

Unit 3

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests.) 6

Unit 4

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning. 9

Unit 5

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Various models for IOT applications.

Text / References Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Course Outcomes: After completion of course, students would be able to:

1. Extract features that can be used for a particular machine learning approach in various IOT applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyze various machine learning approaches and paradigms.

ECPET 23	Power Electronics	3L:0T:0P	3 credits

Unit -1

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit -2

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit -3

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit -4

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical

analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Unit -5

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:

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.

ECPET 24	Mixed Signal Design	3L:0T:0P	3 credits

Unit -1

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Unit -2

Switched-capacitor filters: Non-idealities in switched-capacitor filters, Switched-capacitor filter architectures, Switched-capacitor filter applications.

Unit -3

Basics of data converters; Successive approximation ADCs, Dual slope ADCs,Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Unit -4

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Unit -5

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs, Digital PLLs, DLLs.

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

Course Outcomes:

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

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals.

ECPET 25	High Speed Electronics	3L:0T:0P	3 credits

Unit -1

Transmission line theory (basics) crosstalk and non-ideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation, Cross-modulation, Dynamic range.

Unit -2

Devices: Passive and active, Lumped passive devices (models), Active (models, low vs highfrequency).

Unit -3

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion, Efficiency.

Unit -4

RF power output stages Mixers –Up conversion Down conversion, Conversion gain and spurious response, Oscillators Principles, PLL Transceiver architectures.

Unit -5

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards, Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399.
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5. Kai Chang, "RF and Microwave Wireless systems", Wiley. 6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

Course Outcomes:

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

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics.
3. Design High-speed electronic system using appropriate components.

ECPET 26	Internet of Things and Applications	3L:0T:0P	3 credits

Course Outcomes:

At the end of this course, students will be able to

1. Understand the concept of IOT and M2M
2. Study IOT architecture and applications in various fields
3. Study the security and privacy issues in IOT.

Unit 1

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

Text / Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1stEdition, Apress Publications, 2013.
3. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.