SRM UNIVERSITY AP
Andhra Pradesh

School of Engineering and Applied Sciences

B. Tech Electronics and Communication Engineering

AY: 2018-2022

Syllabus

Department of Electronics and Communication Engineering
SRM University-AP, Andhra Pradesh.

Semester-I					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
ENL 101	Communicative English	3	0	0	3
CDC 111	Soft Skills-1	1	0	0	1
BIO 101	Introduction to Biology	2	0	2	3
MAT 112	Mathematics-I	3	0	0	3
CSE 102	Basic Computer Science and Programming	3	0	2	4
ENG 111	Basic Electronics	3	0	2	4
PHY 112	Classical Mechanics	2	0	2	3
	TOTAL	**17**	**0**	**8**	**21**

Semester-II					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
CDC 102	Soft skills-II	1	0	0	1
CSE 223	Data Structures and algorithms using C	3	0	2	4
ECO 121	Principles of Economics	3	0	0	3
PHY 221	Electricity and Magnetism	2	0	2	3
MAT 121	Multivariable Calculus	3	0	0	3
ENV 111	Environmental Science	2	0	2	3
CHE 101	Principles of Chemistry	2	0	2	3
	TOTAL	**16**	**0**	**8**	**20**

Semester-III					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
	Humanities/Social Studies Elective	3	0	0	3
MAT 211	Linear Algebra	3	0	0	3
EE 211	Electrical Technology	2	0	2	3
ECE 211	Digital Electronics	3	0	2	4
ECE 212	Signals and Systems	3	0	2	4
CDC 204	Quantitative Aptitude	1	0	0	1
ENG 101	Engineering Fundamentals	2	0	2	3
	TOTAL	**17**	**0**	**8**	**21**

Semester-IV					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
CDC 203	Verbal Ability	1	0	0	1
ECE 224	Probability and Random Variables	3	0	0	3
ECE 221	Analog Electronics	3	0	2	4
EEE 212	Control Systems	3	0	0	3
ECE 222	Digital Signal Processing	3	0	2	4
CSE 230	Industry Standard Coding Practice-I	1	0	0	1
ECE 223	Electromagnetic and Wave propagation	4	0	0	4
	TOTAL	**18**	**0**	**4**	**20**

Semester-V					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
ECE 311	Analog Communication	3	0	2	4
ECE 317	HBL based FPGA Design	3	0	2	4
ECE 313	Microprocessors and Interfacing	3	0	2	4
ECE 314	Transmission lines and waveguides	3	0	0	3
TE ECE 316 ECE 315	Technical Elective Information theory and coding Data Communication	3	0	0	3
OE ECE 318	Open Elective Quantum Electronics and Communication	3	0	2	4
CDC 331	Employability Skills	1	1	0	0
CSE 330	Industry Standard Coding Practice - 2	0	0	4	1
	TOTAL	**19**	**1**	**12**	**23**

Semester-VI					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
ECE 321	Microwave theory and Applications	3	0	2	4
ECE 320	VLSI Design	3	0	2	4
ECE 323	Digital Communication	3	0	2	4
ENG 328	UROP	0	0	6	3
OE	**Open Elective**	3	0	0	3
TE PHY 327 ECE 328 ECE 329	**Technical Elective** Introduction to Photonics Satellite Communication Optical Communication	3	0	0	3
CSE 331	Industry Standard Coding Practice-3	0	0	4	1
ISES 312	Industry Specific Employability Skills-VI	1	1	0	0
	TOTAL	**16**	**1**	**16**	**22**

Semester-VII					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
TE ECE 411	**Technical Elective** Embedded systems for Design	3	0	2	4
ECE 419	Fundamentals of wireless communication	3	1	0	4
ECE 410 ECE 416	Adaptive Signal Processing Network control systems	3 3	0 0	0 2	3/4
OE	**Open Elective**	3/3	0/0	0/2	3/4
OE	**Open Elective**	3/3	0/0	0/2	3/4
OE	**Open Elective**	3/3	0/0	0/2	3/4
	TOTAL	**18**	**0**	**2/12**	**19/24**

Semester-VIII					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
ECE 421	Capstone Project	0	0	24	12
	TOTAL	**0**	**0**	**24**	**12**

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List of HS Electives in III-Semester					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
COM 001	Contemporary Issues in Finance	3	0	0	3
ECON 331	Macroeconomics and International Trade	3	0	0	3
HIS 100 A	Idea of India	3	0	0	3
BME 002	Marketing Management	3	0	0	3
BBA 001	Organizational Dynamics	3	0	0	3
ENL 233	Modern Indian Theatre	3	0	0	3

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List of Open Electives in VI-Semester					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
CSE 411	Big Data Analytics	3	0	2	4
CSE 202	Web Technology	3	0	0	3
CSE 202 L	Web Technology Lab	0	0	2	1
ECE 324	Computer Organization and Architecture	3	0	0	3
ECE 325	Digital Image Processing	3	0	0	3
ECE 410	Adaptive Signal Processing	3	0	0	3
ME 416	Surface Engineering	3	0	0	3
ME 562	Mechanical Behavior of Materials	3	0	0	3
ME 223	Alternate Energy Sources	3	0	0	3
EEE 314	Nuclear Power Generation	3	0	0	3
PHY 307M	Special Theory of Relativity	3	0	2	4
PSY 111	Psychology for Everyday Living	4	0	0	4
HIS 200	India and Its People	4	0	0	4
HIS 005	Introduction to Gender	4	0	0	4
MAT 355	CALCULUS OF VARIATION	4	0	0	4
IDEA 103	User Experienced Design	3	0	0	3
IDEA 104	Dream-Discover-Disrupt	3	0	0	3
EEE 315	Artificial Neural Networks	3	0	0	3
MOOC100	Introduction to Robotics	3	0	0	3
MOOC101	Psychology of Stress, Health and Well-being	3	0	0	3
MOOC102	Introduction to Film Studies	3	0	0	3
MOOC103	German - I	3	0	0	3

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List of Open Electives in VII-Semester					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
CSE 202	Web Technology	3	0	0	3
CSE 202 L	Web Technology lab	0	0	2	1
ECE 418	Machine Learning	3	0	2	4
EEE 422	Optimization Techniques	3	0	0	3
ME 418	Introduction to Electric Vehicles	3	0	0	3
IDEA 102	Design Thinking	3	0	0	3
MAT 305	Introduction to Science and Technology	4	0	0	4
PSY 111	Psychology for Everyday Living	4	0	0	4
PSY 116	Neuro Linguistic Programming - Level I	3	0	0	3
BIO 112	Basic Microbiology	4	0	0	4
PHY 223	Introduction to Quantum Computations	3	1	0	4
HIS 005	Introduction to Gender	3	0	0	3
ECO 251	Indian economy	4	0	0	4
EGL 167	Code Name Language	4	0	0	4
TLC 101	Cognitive Learning Theories	2	1	0	3
EEE 305	Advanced Control Systems	3	0	0	3
EEE 305 L	Advanced Control Systems lab	0	0	2	1
MAT 307	Combinatorics and graph theory	4	0	0	4
PHY 301	Atomic and Molecular Physics	3	0	0	3
COM 101	Business Organization and Management	3	0	0	3
COM 107	Finance for Engineering	3	0	0	3
JOU 001	Media through the ages: From print to social	3	0	0	3
CSE 411	Big Data Analytics	3	0	2	4
EEE 421	Linear Systems	3	0	0	3
ME 433	Introduction to High Performance Computing	3	0	0	3
MAT 355	Calculus of Variation	4	0	0	4
MAT 306	First course in cryptography	4	0	0	4
BBA 606	Corporate Social Responsibility	3	0	0	3
BIO 113	Biochemistry I - Biomolecules	4	0	0	4
PHY 224	Introduction to Optics	3	0	0	3
HIS 100	Idea of India	4	0	0	4
TLC 102	Teaching and Learning	3	0	0	3
EGL 333	Thing Theory	4	0	0	4
COM 108	Investment Analysis	3	0	0	3
BBA 304	Human Resource Management	4	0	0	4
IDEA 104	Dream Discover Disrupt	3	0	0	3
CHE 202	Renewable Energy	3	0	0	3
BIO 102	Introductory Biology	4	0	0	4
EGL 102	Technical Writing	4	0	0	4
MAN 001	Mandarin	3	0	0	3

List of Electives					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
ECE 330	Communication Electronics	3	0	0	3
ECE 331	Digital Design with Verilog	3	0	0	3
ECE 325	Digital Image Processing	3	0	0	3
ECE 403	Digital Switching and Multiplexing	3	0	0	3
ECE 332	Digital System Design	3	0	0	3
ECE 333	DSP Processors and Architectures	3	0	0	3
ECE 334	EMI and EMC Techniques	3	0	0	3
ECE 419	Fundamentals of wireless communication	3	0	0	3
ECE 319	Microcontrollers and Applications	3	0	0	3
ECE 335	Modern Digital Signal processing	3	0	0	3
ECE 336	Radar Signal Processing	3	0	0	3
ECE 337	Speech Processing	3	0	0	3
ECE 338	Statistical Theory of Communication	3	0	0	3
ECE 339	Wireless Networks	3	0	0	3
ECE 410	Adaptive Signal Processing	3	0	0	3

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SEMESTER-I

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENL 101	Communicative English	HS	3	0	0	3

UNIT I: RHETORIC AND PUBLIC SPEAKING
Rhetoric, Critical Thinking and Public Speaking; Thinking Outside the Box; How to Deliver a Speech; Fundamentals of Persuasion.

UNIT II: NONVERBAL COMMUNICATION
Nonverbal Communication; Spatial distance, Eye contact and appearances; How nonverbal communication is more important than words.

UNIT III: COMMUNICATION AND THE MEDIA
Persuasion and the media; Radio, television, film, Social media and the internet; How the media sells ideas, images. Products and lifestyles; Fundamentals of Informative/Scientific. Speeches and Research; The Heart of the Speech – Powerful Narratives; The Power of Narrative.

UNIT IV: SMALL GROUP COMMUNICATION
Small group communication; Leadership, Conflict and persuasion in groups. The importance of small groups in business. Dr. A. Fisher's Fundamentals of Small Groups; Group Problem Solving; Learning to say no – don't say you will when you won't. Don't say yes and then don't do it, be true to your word.

UNIT V: PERSUASION, IDEOLOGY AND MEDIA BIAS
Advanced Rhetoric, Ideology, Persuasive Fallacies, How to Construct a Persuasive Speech, How to Present Scientific Data in a Speech, Unmasking Media Bias and Ideology, Full circle – the dangers of rhetoric and ideology.

TEXTBOOKS/REFERENCES

1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, 6th Edition, Pearson Publishing.
2. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition.
3. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CDC 111	Soft Skills-I	HS	1	0	0	1

UNIT I: KNOW THYSELF
Grooming & Social etiquette.

UNIT II: PERSONALITY DEVELOPMENT
Personality construct, The KSAB Model, Components of perception, perceptual errors, perception as a precursor of attitude and behavior.

UNIT III: COMMUNICATION
The 3 Vs of communication: Visual or Kinesics, Vocal (Articulation), Verbal, Active listening, Barriers to listening, GARF (Giving and Receiving Feedback).

UNIT IV: PRESENTATION SKILLS
The four Ps of presentation, Handling different types of target audience.

UNIT V: TIME MANAGEMENT & GOAL SETTING
Pressure Cooker (Activity based on Planning, Organizing and Prioritization), Roller Coaster (Activity on setting SMARTER goals, planning & organizing, short- & long-term goals).

TEXTBOOKS

1. The Perception of Deception, David Icke, David Icke Books, 2014,
2. Eye and Brain: The Psychology of Seeing, Richard, Langton Gregory, Princeton University Press, 1997
3. Awaken the Giant Within, Anthony Robbins, Pocket Books, 2001.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BIO 101	Introduction to Biology	BS	2	0	2	3

UNIT I: BASIS OF LIFE AND DIVERSITY

Molecular evolution, elements to molecules: water, carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals. Diversity of life: virus, bacteria, archea and eukarya. Concept of terrestrial, aquatic and amphibians. Mode of energy & carbon utilization-auto, hetero and lithotrophs.

UNIT II: CELL BIOLOGY

cell: Morphology, cell organelles and functions. concept of unicellular and multicellular organisms. Cell cycle and cell division: mitosis and meiosis. basis of cell-cell communication and signaling.

UNIT III: MOLECULAR BIOLOGY

DNA and chromosomes: structure and organization, DNA replication, transcription, translation. Introduction to genetic engineering.

UNIT IV: ENZYMES AND APPLICATIONS

Introduction to enzymes; classification, parameters influencing the enzyme activity, mechanism of enzyme action and enzyme inhibition. Commercial applications of microorganisms and enzymes.

UNIT V: BIOLOGICAL SEQUENCES AND DATABASES

DNA and Protein sequences, Concept of genomics, transcriptomics, proteomics and metabolomics. File formats of sequence storage: FASTA file, GenBank. Biological databases – NCBI and EMBL browsers, KEGG and UniProt databases. Usefulness of biological Metadata-Array expression and 1000 genomes. Application of BLAST and Protein/Gene ID conversion.

TEXTBOOKS

1. Thrives in Biochemistry and Molecular Biology, Edition 1, 2014, Cox, Harris, Pears, Oxford University Press.
2. Exploring Proteins, Ed. 1, 2014, Price and Nairn,Oxford University Press.
3. Thrives in Cell Biology, Ed. 1, 2013, Qiuyu Wang, Cris Smith and Davis, Oxford University Press.

REFERENCE

1. Lehninger,A. L., Nelson, D.L., &Cox, M. M. Lehninger principles of biochemistry. (2000). Worth Publishers, New York.
2. Wilson, K.,Walker, Principle and techniques of biochemistry and molecular biology,(2005). 6thedn. Cambridge University Press, Cambridge.
3. Harvey Lodish, Arnold Berk and Chris A. Kaiser, Molecular Cell Biology, Ed. 8, 2016, W. H Freeman & Co (Sd).
4. Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. 2014. Molecular Biology of the Cell. (Sixth Edition). W.

W. Norton & Company.
5. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Emily Taylor, Greg Podgorski and Jeff Carmichael. 2016. Biological Science. (6th Edition). Pearson.
6. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Robert and Peter Walter. 2014. Essential Cell Biology. (4th Edition). W. W. Norton & Company.
7. Lisa A. Urry , Michael L. Cain , Steven A. Wasserman , Peter V. Minorsky , Jane B. Reece. 2016. Campbell Biology (11th Edition). Pearson.
8. Peter H Raven, George B Johnson, Kenneth A. Mason, Jonathan Losos and Susan Singer. 2016. Biology. (11th Edition). McGraw-Hill Education.

LIST OF EXPERIMENTS

1. Isolation of starch from potato.
2. Estimation of carbohydrates.
3. Determination of enzyme activity (amylase assay).
4. Observation of various stages of mitosis in onion root tips.
5. Isolation, purification and observation of microbes from different sources.
6. Microbial gram staining.
7. Purification of DNA, restriction digestion, agarose gel electrophoresis and visualization.
8. Isolation of proteins and determination of protein concentration using Bradford's method.
9. Separation of proteins using SDS-PAGE and Coomassie staining.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 112	Mathematics-I	BS	3	0	0	3

UNIT I: LIMIT AND CONTINUITY
Limit of a function at a point, one-sided limits, continuity, limits involving infinity.

UNIT II: DIFFERENTIATION
Derivative at a point, derivative as a function, product rule, quotient rule and chain rule, implicit differentiation, Rolle's theorem, mean value theorem.

UNIT III: INTEGRATION
Area as a limit of finite sums, definite and indefinite integral, fundamental theorem of calculus, integration by substitution, integration by parts, integration by partial fractions.

UNIT IV: APPLICATION OF CALCULUS
Maxima and minima, concavity and curve sketching, optimization problems in physics, economics & mathematics, area between curves, volumes, arc length, moments and centers of mass, newton's method to find roots.

UNIT V: SEQUENCE AND SERIES
Sequences, sum of a series, comparison test, root test, ratio test, leibniz theorem on alternating series, power series, taylor's and maclaurin series, absolute and conditional convergence.

TEXTBOOKS/REFERENCE

1. Thomas' Calculus, 14th Edition, Joel R. Hass,Christopher E. Heil, Maurice D. Weir, 2018.
2. Introduction to Real Analysis 4th Edition, Robert G. Bartle, Donald R. Sherbert, 2014.
3. Calculus and Analytic Geometry, 9th Edition, George B. Thomas, Jr. Ross L. Finney. 2017.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 102	Basic Computer Science and Programming	ES	3	0	2	4

UNIT I: INTRODUCTION TO PYTHON

Knowledge, Machines, Languages, Types, Variables Operators and Branching -– Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

UNIT II: FUNCTIONS

Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files.

UNIT III: TUPLES AND LISTS

Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples.

UNIT IV: CLASSES AND INHERITANCE

Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Gradebook Example, Generators.

UNIT V: COMPUTATIONAL COMPLEXITY

Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

TEXTBOOKS/REFERENCE

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173.
3. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016).

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LIST OF EXPERIMENTS

1. A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount.
2. Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating the nature of real roots, along with the values of the real roots (if any).
3. Write a Python program to find the factorial of the given number (Example: 5!= 5*4*3*2*1 =120)
4. Write a Python program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
5. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
6. Write a python program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm? Explain with an example, where the list of elements is not sorted then what would be the output after each iteration/pass.
7. Write a python program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
8. Write a Program in python using object-oriented concept to make calculator which has the following operations: Addition, Subtraction, Multiplications, Divisions, Exponentials, Modulus.
9. Define is inheritance? Explain with suitable example: Single level inheritance, Multiple Inheritance, Multi-level Inheritance.
10. Write a Program in python using object-oriented concept to create a base class called Polygon and there are three derived classes named as triangle, rectangle and square. The base class consists of the input function for accepting sides length and the derived classes must have output function for displaying area of triangle, rectangle and square.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 112	Classical Mechanics	BS	2	0	2	3

UNIT I: REVIEW OF NEWTONIAN MECHANICS

Introduction to Vector and Coordinate systems, Kinematics: Equations of motion for constant acceleration. Dynamics: Contact forces, Static friction, kinetic friction and worked examples. Free body force diagram; Applications of Newton's law. Worked examples (i.e. pulley, inclined planes) Momentum and Impulse, Impulse momentum theorem. Center of Mass: Calculation of Center of mass for complex systems Work and Kinetic Energy Theorem, Motion at Inclined Plane, Conservation of linear and angular momenta, worked example (Fly wheel).

UNIT II: WAVES, OSCILLATIONS, OPTICS

Simple harmonic motion: simple pendulum, compound pendulum, Damped and driven harmonic oscillations, Quality factor; electrical equivalent (LCR circuit). Circular motion in analogy of Simple Harmonic Motion. Longitudinal waves, transverse waves; standing waves, Concept of Electromagnetic waves. Optics: Interference, diffraction (qualitative). Double slit interference and concept of coherence length, Polarization of light (qualitative), Concept of Lasers.

UNIT III: CLASSICAL THERMODYNAMICS

Thermodynamic systems and equilibrium: example of ideal gas, Zeroth law of thermodynamics and concept of temperature. First law of thermodynamics, internal energy and specific heat. Second law of thermodynamics, Entropy, reversibility. Application of 1st and 2nd law of thermodynamics, Concept of work and free energies. Concept of Phases: Example of phase transitions, Black body radiation – Stefan's law.

UNIT IV: REVIEW OF ELECTRO-MAGNETISM

Properties of charge and Coulomb's law, calculation of electric field and potential. Gauss's law (differential and integral form). Application of Gauss's law (line, plane, spherical symmetry) Dielectrics from the concept of dipole movements in material, Fields in parallel plate capacitor with dielectric medium. Biot-Savart Law for magnetic fields, Magnetic field (circular loop). Ampere's circuital law, Examples – Infinite wire and Solenoid. Lenz's Law, Faraday's law. Maxwell's equations.

UNIT V: MATERIAL PROPERTIES

States of Matter: Solid, Liquid, Gases and Plasma, Mechanical Properties of solids: linear elasticity (Hooke's Law). Elastic moduli. Shear stress and strain. Rigidity modulus. Moment of Cantilevers: Young's Modulus. Bulk and surface properties of liquid – Adhesion, Cohesion, Surface Tension. Viscosity of liquids, Stoke's equation, Bernoulli's principle (Quantitative).

TEXTBOOKS/REFERENCE

1. University Physics With Modern Physics with Mastering Physics - D Young, Roger A Freedman And Lewis Ford, XII Edition (2018), Publisher – PEARSON
2. Physics for Scientist and Engineers - Raymond A. Serway, John W. Jewett XIX Edition (2017), Publisher - Cengage India Private Limited
3. Concept of Modern Physics - Arthur Besier, Shobhit Mahajan, S Rai, 2017 Edition, Publisher - Tata McGraw Hill.
4. Introduction to Electrodynamics – David J. Griffiths; 4th Edition (2012), Publisher - PHI Eastern Economy Editions.
5. Electricity and Magnetism - A S Mahajan and A ARangwala, Revised of 1Edition (2001), Publisher - McGraw-Hill.
6. Advanced Engineering Mathematics - Erwin Kreyszig, X Edition (2016), Publisher - Wiley.

LIST OF EXPERIMENTS

1. (a.) Revisions of Vernier caliper and Screw Gauge measurement methods.
   (b.) Plotting experimental data in graphs and error analysis.
2. To determine the moment of inertia of a flywheel.
3. (a.) Measurement of time period for a given compound pendulum with different lenghs.
   (b.) To determine radius of gyration of a given pendulum.
4. Verification of Stefan`s Law.
5. Measurement of specific heat capacity of any given material.
6. Verify of Hooke's law and to determine spring contact for given spring combinations.
7. To determine the rigidity modulus of steel wire by torsional oscillations.
8. To calculate Young's modulus of a given material by deflection method.
9. (a.) To measure the capacitance as a function of area and distance between the plates.
   (b.) To determine the dielectric constant of different dielectric materials.
10. (a.) Measurement of the induced voltage impulse as a function of the velocity of the magnet.
    (b.) Calculation of the magnetic flux induced by a falling magnet as a function of the velocity of the magnet.
11. (a.) To study the magnetic field along the axis of a current carrying circular loop.
    (b.) To study the dependency of magnetic field on the diameter of coil.
12. (a.) To investigate the spatial distribution of magnetic field between coils and determine the spacing for uniform magnetic field.
    (b.) To demonstrate the superposition of the magnetic fields of the two individual coils.
13. Study of B-H-Curve, To study permeability curve of a given material.

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SEMESTER-I

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENG 111	Basic Electronics	ES	3	0	2	4

UNIT I: BASIC ELECTRONIC CIRCUIT CONCEPTS

Introduction to Units, Scales, Charge, Current, Voltage, Power, Voltage and Current Sources, Dependent and Independent Sources, Ohm's Law, Resistance, Conductance, Resistivity, Conductivity. Introduction to Nodes, paths, Branches, Loop and KCL, Numericals. KVL, Single Loop and node pair circuits analysis. Series and Parallel connected sources, Resistors in series, parallel, Voltage and Current Division, Numerical, Thevenin Equivalent Circuits, Norton Equivalent Circuits.

UNIT II: SEMICONDUCTOR BASICS AND DIODE MODELS

Introduction to Semiconductors- Si, Ge, GaAs, Covalent bonding and Intrinsic Semiconductors, Difference in band Diagrams of Insulators, conductors, Semiconductors, Doped Semiconductor, n-type and p-type, Current mechanisms in Semiconductor-Drift and Diffusion with expressions, Resistivity of a semiconductor, Numerical, PN Junction Diode Operation under No Bias, Forward bias, Reverse Bias conditions, I-V characteristics, Reverse Breakdown, Effect of Temperature on Diode characteristics, I-V Characteristics of Ideal vs Practical diodes, Diode Resistance levels, Diode Equivalent circuits- Piecewise, Simplified and Ideal Diode models and I-V Characteristics, Diode Capacitances and Reverse recovery time, Zener Diode operation.

UNIT III: DIODE APPLICATIONS

Load line Analysis, Series and Parallel Diode Configurations and analysis of circuits with application of KCL, KVL, etc. Diode based AND/OR Logic gates design and analysis, Half wave Rectifier Operation; Circuit, waveforms, DC output, Peak output, Ripple factor with a filter circuit, PIV, Bridge Full wave Rectifier Operation; Circuit, waveforms, DC output, Peak output, Ripple factor, PIV, CT Full wave Rectifier Operation; Circuit, waveforms, DC output, Peak output, Ripple factor with a filter circuit, PIV. Analysis and Design with Series and Parallel configuration of Clipper circuits. Analysis and Design with Series and Parallel configuration of Clipper circuits. Clamper Circuits and analysis with DC sources, Zener Diode as Voltage Regulator circuit.

UNIT IV: BJT and MOSFETs

BJT structure and Physical operation, Large signal models and Operation in Saturation, BJT Current-Voltage characteristics and Graphical Representation, Early effect and model. Analysis of BJT circuits at DC, MOSFET structure and operation, P-MOSFET and CMOS introduction, MOSFET I-V Characteristics, Large signal model, Channel Length modulation and Characteristics, Model. Analysis of MOSFET circuits at DC.

UNIT V: SINGLE STAGE TRANSISTOR AMPLIFIERS

Basic Principles of Amplification: BJT vs MOSFET, BJT and MOSFET small signal operation and models, BJT and MOSFET basic configurations, characterizing amplifiers, Analysis of CS (CE) Amplifiers with source (Emitter) Resistance, Analysis of CG and CB Amplifiers. Analysis of Source and Emitter followers, BJT and MOSFET biasing arrangements.

TEXTBOOKS

1. Engineering Circuit Analysis, by William Hayt, J E Kemmerly and S.M. Durbin, 8th Edition, Mc Graw Hill.
2. "Electronic Devices and Circuit Theory" by R L Boylestad, L Nashelsky, 11th edition.
3. "Microelectronic Circuits Theory and Applications", by Sedra and Smith, 7th Edition, Oxford.

LIST OF EXPERIMENTS

1. Verification of KCL, KVL and Ohm's Laws.
2. Analysis of a Given Circuit with Resistors and Sources and Verification.
3. Verification of PN Junction Diode I-V Characteristics in FB and RB Operation.
4. Diode based Rectifier Circuits.
5. Introduction to PCB design.
6. Diode based Clipper and Clamper Circuits.
7. Zener Diode as Voltage Regulator.
8. BJT CE Configuration Input and Output Characteristics.
9. MOSFET CS Configuration Input and Output Characteristics.
10. MOSFET Single stage CS Amplifier Frequency Response.

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SEMESTER-II

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CDC 102	Soft Skills-II	HS	1	0	0	1

UNIT I: MOTIVATION
Maslow's theory of Motivation Soldiers' Walk and The Japanese Fan (Activities on factors of motivation), Steps to ward off de-motivation.

UNIT II: CREATIVITY AND INNOVATION
Activity on Brain Storming, Types of Creativity, Common Barriers of creativity, Sources of New Idea, Activity topics to enhance the power of aesthetics and precision. Aim is to create interest in research, Activity.

UNIT III: CRITICAL AND LATERAL THINKING
Importance's of Critical and Lateral thinking, Fill Me Up, Stimulating Lateral Thinking, Activity to enhance critical and lateral thinking.

UNIT IV: TEAM DYNAMICS
Importance of Team Dynamics, Story boarding, Frenzy, Activities Come to my Island, Striking Cars, Defend the Egg, Tallest Tower, Activities on the different stages of team building, team communication, coordination and collaboration.

UNIT V: MINI PROJECT
Individual projects on topics provided by faculties.

TEXTBOOKS/REFERENCE

1. Maslow, A. H. (1943) A Theory of Human motivation. In R. J. Lowry (1973) Dominance, Self-Esteem, Self-Actualization: Germinal Papers of A.H. Maslow (pp. 153-173). Belmont, California: Wadsworth Publishing Company, Inc.
2. Sparking Student Creativity, Practical ways to promote innovative and problem solving, Patti Drapeau.
3. Teach yourself to think, Edward de Bono, 1995.

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 223	Data Structures and Algorithms using C	ES	3	0	2	4

UNIT I: INTRODUCTION TO C PROGRAMMING

Identifiers, basic data types, constants, variables, keywords, operators: arithmetic, relational and logical, increment and decrement operators, conditional operator, assignment operators, Instruction: type declaration, Input-output, conditional, loop control, Arrays, Functions, pointers, dynamic memory management functions Derived types- structures- declaration, definition and initialization of structures, accessing member of structure, arrays of structures, structures and functions, pointers to structures, self-referential structures.

UNIT II: INTRODUCTION TO DATA STRUCTURES

Stacks and Queues: representation and application, implementation of stack and queue operations using C. Linked lists: Single linked lists, implementation of link list and various operation using C, Double linked list, circular list.

UNIT III: TREES

Tree terminology, Binary tree, Binary search tree, infix to post fix conversion, postfix expression evaluation. General tree, AVL Tree, Complete Binary Tree representation.

UNIT IV: GRAPHS

Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, shortest path algorithms. Implementation of shortest path algorithm using C.

UNIT V: SORTING AND SEARCHING TECHNIQUES

Bubble sort and its algorithm analysis, Selection sort and its algorithm analysis, Insertion sort and its algorithm analysis, Quick sort and its algorithm analysis, Merge sort and its algorithm analysis, Heap sort and its algorithm analysis, Radix sort and its algorithm analysis, Linear and binary search methods and its algorithm analysis, Hashing techniques and hash functions.

TEXTBOOKS

1. Data structure using C, Aaron M. Tenenbaum, Y Langsam and Mosche J. Augenstein, Pearson publication.
2. Data structures and Algorithm Analysis in C , Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh , Second Edition, Oxford University Press.
3. Programming with C, Byron Gottfried, McGraw hill Education, Fourteenth reprint,2016

REFERENCE

1. Fundamentals of data structure in C - Horowitz, Sahani & Anderson Freed, Computer Science Press.
2. Fundamental of Data Structures - (Schaums Series) Tata-McGraw-Hill.
3. G. A. V. Pai: “Data Structures & Algorithms; Concepts, Techniques &
4. Algorithms” Tata McGraw Hill.

LIST OF EXPERIMENTS

1. Write a C program to find the factorial of the given number (Example: 5! = 5*4*3*2*1 =120).
2. Write a C program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until “-10” is encountered.
3. Write a C program for implementation of Stack operations using arrays.
4. Write a C program for implementation of Queue operations using arrays.
5. Write a C program for Linked list implementations and problems related to linked list such as inverting list, concatenation, etc.
6. Write a C program for Linked list-based implementation of stack and queue operations.
7. Write a C program for Evaluation of expressions.
8. Write a C program for implementation of Binary tree traversals techniques.
9. Write a C program for implementation of Graph traversals techniques (BFS and DFS).
10. Write a C program for Linear search and Binary search algorithms. What is the best case and worst-case time complexity of those searching algorithms?
11. Write a C program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm?
12. Write a C program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
13. Write a C program for Insertion sort algorithm. What is the worst case or average case time complexity of Insertion sort algorithm?
14. Write a C program for Quick sort algorithm. What is the worst case or average case time complexity of Quick sort algorithm?
15. Write a C program for Merge sort algorithm. What is the worst case or average case time complexity of Merge sort algorithm?

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECO 121	Principles of Economics	HS	3	0	0	3

UNIT I: INTRODUCTION TO ECONOMICS

Why study economics? Scope and method of economics; the economic problem: scarcity and choice; the question of what to produce, how to produce and how to distribute output, Science of economics; the basic competitive model; prices, Property rights and profits; incentives and information; rationing, Opportunity sets; economic systems; reading and working with graphs.

UNIT II: DEMAND AND SUPPLY

Determinants of individual demand/supply; demand/supply schedule and demand/supply curve; market versus individual demand/supply. Shifts in the demand/supply curve, demand and supply together. How prices allocate resources; elasticity and its application. Controls on prices; taxes and the costs of taxation. Consumer surplus; producer surplus and the efficiency of the markets.

UNIT III: CONSUMER THEORY

The consumption decision - budget constraint, the consumption decision - budget constraint, consumption and income/price changes, Demand for all other goods and price changes, Utility and preferences (indifference curves); properties of indifference curves, Consumer ‘s optimum choice, Income and substitution effects, Applying consumer theory: Labour.

UNIT IV: PRODUCER THEORY

Production, short- run production function and returns to factor, Average-marginal relationship, Long– run production function and laws of return to scale- role of technology, Cost function and cost structure of a firm in the short- run, Long run cost function and cost structure.

UNIT V: TYPES OF MARKET

Perfect competition -features, Perfect competition- profit maximization, Shut-down and break-even points. Monopoly: marginal revenue; marginal cost; profit maximization. Shutdown rule; market power; price discrimination. Monopolistic competition and product differentiation.

TEXTBOOKS/REFERENCE

1. Principles of microeconomics, N. Gregory Mankiw, Publisher: Cengage Learning fifth edition.
2. Perloff, Jeffrey M. Microeconomics. 5th ed. Addison Wesley, 2008. ISBN: 9780321558497.

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 221	Electricity and Magnetism	BS	2	0	2	3

UNIT I: INTRODUCTION TO VECTOR ALGEBRA
Introduction to vectors, scalar and vector product. Gradient of a scalar field. Divergence and Curl of vector fields and their physical significance. Gauss and Stokes theorems. Coordinate systems–introduction to Cartesian system. Spherical and Cylindrical coordinate systems.

UNIT II: ELECTROSTATICS
Coulomb's law and electric field. Gauss Law, Electric Potential, Potential Energy, Conductors under Electrostatic Equilibrium, Capacitors.

UNIT III: DIELECTRICS AND POLARIZATION
Introduction to Electric Dipole and dipole Moment. Potential and field due to electric dipole. Polarization in dielectrics. Modification of Gauss's Law in terms of electric displacement. Electric Susceptibility and dielectric constant. Bound charges.

UNIT IV: MAGNETOSTATICS
Magnetic force and cyclotron, Biot-Savart Law for magnetic fields, Magnetic field due to various current loops, Ampere's circuital law. Equation of Continuity, Magnetization in Materials.

UNIT V: INTRODUCTION TO ELECTRODYNAMICS
Introduction to time-varying fields, Faraday's law of induction, Generalization of Ampere's law. Maxwell's equations. Derivation of wave equation. Planar Waves in free space.

LIST OF EXPERIMENTS

1. To find the dielectric constant of the medium using parallel plate capacitor.
2. To find the band gap energy of a semi-conductor using Four-probe method.
3. To find the band gap energy of a semi-conductor using Four-probe method.
4. Find the magnetic field due to Helmholtz coils and verify its relation by varying the distance.
5. Use Faraday's law for finding the total magnetic flux through the coil.
6. To find the type and concentration of charge carriers using hall probe.
7. Verify the Biot-Savart law for a given circular coil.
8. To find the fill factor of a given solar cell using I-V characteristics.
9. To find the type of material using the deflection in magnetic field.
10. To study the Hysteresis curve for a given magnetic material.
11. Practice session I and remedial session.
12. Practice session II and remedial session
13. Model Exam.
14. Model Exam.
15. Model Exam.

TEXTBOOKS/REFERENCE

1. Introduction to Electrodynamics –David J. Griffiths; 4th Edition, 2012, PHI Eastern economy editions.
2. Electricity and Magnetism- A. S. Mahajan and A. A. Rangwala, 1st Revised Edition, 2007, McGraw-Hill Education.

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CHE 101	Principles of Chemistry	BS	2	0	2	3

UNIT I: CHEMICAL BONDING

Ionic, covalent, and metallic bonds. Theories of bonding: Valence bond theory, nature of covalent bond, sigma (σ) bond, Pi(π) bond. Hybridization: Types of hybridizations, sp2, sp3, sp3d, d2sp3. Shapes of molecules (VSEPR Theory):BeCl2,CO2,BF3,H2O,NH3, CH4,PCl5,XeF2,SF6,XeF4.Molecularorbitaltheory:Linear combination of atomic orbitals (LCAO Method), bond order, homo(H2,O2,N2) and hetero nuclear diatomic molecules(NO,CO).Non-covalent interactions: Vander Waals interactions, dipole-ipole interactions, and hydrogen bonding.

UNIT II: PHASE RULE AND KINETICS

Phase rule: Introduction, Definition of the terms used in phase rule with examples. Application of phase rule to water system, Sulphur system and lead-silver system. Kinetics: Order and molecularity of reactions, zero order, first order and second order reactions.

UNIT III: WATER TECHNOLOGY

Standards for drinking water, Methods of Treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization, Break point chlorination. Determination of Hardness of water by EDTA method. Demineralization of water. Softening of water: Lime-soda Process, Ion exchange process, Zeolite process. Boiler Troubles: Priming, Foaming, Scale, Sludge, Corrosion, Caustic Embrittlement.

UNIT IV: POLYMER CHEMISTRY

Classification of polymers: Natural and synthetic. Thermoplastic and Thermosetting. Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tactility, Molecular weight average, number average and poly dispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT V: ELECTROCHEMISTRY

Arrhenius theory of electrolytic dissociation, classification of electrolytes; degree of Dissociation of acids, dissociation constant of weak acids, concept of Ph and pOH, buffer solutions, solubility product, common ion effect indicators and theory of acid base indicators, conductance of solutions-specific, molar and equivalent conductance, Variation of molar conductance with dilution for strong and weak electrolytes; Migration of ions-Kohlrausch's law of independent migration of ions, Ostwald's dilution law; Nernste equation for single electrode and electrochemical cells.

LIST OF EXPERIMENTS

1. Volumetric titration of HCl vs NaOH
2. Conductometric titration of HCl vs NaOH
3. Standardization of potassium permanganate by Oxalic acid
4. Iodometric Determination of Ascorbic Acid (Vitamin C)
5. Determination of hardness of water by EDTA method
6. Determination of strength of given hydrochloric acid using pH meter
7. Estimation of iron content of the given solution using potentiometer
8. Determination of sodium and potassium by flame photometry

TEXTBOOKS/REFERENCE

1. A. Bahl and B. S. Bahl, G. D. Tuli, Essentials of physical chemistry, S Chand Publication,2014, ISBN: 8121929784.P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller and F.A. Armstrong Shriver andAtkins' Inorganic Chemistry, 5th Ed., Oxford University Press, London, 2010, ISBN 978-1-42-921820-7.
2. Atkins, P.W.; de Paula, J. Physical chemistry, 8th ed., 2006 Oxford University Press. ISBN0-19-870072-5.
3. B. R. Puri, L. R. Sharma & M. S. Pathania, Principles of Physical Chemistry, 46th Ed.,2013, Vishal Publication Company.
4. F.W. Billmeyer, Text Book of Polymer Science, 3rd Ed., John Wiley & Sons, New York,2003.
5. J. Bard and L.R. Faulkner, Electrochemical methods –Fundamentals and applications, 2nd Ed., John Wiley and Sons, 2001.
6. Jain P.C. & Monika Jain, Engineering Chemistry, Dhanpat Roy & Sons, 2015.

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 121	Multivariable Calculus	BS	3	0	0	3

UNIT I: VECTORS AND MATRICES
Three-dimensional coordinate system, vectors, dot products, vector products, lines and planes.

UNIT II: PARTIAL DERIVATIVES
Functions of several variables, Limits and continuity for several variable functions, Partial derivatives, The chain rule, Directional derivatives, Gradient.

UNIT III: DOUBLE INTEGRAL AND LINE, INTEGRAL IN PLANES
Extreme values, saddle points, lagrange multipliers.

UNIT IV: TRIPLE INTEGRALS IN 3D
Double and integrated integrals, area by double integration.

UNIT V: SURFACE INTEGRALS IN 3D
Triple integration and applications.

TEXTBOOKS/REFERENCES

1. Edwards, Henry C Thomas- Calculus, 14th edition. Chapters 12 to 16 relevant sections.
2. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996.
3. T. M. Aposol, Calculus - Vol.2, 2nd Edn., Wiley India, 2003.

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SEMESTER-II

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENV 111	Environmental Science	BS	2	0	2	3

UNIT I: ENVIRONMENTAL CRISIS AND SUSTAINABLE DEVELOPMENT

Global environmental crisis and its causes, man-environment relationship. Ecological footprint, what is sustainable development, why you should study environmental science?

UNIT II: ECOSYSTEMS

What is an ecosystem? Structure and functions of an ecosystem. Energy flow in an ecosystem, biomass flow in an ecosystem, food chain and web. Ecological pyramid, water cycle, carbon cycle, Sulphur cycle. Forest ecosystems: tropical rain forest, coniferous forests, tundra forests, temperate forests. Grasslands and desert ecosystems. Aquatic ecosystems: zones in ocean, ocean activities, coastal zones. freshwater zones, wetlands, estuaries, rivers, streams, mangroves, state of rivers in India.

UNIT III: RENEWABLE AND NON-RENEWABLE RESOURCES

Energy resources: Global energy crisis, energy sources, energy needs, global energy consumption, Renewable and Non -renewable energy sources: Hydropower, Solar, tidal, wind, energy, Bioenergy, coal, natural gas. Energy resources: fossil fuel vs renewable fuels, peak oil. conventional and unconventional oil, oil price determination. Environmental implications of Energy use: India and world, Energy use pattern – national and global. Water availability, Water for irrigation, water situation in India.

UNIT IV: BIODIVERSITY

Significance of biodiversity, Current state of biodiversity: National and global, Causes of biodiversity loss, Biological hotspot s, aquatic biodiversity, Endangered species and endemic species of India. Biodiversity conservation: Seed banks, botanical gardens, marine biodiversity protection, national and international efforts.

UNIT V: POLLUTION AND POLICIES

Solid waste management in cities, hazardous waste, effluent treatment, liquid waste, Water pollution, eutrophication of lakes, ground water pollution, water quality measurement, sewage water treatment, water purification, Air and noise pollution, sources of air pollution, smog, urban heat island, air pollution in India, effects of noise pollution. Climate change, IPCC assessment, carbon dioxide concentration, ozone layer depletion, international initiatives, Environmental laws, environmental laws in India for water, air, wildlife protection, forests, environment, Disaster management, global disasters, tsunami, landslides, floods, cyclones, nuclear disasters, state of disaster management in India. Summary of environmental issues, conflicts, problems and solutions.

LIST OF EXPERIMENTS

1. Water parameters- Test for alkalinity and turbidity of water.
2. Determination of dissolved oxygen in water.
3. Test for total suspended solids and total dissolved solids.
4. Determination of total hardness of water by EDTA titration.
5. Determination of biological oxygen demand of wastewater.
6. Determination of chemical oxygen demand of wastewater.
7. Test for iron content in river water.

TEXTBOOKS/REFERENCE

1. Environmental Studies (3rd edition) by R. Rajagopalan in Oxford University Press, 2016. ISBN: 9780199459759.

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SEMESTER-III

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 211	Linear Algebra	BS	3	0	0	3

UNIT I: MATRICES AND GAUSSIAN ELIMINATION
Introduction, Geometry of linear equations, Gaussian elimination, Matrix notation and matrix multiplication, Triangular factor and row exchanges, Inverses and transposes.

UNIT II: VECTOR SPACES
Vector spaces and subspaces, Solving Ax=0 and Ax=b, Linear independence, Basis and dimension, The f our fundamental subspaces, Graphs and networks, Linear transformations.

UNIT III: ORTHOGONALITY
Orthogonal vectors and subspaces, Cosines and projections onto lines, Projection and least squares, Orthogonal bases, Gram-Schmidt.

UNIT IV: DETERMINANTS
Introduction, Properties of the determinant, Formulas for the determinant, Applications of determinants.

UNIT V: EIGENVALUES AND EIGENVECTORS
Introduction, Diagonalization of a matrix, Difference equations and power of A^k, Differential equations for e^{At}, Complex matrices and similarity transformations.

TEXTBOOKS/REFERENCE

1. G. Strang, Linear Algebra and Its applications, Nelson Engineering, 4th Edn., 2007.
2. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 1996.
3. S. Axler, Linear Algebra Done Right, 2nd Edn., UTM, Springer, Indian edition, 2010.

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EE 211	Electrical Technology	ES	2	0	2	3

UNIT I: CIRCUIT ANALYSIS

Circuit analysis nodes, paths, loops, branches, resistors in series and parallel, voltage and current division, ideal and practical voltage and current source, source transformations, nodal analysis, the supernode, mesh analysis, the supermesh--with independent and dependent voltage and current sources. Network reduction technique using star – delta transformation. Illustrative examples.

UNIT II: NETWORK THEOREMS

Network theorems superposition theorem, thevinin's theorem, norton's theorem, maximum power transfer theorem, reciprocity theorem, millman's theorems--with independent and dependent voltage and current sources. Illustrative examples.

UNIT III: TWO PORT NETWORKS

Two port networks one port networks, admittance parameters, impedance parameters, hybrid parameters and transmission parameters. Illustrative examples.

UNIT IV: CIRCUIT DYNAMICS AND FORCED RESPONSE

Circuit Dynamics and Forced Response Step Response of a Series RL, RC (First Order System) and RLC Circuit (Second Order System) under DC Source Excitation--Time Constant, Rise Time, Peak Time, Peak Overshoot/Undershoot and Settling Time. Principle of Duality. Illustrative examples.

UNIT V: ELECTROCHEMICAL DEVICES

Single-phase AC circuits Basic Concepts Related to Generation of Sinusoidal AC Voltage, Definitions of Average Value, Root Mean Square Value, Form Factor and Peak Factor. Steady State Analysis of Pure R, L, C Circuits, RL, RC and RLC circuits with Phasor Diagrams under AC Excitation. Concepts of Resonance, Definitions of Real Power, Reactive Power, Apparent Power and Power Factor. Illustrative examples.

TEXTBOOKS/REFERENCE

1. Electrical Engineering Fundamentals, Vincent Del Toro, Pearson, 2016.
2. Circuit Theory Analysis and Synthesis, Abhijit Chakrabarti, Dhanpat Rai & Co. 7th Edition, 2017.
3. G.H Jeffery, J Bassett, J Mendham, R.C Denny, Vogel's Text Book of Quantitative Chemical Analysis, Longmann Scientific and Technical, John Wiley, New York.
4. J.B Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001.
5. A.I Vogel, A.R Tatchell, B.S Furnis, A.J Hannaford, P.W.G Smith, Vogel's Text Book of Practical Organic Chemistry, Longman and Scientific Technical, New York, 1989.
6. J.V. McCullagh, K.A. Daggett, J. Chem. Ed. 2007, 84, 1799.

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 211	Digital Electronics	C	3	0	2	4

UNIT I: DIGITAL FUNDAMENTALS

4 and 5 variable K-maps, 1's and 2's complements, Codes – Binary. BCD, Excess 3, Gray, Alphanumeric codes, Sum of products and product of sums, Minterms and Maxterms, Quine-McCluskey method of minimization.

UNIT II: COMBINATIONAL CIRCUIT DESIGN

4 bit Adder and Subtractor, Binary Parallel Adder – Carry look ahead adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III: SYNCHRONOUS SEQUENTIAL CIRCUITS

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits, Design – Moore/Mealy models. State minimization. State assignment. Circuit implementation – Design of Counters, Ripple Counters-Ring Counters, Shift Registers, Universal Shift Register.

UNIT IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS

Stable and Unstable states, Output specifications, Cycles and races, State reduction, Race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V: MEMORY DEVICES

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM – EAPROM. RAM – RAM organization – Write operation – Read operation –Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using ROM. PLA, PAL.

LIST OF EXPERIMENTS

1. Realization of Basic Logic Gates.
2. Design of Code Converters (Binary to Gray) & (Gray to Binary).
3. Design of
   Half-Adder/Subtractor.
   Full-Adder/Subtractor.
   Multiplexers/De Multiplexers.
   ALU Design.
4. Design of Decoder and Encoder/ BCD 7SSD.
5. Design of Magnitude Comparator (2-bit).
6. Design and Verification of Flip-Flops using IC.
7. Design of Asynchronous Counter (Any Mod, Up and Down, Johnson and Ring).
8. Design of Synchronous Counter (Any Mod, Decade counter 74ls90).
9. Design of Universal Shift Register (Serial to Parallel, Parallel to Serial, Serial to Serial and Parallel to Parallel Converters).
10. Design & Verification of Memory (SRAM).

TEXTBOOKS/REFERENCE

1. M. Morris Mano, “Digital Design”, 5th Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2014.
2. John F.Wakerly, “Digital Design”, Fourth Edition, Pearson/PHI, 2008.
3. John.M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2006.
4. Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.
5. Donald P.Leach and Albert Paul Malvino, “Digital Principles and Applications”, 6th Edition, TMH, 2006.
6. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011.
7. Donald D.Givone, “Digital Principles and Design”, TMH, 2003.

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 212	Signals and Systems	C	3	0	2	4

UNIT I: SIGNALS CLASSIFICATION, TRANSFORMATIONS, REPRESENTATION
Classification of signals: continuous-time/discrete-time, even-odd, periodic-aperiodic, energy-power, random-deterministic. Standard signals: impulse, step, ramp, exponential and sinusoids. Transformations of the independent variable: shifting, scaling and reversal. Representation of periodic signals using Fourier series.

UNIT II: SYSTEMS: CLASSIFICATION AND TIME DOMAIN ANALYSIS
Classification of systems: linear-nonlinear, time-invariant/time-variant, memory, causal, continuous-time/discrete-time. LTI System properties: causality, memory, stability, and invertibility. Impulse response, linear convolution and discrete-time convolution, graphical method to solve convolution.

UNIT III: CONTINUOUS & DISCRETE TIME SYSTEMS: FREQUENCY DOMAIN ANALYSIS
Introduction to Laplace transform and region of convergence, properties of Laplace transform, inverse Laplace transform, initial and final value theorems. Introduction to Z-transform and its region of convergence, properties of Z-transform, inverse Z-transform, the unilateral Z-transform.

UNIT IV: CONTINUOUS & DISCRETE TIME SIGNALS: FOURIER ANALYSIS
Introduction to sampling and reconstruction, aliasing. Continuous time Fourier transform (CTFT), properties of CTFT, convolution property, CTFT of periodic signals. Discrete time Fourier transform (DTFT) and its properties, DTFT of periodic signals.

UNIT V: DISCRETE FOURIER TRANSFORM AND FFT
Introduction to discrete Fourier transform (DFT) and its relation to DTFT, properties of DFT, inverse DFT, convolution using DFT. Computation of DFT using fast Fourier transform (FFT), decimation in time FFT, decimation in frequency FFT.

TEXTBOOKS

1. "Signals and Systems" by Oppenheim, Wilsky and Nawab, Prentice Hall, 2nd edition. ISBN: 9780138147570.
2. "Signals and Systems" by Simon Haykin and Berry Van Veen, 2nd edition, ISBN: 9780471164746.

REFERENCE

1. "Principles of Signal Processing and Linear Systems" by B P Lathi, 2nd edition, ISBN: 9780198062271.
2. "Signals and Systems using MATLAB" by Louis F Chaparro, 2014 edition, Academic Press, ISBN: 9780123948434.

LIST OF EXPERIMENTS

1. Plotting even and odd components of continuous-time signals.
2. Plotting even and odd components of discrete-time signals.
3. Time period calculation of continuous time signals.
4. Time period calculation of discrete time signals.
5. Shifting, scaling and reflection of discrete time signals.
6. Energy and power of signals.
7. Fourier series representation of periodic signals.
8. Verification of Reciprocity theorem.
9. Convolution between two discrete time signals.
10. Finding of Laplace transform.
11. Finding of Z-transforms.
12. Discrete Fourier Transform (DFT) and Inverse DFT.

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CDC 204	Quantitative Aptitude	HS	1	0	0	1

UNIT I: QUANTITATIVE REASONING
Number properties, Percentage, Ratio and proportion, Profit and loss, Simple and compound interest, Averages, Speed, Time and work, Powers and roots, Linear equations, Quadratic equations, Pipes, cisterns.

UNIT II: VERBAL REASONING
Proposition, Premise: Syllogism: Verbal Analogies, Verification of truth of the statement, Assertion and reason, Situation reaction test, Decision making, Alpha-numerical sequence puzzle.

UNIT III: VERBAL ABILITY
Preposition, Articles, Adverbs, Adjectives, Conjunctions and Parallel Structures.

UNIT IV: DATA ANALYSIS AND INTERPRETATION
Statistics: Average, Median, Mode, Range, Standard deviation,

TEXTBOOKS/REFERENCE

1. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
2. P. Anand, Quantitative Aptitude, Wiley, 2015.
3. Archana Ram, Placementor, Oxoford Publication, 2018.

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SEMESTER-III

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENG 101	Engineering Fundamentals	ES	2	0	2	3

UNIT I

Sources of energy, types of prime movers, force, mass, pressure, work, power, energy, heat, temperature, internal energy, enthalpy, efficiency, zeroth law, first law, thermo dynamic system, different types of fuels, non-conventional energy -wind, solar, bio, global warming.

UNIT II

Introduction-fluids, physical properties of fluids, relationship between stress and strain- rate for newtonian and non-newtonian fluids, description of fluid flow, classification of flows-laminar and turbulent flows, measurement of flow.

UNIT III

Heat Engines-External, Internal, Carnot, Rankine, Otto, Diesel Cycles; Steam Boilers- Fire Tube, Water Tube Boilers, Valves; IC Engine-Components, 2 Stroke,4 Stroke, Engine Performance, Efficiency.

UNIT IV

Pumps Reciprocating, Rotary, Pump Efficiency; Air Compressors-Reciprocating/Rotary; Refrigeration and Air Conditioning-Principles of Working; Brakes, Clutches and Couplings, Drives-Transmission of Power-Belt Drive, Gear Drive, Chain Drive.

UNIT V

Mechanics of Materials-Engineering Materials, Material Properties- Tensile Strength, Toughness, Malleability, Hardness, Ductility, Stiffness, Brittleness, Elasticity, Plasticity, Creep, Fatigue, Failure, Stress-strain splots, failures.

TEXTBOOKS

1. Elements of Mechanical Engineering, S Trymbak Murthy, IK International Publishing, 2010.
2. Elements of Mechanical Engineering, RKRajput, Laxmi Publications Ltd, 2005.

REFERENCES

1. Elements of Mechanical Engineering, V.K. Manglik, PHI Publications,2013.
2. Elements of Mechanical Engineering, B. L. Theraja, S. Chand Ltd. 1999.

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SEMESTER-IV

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CDC 203	Verbal Ability	HS	1	0	0	1

UNIT I: QUANTITATIVE REASONING
Speed, Time and work, Powers and roots, Pipes, cisterns. Problems on Clock, Calendar and Cubes, Height and Distance, Logarithms.

UNIT II: NON-VERBAL REASONING
Alpha-numerical sequence puzzle, Symbols and their relationships, Blood Relations, Seating Arrangement, Coding-Decoding, Input- Output, test Direction Sense Test.

UNIT III: DATA ANALYSIS AND INTERPRETATION
Graphical and Numerical Methods for Describing Data, Interpretation of data in tables and graphs, Permutations and Venn diagrams, Counting Methods, Probability.

UNIT IV: VERBAL ABILITY
Conditionals, Tense Forms, Verb Forms.

UNIT V: VERBAL ABILITY
Phrasal Verbs, Cohesion and Coherence.

TEXTBOOKS

1. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
2. P. Anand, Quantitative Aptitude, Wiley, 2015.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 224	Probability and Random variables	C	3	0	0	3

UNIT I: REVIEW OF BASIC PROBABILITY THEORY
Definition and axioms of probability, probability spaces, joint and conditional probabilities, Independent events, Total probability theorem – Bayes' theorem.

UNIT II: RANDOM VARIABLES
Introduction to the concept of random variables, Continuous and Discrete random variables, Probability (Cumulative) distribution function (CDF), Probability Distribution Function (PDF), Joint distribution function of two random variables. Conditional CDF and PDF, Independent random variables, Various Continuous and Discrete random distributions (Special focus is on Uniform, Gaussian, Poisson random variables).

UNIT III: STATISTICAL AVERAGES
Introduction to the concept of statistical averages, various statistical averages – Expectation, Variance, Mean square value etc., Chebyshev inequality, Central limit theorem.

UNIT IV: RANDOM PROCESSES: TIME DOMAIN ANALYSIS
Introduction to the concept of random process, Classification of random processes, Stationary random processes, Ergodic random processes, Correlation functions and their properties, Gaussian and Poisson random process, Sample t-tests, analysis of statistical means.

UNIT V: RANDOM PROCESSES: FREQUENCY DOMAIN ANALYSIS
Introduction to the concept of Power Spectral Density, Relation between Power spectral density and auto correlation function – Wiener Kinchine Theorem, Noise: White and Coloured, Linear Time Invariant (LTI) systems with random processes as inputs, Noise bandwidth, Band pass, Band limited and narrow band processes.

TEXTBOOKS

1. Probability theory, Random variables and Random signal principles, Peebles, 4th Edition, TMH.
2. Communication Systems, Simon Haykin, 4th Edition, John Wiley & Sons.

REFERENCE

1. Probability and Random Processes for Electric and Computer Engineers, John A Gubner, 1st Edition, CAMBRIDGE University press.
2. Probability, Random variables and Stochastic processes – A Papoulis and Unnikrishnan Pillai, 4th Edition, Mc Grahill Publishers.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 221	Analog Electronics	C	3	0	2	4

UNIT I: BJT BIASING AND SINGLE STAGE AMPLIFIERS
BJT Device Structure and Physical Operation, BJT Current Voltage characteristics, BJT Circuits at DC, Amplifier Basic Principles, Circuit Models for Amplifier, Small Signal Models for BJT, BJT Biasing, Analysis of CE,CB, CC Amplifiers.

UNIT II: MOSFET BIASING AND SINGLE STAGE AMPLIFIERS
MOSFET Device Structure and Physical Operation, MOSFET Current Voltage characteristics, MOSFETS Circuits at DC,MOSFET Biasing, Small Signal models for MOSFET, Analysis of CG,CS,CD Amplifiers.

UNIT III: DIFFERENTIAL AMPLIFIERS AND FREQUENCY RESPONSE OF SINGLE STAGE AMPLIFIERS
MOS Current Mirror, Analysis of MOS Differential Pair, Common Mode Rejection Ratio, DC Offset, MOS Differential Amplifier with current mirror load Low frequency response of CS amplifier, High frequency response of CS amplifier, Millers Theorem, High frequency response of CMOS Differential Amplifier.

UNIT IV: FEEDBACK AMPLIFIERS
General Feedback structure, Negative feedback, Feedback amplifier types, stability problem, frequency compensation.

UNIT V: SIGNAL GENERATORS AND WAVEFORM SHAPING CIRCUITS
Basic principles of sinusoidal oscillators, op-amp RC oscillator, Wein Bridge oscillator, MOSFET Crystal oscillators, Bistable multivibrators, 555 timer IC and applications.

TEXTBOOKS

1. Microelectronic Circuits: Theory and Applications, Adel S. Sedra and K . C. Smith, 7th edition, Oxford University Press.

REFERENCE

1. Bezhad Rizavi "Fundamentals of Microelectronics", Wiley, (2006).
2. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill.
3. EducationElectronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson.

LIST OF EXPERIMENTS

1. Analysis of Feedback circuits with Op-amps.
2. Analysis of Feedback circuits with MOSFETs.
3. Design and Analysis of RC phase shift, LC oscillators.
4. Design and Analysis of Wien Bridge oscillator.
5. Design and Analysis of 555 timer based Astable and Monostable Multivibrators.
6. Design and Analysis of MOSFET based Class A, Class B, Class AB Power amplifier.
7. Design and Analysis of Op-amp based Active filters.
8. Design and Analysis of Voltage regulator circuits.
9. Design and Analysis of Voltage reference circuits.
10. Design and Analysis of ADCs, DACs-I.
11. Design and Analysis of ADCs, DACs-II.
12. Course project.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 212	Control Systems	C	3	0	0	3

UNIT I: INTRODUCTION TO CONTROL SYSTEMS
Introduction, Types of Control Systems, Effect of Feedback Systems, Modelling of Physical Systems, Transfer functions. Block diagrams and Signal Flow graphs.

UNIT II: TIME RESPONSE OF FEEDBACK CONTROL SYSTEMS
Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants.

UNIT III: STABILITY ANALYSIS
Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.

UNIT IV: FREQUENCY DOMAIN ANALYSIS AND STABILITY
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin. Introduction to lead, lag and lead-lag compensating networks. Design of closed loop systems using compensation techniques in time domain and frequency domain. Brief idea of proportional, derivative and integral controllers.

UNIT V: STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties Concepts of Controllability and Observability.

TEXTBOOKS

1. Norman S. Nise, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc , 2010.
2. M Gopal, Control Systems: Principles and Design, McGraw Hill Education; 4 Edition, 2012.
3. K. Ogata, Modern Control Engineering, Prentice Hall India, 2006.

REFERENCE

1. Raymond T. Stefani (Author), Bahram Shahian, Clement J. Savant, Gene H. Hostetter.
2. Design of Feedback Control Systems, Oxford University Press, 2001.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 222	Digital Signal Processing	C	3	0	2	4

UNIT I: INTRODUCTION AND TIME DOMAIN PROCESSING

Review of signals and systems, Differences between analog and digital signal processing, Filtering in time domain: linear convolution, Circular convolution, Linear correlation and circular correlation; auto correlation and cross correlation of signals.

UNIT II: FREQUENCY DOMAIN PROCESSING

Discrete Fourier transform (DFT), Methods to compute DFT: Cooley-Tukey FFT algorithm, properties of FFT. Decimation in time and decimation in frequency algorithms to compute DFT using FFT. Rader's and Bluestein's FFT algorithms.

UNIT III: ANALOG FILTERS

Transfer function, Design of Butterworth, elliptic, Chebyshev, and Bessel filters, Filter order and roll-off rate, Lowpass, High pass, Bandpass and band stop filters, Higher order filters, Linear phase and its importance, Phase delay and group delay of the filters.

UNIT IV: DIGITAL FILTERS

Finite impulse response (FIR) filters, Infinite Impulse Response (IIR) filters, Realization of digital filters: canonical form, Direct form-I, form-II methods, Converting analog filters to digital filers: bilinear transformation. All-pass filter and inverse filter.

UNIT V: MULTI-RATE SIGNAL PROCESSING

Decimation, Interpolation, Sampling rate conversion of non-integer factors; multistage implementation and polyphase implementation of decimation and interpolation, Introduction to sub-band coding and multi-resolution analysis.

TEXTBOOKS/REFERENCE

1. "Digital Signal Processing" by Tarun Kumar Rawat, Oxford Higher Education, 2017 edition.
2. "Discrete-time signal processing" by A. Oppenheim and R. W. Schafer, Pearson, 2014 edition.
3. "Principles of Signal Processing and Linear Systems" by B P Lathi, Oxford University Press, 2009 edition.
4. "Digital Signal Processing" by J. G. Proakis and D. G. Manolakis, 2007 edition, Pearson India.

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LIST OF EXPERIMENTS

1. Obtain linear convolution of two finite length sequences.
2. Obtain DFT / IDFT of given Discrete Time signals.
3. Obtain circular convolution of two finite length sequences.
4. Obtain linear correlation and circular correlation of two finite length sequences.
5. Implementation of FFT of given sequence.
6. Implementation of Butterworth Low Pass Filter.
7. Implementation of Chebyshev Low Pass Filter.
8. Implementation of High Pass IIR filter for a given sequence.
9. Implementation of Low Pass FIR filter for a given sequence.
10. Implementation of Low Pass IIR filter for a given sequence.
11. Implementation of Decimation Procedure.
12. Implementation of Interpolation Procedure.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 230	Industry Standard Coding Practice-I	ES	0	0	4	1

UNIT I
Problem Solving with - Basic coding practices, Expression Evaluation, Operators Usage, Expressions, Control Structures, Loop & Iterations for all test case scenarios.

UNIT II
Problem Solving using time efficient logics, linear list data, Array problems, 2D Arrays and Matrix Data for all test case scenarios.

UNIT III
Problem Solving with - Pointers &Memory referencing, String Handling, functions for all test case scenarios.

UNIT IV
Problem Solving with - parameter passing, Recursions, Recursion Analysis, Structures and unions, Enumerations & Memory allocation for all test case scenarios.

UNIT V
Problem solving with - String manipulations. Lists, display patterns, strings, matrix, tuples, dictionaries, modules, packages, exception handling using Python.

TEXTBOOKS/REFERENCE

1. Problem solving with C++ -9e- Walter Savitch – Pearson.
2. The complete Reference C, Fourth REdition – Herbert Schildt – MC Graw Hill.
3. Programming in Python 3, A complete introduction to Python language - 2e - Mark Summerfield – Addison-Wiley.

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SEMESTER-IV

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 223	Electromagnetic Wave Propagation	C	4	0	0	4

UNIT I: ELECTROMAGNETIC BOUNDARY CONDITIONS

Review of Electro statics and Magneto statics: Basic laws, Maxwell's equations for static fields, Electric fields in material space: Properties of materials, Continuity equation, Electric and Magnetic boundary conditions.

UNIT II: TIME VARYING ELECTROMAGNETIC FIELDS

Faradays law, Displacement current, Maxwell's equations (final form), Time varying fields – Maxwell's equations, Time harmonic fields – Maxwell's equations.

UNIT III: ELECTROMAGNETIC WAVE PROPAGATION

Introduction to EM wave, Waves in general- various parameters of wave, EM wave propagation in lossy dielectric media, Planewave in lossless dielectric media, Planewaves in free space, Plane waves in good conductors.

UNIT IV: POWER CONSIDERATION OF EM WAVE

Power of EM wave, Poynting's vector, Poynting's theorem, EM wave at boundary between two different media: Reflection of plane wave at normal incidence, Reflection of plane wave at oblique incidence: Parallel polarization, Perpendicular polarization.

UNIT V: MODERN APPLICATIONS OF EM WAVES

Microwaves: Telecommunications, Radar systems, Heating systems etc. Electromagnetic Interference and compatibility: Source and characteristics of EMI, EMI control techniques like grounding, shielding, filtering. Optical fiber: Numerical aperture, Attenuation and Dispersion.

TEXTBOOKS

1. Mathew N.O. Sadiku, "Elements of Electromagnetics", 3rd edition, Oxford University press.
2. William Hayt , Buck, "Engineering Electromagnetics", 8th edition, TMH.

REFERENCE

1. K D Prasad, "Antenna and Wave propagation", Satya Prakashan, New Delhi.
2. E C Jordan and Balmain, "Electromagnetic waves and Radiating systems", Pearson Education.

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SEMESTER-V

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 311	Analog Communication	C	3	0	2	4

UNIT I: INTRODUCTION: SIGNALS AND SPECTRA

Introduction to Communication Engineering, Brief review of signals and systems: Fourier series, Fourier Transform and its properties, Hilbert transform, LTI Systems, Analytic representation of Band pass signals, Communication channel, Distortion less transmission.

UNIT II: LINEAR CONTINUOUS WAVE MODULATION

Amplitude modulation (AM), DSB-SC, SSB, VSB Modulation and Demodulation, Modulation index, Super hetrodyne receiver, FDM and carrier spacing in FDM.

UNIT III: EXPONENTIAL CONTINUOUS WAVE MODULATION

Angle modulation, Frequency modulation, Phase modulation: Generation and Demodulation, Feedback demodulators: PLL, Frequency compressive feedback demodulators, FM receivers.

UNIT IV: PERFORMANCE OF ANALOG MODULATION IN PRESENSE OF NOISE

Review of Probability, random variables and random process, performance of AM, FM, PM in the presence of noise, Pre-emphasis & De-emphasis.

UNIT V: DIGITAL MODULATION

Introduction to sampling and quantization, PCM, DPCM and Delta Modulation, Digital modulation: PAM, PWM and PPM, Time division multiplexing.

TEXTBOOKS

1. "Communication Systems: An Introduction to signals and noise in Electrical Communication", by A. Bruce Carlson, Paul B. Crilly, Fifth Edition, McGraw-Hill Education.
2. "Communication Systems", by Simon Haykin, Michael Moher, Fifth Edition, Wiley Publishers.

REFERENCE

1. "Principles of Communication Systems" by Herbut Taub and Donald L. Schilling, Goutam Saha, Fourth Edition, McGraw Hill Education.

LIST OF EXPERIMENTS

1. Analyse and test AM- Modulation & Demodulation.
2. Analyse and test AM - DSB SC.
3. SSB-SC Modulation & Demodulation.
4. Analyse and test FM - Modulation & Demodulation.
5. Phase locked loop.
6. Pre-emphasis & De-emphasis.
7. Sampling Theorem verification.
8. Analyse and Test Pulse Amplitude Modulation & Demodulation.
9. Analyse and Test Pulse Position Modulation and Demodulation.
10. Analyse and Test Pulse Width Modulation & Demodulation.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 317	HDL based FPGA Design	C	3	0	2	4

UNIT I: INTRODUCTION TO LOGIC DESIGN USING VERILOG HDL

Introduction, Language Elements, Expressions, Modules and Ports, Built-in Primitives, User-Defined Primitives, Dataflow Modeling, Behavioral Modeling, Structural Modeling, Tasks and Functions, Test bench.

UNIT II: COMBINATIONAL AND SEQUENTIAL LOGIC DESIGN USING VERILOG HDL

Combinational Logic-Adder, Subtractor, Multiplexer, Decoder, Priority Encoder, Magnitude comparator, ALU Sequential Logic, Latches, Flip-flops, Counters, Registers, FSMs.

UNIT III: FIELD PROGRAMMABLE GATE ARRAYS

FPGA Evolution, Programmable Logic Devices, Field Programmable Gate Arrays, FPGA Design Techniques, Design Constraints using FPGAs, Design Automation of FPGAs. Simulation, Synthesis, RTL Design Flow. Physical Design Flow, Place and Route, Timing Analysis, Design Pitfalls.

UNIT IV: BEST PRACTICES FOR SUCCESSFUL FPGA DESIGN

Three Steps to Successful FPGA design, The Role of Project Management, Design Specification: Communication Is Key to Success, Engineering Resources, Device Selection, FPGA design environment, Challenges That FPGAs Create for Board Design, Key Factors in Accurate Power Estimation, Recommended Team Based Design Flow, RTL Design for FPGA devices, Writing Effective HDL, RTL Coding Styles for Synthesis, Analyzing the RTL Design, Timing Closure Challenges, Design Sign-off.

UNIT V: HDL COMPLEX DESIGN EXAMPLES AND FPGA APPLICATIONS

Computer Arithmetic Designs- Floating-Point Addition, Floating-Point Subtraction, Floating-Point Multiplication, I/O Modules UART.

TEXTBOOKS/REFERENCE

1. Joseph Cavanagh, Verilog HDL Design Examples, Taylor and Francis, CRC press, 2018.
2. Peter Wilson - Design Recipes for FPGAs using Verilog and VHDL [2nd ed.]-Elsevier (2016).
3. Philip Andrew Simpson (auth.) - FPGA Design_ Best Practices for Team-based Reuse-Springer International Publishing (2015).
4. Pong P. Chu - FPGA Prototyping Using Verilog Examples, Springer.
5. Douglas J Smith-HDL Chip Design: A Practical Guide for Designing, Synthesizing and Simulating ASICs and FPGAs using VHDL or Verilog, Doone Publications.

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LIST OF EXPERIMENTS

1. Verilog HDL Implementation, Simulation and Synthesis of Logic gates, 1-bit Adder, subtractors.
2. Verilog HDL Implementation, Simulation and Synthesis of Decoders, Multiplexers and Magnitude comparators.
3. Verilog HDL Implementation, Simulation and Synthesis of 4- bit adder, subtractors.
4. Verilog HDL Implementation, Simulation and Synthesis of Latches and Flip-flops.
5. Verilog HDL Implementation, Simulation and Synthesis of 4-bit Register, Counter, Shift register, universal shift register.
6. Verilog HDL Implementation, Simulation and Synthesis of FSMs.
7. FPGA Introduction and Implementation of above simple Designs.
8. FPGA Introduction and Implementation of above complex Designs.
9. Course Project.
10. Course Project.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 313	Microprocessors and Interfacing	C	3	0	2	4

UNIT I: 8086 MICROPROCESSOR

8086 architecture- Functional Diagram, Register Organization, Memory segmentation, Memory addresses, physical memory organization, Signal descriptions of 8086-common function signals, Minimum and Maximum mode signals, Read Write cycles, Timing diagrams, Interrupt structure of 8086.

UNIT II: ASSEMBLY LANGUAGE PROGRAMMING OF 8086

Instruction formats, addressing modes, instruction set, assembler directives, Simple programs involving logical, Branch and call instructions, Sorting, evaluating arithmetic expressions, String manipulations.

UNIT III: PERIPHERAL INTERFACING WITH 8086 MICROPROCESSOR

8255 PPI, Keyboard, display controllers, Stepper motor, A/D & D/A Converter Interfacing with 8086 microprocessor, Static and Dynamic memories, Vector interrupt table, Interrupt service routine, Introduction to DOS & BIOS interrupts, Programmable Interrupt Controller 8259, DMA controller 8257 Interfacing with 8086 microprocessor.

UNIT IV: COMMUNICATION INTERFACE

Serial communication standards, serial data transfer schemes, 8251 USART architecture and Interfacing, RS232, prototyping and trouble shooting.

UNIT V: INTRODUCTION TO MICROCONTROLLERS

Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, Addressing modes and instruction set of 8051, Simple programs.

TEXTBOOKS/REFERENCE

1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, 6th edition, Penram.
2. D V Hall, “Microprocessors and Interfacing”, MGH, 2nd edition.
3. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Edition.

LIST OF EXPERIMENTS

1. (a)Addition of two 8-bit numbers.
   (b)Subtraction of two 8-bit numbers.
   (c)Multiplication of two 8-bit numbers.
   (d) Division of two 8-bit numbers.
2. (a)Addition of two 16-bit numbers.
   (b)Subtraction of two 16-bit numbers.
   (c)Multiplication of two 16-bit numbers.
   (d)Division of two 16-bit numbers.
3. Logical operations using 8086 (a) and (b) or (c)x-or.
4. (a) Two digit BCD addition.

(b) Two digit BCD subtraction.

5. (a)Sorting of data in ascending order.
   (b)Sorting of data in descending order.
6. (a)Program to test whether the 5-bit is '0' or '1'
   (b)Counting number of '1's in a given data.
7. ASCII arithmetic operations.
8. (a)ALP for conversion of packed BCD to unpacked BCD.
   (b)ALP for conversion of packed BCD to ASCII.
   (c) ALP for conversion of data from BCD to HEX.
9. (a)ALP to move a block of 10 bytes.
   (b)ALP to test the parity of the given data.
10. (a) ALP to interface 8086 with 8255 for control of stepper motor.
    (b)ALP to interface 8086 with 8279 for 7-segment display.
    (c) ALP to interface 8086 with 8255 to implement traffic light model.
    (d) ALP to interface 8086 with elevator.
    (e) ALP to interface 8086 with DDAC.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 314	Transmission lines and Waveguides	C	3	0	0	3

UNIT I: TRANSMISSION LINE THEORY

General theory of Transmission lines, the transmission line, general solution. The infinite line – Wavelength, velocity of propagation, Waveform distortion, the distortion-less line. Loading and different methods of loading. Line not terminated in characteristic impedance. Reflection coefficient – calculation of current, voltage, power delivered and efficiency of transmission. Input and transfer impedance – Open and short-circuited lines, reflection factor and reflection loss.

UNIT II: HIGH FREQUENCY TRANSMISSION LINES

Transmission line equations at radio frequencies – Line of Zero dissipation – Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio – Input impedance of the dissipation-less line – Open and short-circuited lines – Power and impedance measurement on lines – Reflection losses – Measurement of VSWR and wavelength.

UNIT III: IMPEDANCE MATCHING IN HIGH FREQUENCY LINES

Impedance matching: Quarter wave transformer – Impedance matching by stubs – Single stub and double stub matching – Smith chart – Solutions using Smith chart – Single and double stub matching using Smith chart.

UNIT IV: PASSIVE FILTERS

Characteristic impedance of symmetrical networks – filter fundamentals, Design of filters: Constant K – Low Pass, High Pass, Band Pass, Band Elimination, m- derived sections – low pass, high pass composite filters.

UNIT V: WAVE GUIDES AND CAVITY RESONATORS

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

TEXTBOOKS

1. John D Ryder, "Networks, lines and fields", 2nd Edition, PHI, 2010.
2. David K Cheng, "Field and wave electromagnetics", 2nd Edition, Pearson education.

REFERENCE

1. Mathew N.O. Sadiku, "Principles of Electromagnetics", 6th edition, Oxford Higher Education.

SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CDC 331	Employability Skills	HS	1	1	0	0

UNIT I

Types and Properties of Numbers and Remainders, LCM, GCD, Fractions and decimals, Surds and Progressions.

UNIT II

Permutations, Combinations and Probability, Data Interpretation.

UNIT III

Geometry and Coordinate Geometry, trigonometry and Mensuration.

UNIT IV: REASONING

Syllogism and Non-Verbal Reasoning, Analytical Reasoning.

TEXTBOOKS/REFERENCE

1. Arun Sharma – How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. R.S Agarwal, A Modern Approach to Verbal and Non Verbal Reasoning S.Chand Publications.
3. Arun Sharma– How to Prepare for Data Interpretation & Logical Reasoning for the CAT.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 330	Industry Standard Coding Practice-2	ES	0	0	4	1

UNIT I

Problems Solving with: Structure Pointers, formation of links, Operations on Linked lists, Operations on a circular linked list, Operations on a double linked list & Industry Standard Practice Questions.

UNIT II

Problem Solving with - Stack Operations, Queue data structure Implementation, Linear / Binary Search Algorithms, Sorting Algorithms, Industry Standard Practice Questions.

UNIT III

Problem Solving with - Nonlinear data structures, trees operations, application of search property on a binary tree, tree balancing.

UNIT IV

Problem Solving with - Multiway search structures, Operations on a 2-4 tree, nonlinear structures, red, black trees & operations, Tries, String Algorithms &Industry Standard Practice Questions.

UNIT V

Problem Solving with – features of Object-oriented programming, leveraging Standard Template Libraries. Industry Standards of leveraging DBMS concepts, SQL Queries, Entity Relationship Models, Query Optimization, Transactions & Concurrency, Normalization & Industry Standard Practice Questions.

TEXTBOOKS/REFERENCE

1. Fundamentals of Data Structures in C++ - 2e- Sahni Horowitz - Universities Press.
2. Algorithms -4e- Robert Sedgewick & Kevin Wayne - Addison-Wesley Professional.
3. C++ Standard Library A Tutorial and Reference – 2e - Nicolai M. Josuttis - Addison Wesley Longman
4. An Introduction to Database Systems – 8e - C.J. Date – Pearson.
5. Competitive Programming – 3e – Steven Halim, Felix Halim

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 318	Quantum Electronics and Communication	OE	3	0	2	4

UNIT I: QUANTUM OPERATORS, STATES AND THEIR APPLICATIONS

Quantum states and wave functions, Dirac notation(bra–ket notation) of states, Basis vectors and orthogonality, Linear operators and matrices in Hilbert spaces, Qubits and Bloch sphere, Base states and superposition, Structural randomness, Heisenberg's Uncertainty Principle, Unitary operators and projectors.

UNIT II: QUANTUM LOGICS

Abramsky-Coecke semantics, No-cloning theorem, Quantum entanglement, Entangled states, Bell states, Bell inequalities, Pauli, Hadamard gates, CNOT, Toffoli gates, Quantum teleportation, Universality of two-qubit gates.

UNIT III: QUANTUM ELECTRONICS USING OPTICS

Photon, Laser pulses as quantum states, Single photon (quanta) counting with avalanche photodiode, HOM interference, Pure and mixed states, Quantum states of single photons, Optical Qubits, Optical Two-Qubit Gates (CNOT), Deutsch-Josza algorithm and applications, Quantum Fourier transform, Shor's Algorithm – Periodicity.

UNIT IV: SOLID STATE QUANTUM DEVICES

Quantum states of electron in 1D structures, Design, growth, and exploration of quantum matter hetero structures, Interfaces and superlattice-type structures, Junction transistors, Field Effect transistors, Single Electron Transistor (SET)Tunneling, Coulomb Island and Coulomb Blockade in SET, SET Fabrication: Quantum dots, Graphene SET.

UNIT V: QUANTUM COMPUTING AND COMMUNICATIONS

Density matrix and information propagations, Quantum cryptography, Communication across two-input quantum gate (C-NOT) and Teleportation, Physical realization of quantum computation: ion trap, Physical realization of quantum computation: cavity QED, Quantum key distribution, Noise and decoherence: DiVincenzo's criteria, Quantum error correction and examples, Circuit for a quantum Fourier transform.

TEXTBOOKS/REFERENCE

1. Phillip Kaye, Raymond Laflamme, and Michele Mosca (2007). An Introduction to Quantum Computing. Oxford University Press.
2. Michael A. Nielsen and Isaac L. Chuang (2000). Quantum Computation and Quantum Information. Cambridge University Press.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 316	Information Theory and Coding	TE	3	0	0	3

UNIT I: INFORMATION ENTROPY FUNDAMENTALS
Uncertainty, Information, Entropy, 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
Pulse code Modulation, 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, Linear Prediction Coding.

UNIT III: ERROR CONTROL CODING
Linear Block codes, Syndrome Decoding, Minimum distance consideration, Cyclic codes, Generator Polynomial, Parity check polynomial, Encoder for cyclic codes, Calculation of syndrome, Convolutional 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 and 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.

TEXTBOOKS/REFERENCE

1. Thomas M. Cover and Joy A Thomas, “Elements of Information Theory”, 2nd edition, Wiley.
2. Simon Haykin, “Communication Systems”, 4th edition, Wiley.

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SEMESTER-V

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 315	Data Communication	TE	3	0	0	3

UNIT I: INTRODUCTION

Uses of computer networks, network hardware, network software, references models, example networks.

UNIT II: PHYSICAL LAYER

The theoretical Basis for data communication, guided transmission media, the public switched telephone network, cable television.

UNIT III: DATA LINK LAYER

Data link layer design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols.

UNIT IV: NETWORK LAYER

Store and forward packet switching, routing algorithms, congestion control algorithms, internetworking, the network layer in the internet.

UNIT V: APPLICATION LAYER

DNS-the domain name system, electronic mail, the world wide web, multimedia.

TEXTBOOKS

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5/e, Pearson Education, 2013.
2. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill Publishers, 2007.

REFERENCE

1. S. Keshav, An Engineering Approach to Computer Networking, Pearson Education, 1997.
2. W.A. Shay, Understanding Communications and Networks, 3/e, Cengage Learning, 2004.

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SEMESTER-VI

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 321	Microwave Theory and Applications	C	3	0	2	4

UNIT I: MICROWAVE TRANSMISSION LINES

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide. Related Problems.

UNIT II: CIRCULAR WAVEGUIDES

Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Impossibility of TEM mode. Micro strip Lines– Introduction, Z0 Relations, Effective Dielectric Constant, Losses, Q factor. Cavity Resonators– Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients. Related Problems.

UNIT III: WAVEGUIDE COMPONENTS AND APPLICATIONS

Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types. Waveguide Multiport Junctions – E plane and H plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2 Hole, Bethe Hole types.

UNIT IV: MICROWAVE TUBES

Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications. O-type tubes : 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency. Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance; Oscillating Modes and o/p Characteristics, Electronic and Mechanical Tuning. Related problems.

UNIT V: MICROWAVE SOLID STATE DEVICES

Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes. Avalanche Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics.

TEXTBOOKS

1. Microwave Devices and Circuits — Samuel V. Liao, Pearson, 3rd Edition, 2003.
2. Microwave Principles — Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.

REFERENCE

1. Foundations for Microwave Engineering — R.E. Collin, IEEE Press, John Wiley, 2ndEdition, 2002.
2. Microwave Circuits and Passive Devices — M.L. Sisodia and G.S. Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
3. Microwave Engineering Passive Circuits — Peter A. Rizzi, PHI, 1999.

LIST OF EXPERIMENTS

1. Study the components used in microwave Test-bench.
2. Study of V-I Characteristics of Gunn Diode.
3. To determine the frequency and wavelength in a rectangular waveguide working on TE10 mode.
4. Impedance Measurement.
5. VSWR measurement.
6. Study- Characteristics of Reflex Klystron.
7. Attenuation Measurement.
8. Simulation study of Smith chart - Single and double stub matching.
9. Measurement of S-parameters of E-plane Tee & H-plane Tee.
10. Study the Characteristics of Magic Tee.
11. Measuring of dielectric constant of a material using waveguide test bench at X-band.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 320	VLSI Design	C	3	0	2	4

UNIT I: VLSI DESIGN FLOW

Specification, Design entry, Functional simulation, Planning placement and routing, Timing simulation, Digital Design Implementation strategies (ASIC, Custom IC and FPGA Design flows) Introduction. Verilog HDL implementation of basic logic gates. Combinational and Sequential circuits.

UNIT II: MOS TRANSISTOR

Introduction, Ideal I-V characteristics, C-V Characteristics, Simple MOS Capacitance Models, Detailed MOS Gate Capacitance Model, Non-ideal I-V Effects, Mobility Degradation and Velocity Saturation, Channel Length Modulation, Threshold Voltage Effects, Junction Leakage, Body effect, Tunneling, DC Transfer Characteristics: Static CMOS Inverter DC Characteristics, Beta Ratio Effect, Noise Margin, Pass Transistor DC Characteristics.

UNIT III: COMBINATIONAL CIRCUIT DESIGN

CMOS Logic, Inverter, NAND Gate, NOR Gate, Combinational Logic, Compound Gates, Pass Transistors and Transmission Gates, Tristates, Multiplexers, Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Complementary Pass-Transistor Logic Circuits, Datapath Subsystem: Single-Bit Addition, Ripple Carry Adder, Carry Look ahead Adder, Carry Save Adder, Unsigned Array Multiplication, 2's Complement Array Multiplication, Wallace Tree Multiplication.

UNIT IV: SEQUENTIAL MOS LOGIC CIRCUITRY

Behavioral of Bistable element, SR Latch Circuitry, Clocked latch and Flip Flop Circuitry, C-MOS D-Latch and Edge Triggered Flip-Flop, Sequencing Static Circuits: Sequencing Methods, Max-Delay Constraints, Min-Delay Constraints Time Borrowing, Clock Skew.

UNIT V: CMOS PROCESSING TECHNOLOGY

CMOS Technologies, Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO2), Isolation, Gate Oxide, Gate and Source/Drain Formations, Contacts and Metallization, Passivation, Methodology: Lambda Design Rules, Transistor Scaling, Inverter (nMOS and CMOS).

TEXTBOOKS/REFERENCE

1. Jan Rabaey, AnanthaChandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997.
3. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993.
4. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005 3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

LIST OF EXPERIMENTS

1. CMOS inverter.
2. CMOS NOR/ NAND gates.
3. CMOS XOR and MUX gates.
4. CMOS Static / Dynamic logic circuit (register cell).
5. CMOS Latch.
6. Pass transistor.
7. Layout of any combinational circuit (complex CMOS logic gate)
8. 6T SRAM cell Design and Analysis.
9. Layout of 6T SRAM cell and Stability Analysis.
10. Course project.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 323	Digital Communication	C	3	0	2	4

UNIT I: INTRODUCTION

Block diagram of digital communication, ADC, DAC. Channel models: Binary symmetric channel, discrete input and continuous output channel, waveform channel (AWGN channel) Source coding: Mathematical model of information, Entropy, Mutual information, coding for discrete memory less channels: Huffman coding.

UNIT II: CHARACTERISATION OF COMMUNICATION SIGLAS AND SYSTEMS

Representation of bandpass signals and systems, representation of stationary stochastic process, signal space representation: Gram-Schmidt orthogonalization procedure Representation of digitally modulated signals: M-PAM, M-PSK, QAM, M-FSK Spectral characteristics of digitally modulated signals.

UNIT III: RECEIVER FOR DIGITAL MODULATION

Optimum receiver for signals corrupted by AWGN: Correlation and Matched filter demodulator, Optimum detector, performance of optimum receiver for digital modulation schemes: BER Plots. Simulation of performance of various modulation schemes in the presence of AWGN.

UNIT IV: CHANNEL CODING

Channel capacity, block codes and convolution codes, Simulation of block and convolution codes and performance in the presence of AWGN.

UNIT V: DESIGN OF DIGITAL COMMUNICAITO SYSTEMS

Goals of communication system designer, Shannon–Hartley capacity theorem, error probability plane and bandwidth efficiency plane, modulation & coding tradeoff, Simulation of Digital Communication system design for the given specification.

TEXTBOOKS

1. “Digital Communications” by John G. Proakis, 4th edition, McGrawHill, 2000.
2. “Principles of Communication Engineering” by J M. Wozencraft and I M Jacobs, Waveland Pr Inc, 1990.

REFERENCE

1. B. Sklar, Digital Communications: Fundamentals & Applications, Pearson Education, (2/e), 2001.
2. A.B. Carlson : Communication Systems, 3/e McGraw Hill.

LIST OF EXPERIMENTS

1. Pulse Code Modulation and Demodulation.
2. Differential Pulse Code Modulation and Demodulation.
3. Delta Modulation.
4. Time Division Multiplexing.
5. Companding.
6. Data Formatting.
7. ASK, FSK and PSK.
8. QAM.
9. Differential Phase Shift Keying.
10. Linear Block Code – Encoder and Decoder / Binary Cyclic Code – Encoder and Decoder.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENG 328	Undergraduate Research Opportunity-UROP	PR	0	0	6	3

UNIT I: CONCEPTION OF IDEA
Based on interest conceive an idea, Do a feasibility check of the project.

UNIT II: SUBMISSION OF ABSTRACT OF THE IDEA
Literature Survey of similar/related works, Write an abstract of the proposed idea.

UNIT III: RESOURCE PROCUREMENT AND WORK EXECUTION TIMELINE
Create a checklist of resources required, Resource Procurement. Creating timeline for execution of various modules of the project.

UNIT IV: PROTOTYPE BUILDING AND EXECUTION
Execution of the various modules of the project and intermediate report submission, Initiation of the process for a possible publication or patent.

UNIT V: PRESENTATION OF EXECUTED PROJECT AND REPORT / PAPER SUBMISSION
Presenting the executed work, Submitting the work for a possible publication or patent or both

TEXTBOOKS/REFERENCE

1. As deemed fit by student under guidance from supervisor for the project execution.

SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ISES 312	Industry Specific Employability Skills-VI	HS	1	1	0	0

UNIT I
Antonyms, synonyms, odd words, Idioms and phrasal verbs, same word with different part of speech, Word analogy. Sentence completion.

UNIT II
Text completion, Sentence equivalence, Introduction to Different Parts of an Argument in Reasoning, Assumption of an Argument, strengthening of an Argument, Weakening of an argument.

UNIT III
Para jumbles, Sentence Completion & Text Completion, Reading Comprehension, Identification of errors, Sentence correction.

UNIT IV
Resume writing, Cover letter.

UNIT V
GD, PI.

TEXTBOOKS/REFERENCE

1. Verbal Ability and Reading comprehension-Sharma and Upadhyay.
2. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
3. GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition.
4. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.
5. Soft Skills Training: A Workbook to Develop Skills for Employment Book by Frederick H. Wentz.
6. The Resume Writing Guide: A Step-by-Step Workbook for Writing ...Book by Lisa McGrimmon.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 331	Industry Standard Coding Practice-3	ES	0	0	4	1

UNIT I

Problem solving with - Descriptive statistics, Mean/median/mode, Measures of dispersion/range variance, deviations, mean/median/mode problems, Random variables, Univariate & Bivariate random variables.

UNIT II

Problem solving with - Graphs, Handshaking Lemma, Simple Graphs, DFS/BFS, connected components, coloring, Introduction to DAGs, Spanning Trees, Articulation Points/ Connected points.

UNIT III

Problem solving with - Greedy Methods: Coin change, Fractional Knapsack, Activity Selections/ Job sequencing with Deadlines, Spanning Trees, Dynamic Programming: 0/1 Knapsack, Substructures, longest common substring/subsequence, Longest Increasing sub sequence, Grid based Problems.

UNIT IV

Problem solving with - Divide & Conquer Strategies: Quick/Merge Sort, Min/Power functions, Backtracking, N Queens problem, Finding the path & Grid based problems, iterative/loop free approaches.

UNIT V

R Language Constructs, calculations, Operators, vectors, lists, Practice problems implementing R language, Matrices and data frame, Conditional statements and loops, Problem Solving on R language examples.

TEXTBOOKS/REFERENCE

1. An Introduction to Statistical Learning: with Applications in R - Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.
2. Introduction to Algorithms by Thomas H. Corman, The MIT Press, 3rd Edition.
3. Introduction to Algorithms: A Creative Approach by Udi Mander, Pearson.
4. R Cookbook - Paul Teetor, O'reilly.
5. Competitive Programming – 3e – Steven Halim, Felix Halim.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 327	Introduction to Photonics	TE	3	0	0	3

UNIT I: INTRODUCTION TO PHOTONICS

Introduction to light ~ wave vs particle I, Introduction to light ~ wave vs particle II, Interference I, Interference II, Fresnel Diffraction, Fraun-hoffer diffraction of light, Coherence of light, Polarization I, Polarization II.

UNIT II: INTERACTION OF LIGHT WITH MATTER

Interaction of radiation with matter – threshold conditions, 2-level and 3-level laser systems, Einstein's theory for lasers, CW and Pulsed operations in lasers, Characteristics of laser beam, Non-linear materials – higher harmonic generations, Optical resonators I, Optical Resonators II, Q-switching and Mode locking of lasers.

UNIT III: INTRODUCTION TO FIBRE OPTICS

Introduction to fibres, Description of fibres – Numerical aperture, Propagation of light through fibre, Preparation of fibres, Fibre couplers and connectors, Optical detectors, Fibre Amplifiers, Fibres for different spatial modes of light, Integrated fibre optics.

UNIT IV: PHOTON STATISTICS

Introduction, Photon statistics of laser light, Derivation of Poissonian statistics, Description of thermal light – Bunching of photons, Anti-bunching of light, Sub and super Poissonian statistics, Description of Quantum light, Ideal single photon sources, Heralded single photon sources.

UNIT V: HOLOGRAPHY AND OPTICAL IMAGING

Introduction to Holography, Computer generated holography, Generation of structured light using holography, Review of Imaging, Fourier transforms for imaging, Reconstruction of phase using holography, Bio-imaging, Optical Trapping and tweezers, Optical Coherence tomography.

TEXTBOOKS/REFERENCE

1. Polarized light by Goldstein.
2. Nonlinear Optics, 3rd Ed. by Robert Boyd.
3. Introduction to Optics by Hecht.
4. Quantum optics by Mark Fox.
5. Lasers by Silfvast.
6. Fibre Optics by Ajoy Ghatak

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 328	Satellite Communication	TE	3	0	0	3

UNIT I: ELEMENTS OF ORBITAL MECHANICS
Equations of motion. Tracking and orbit determination, orbital correction/control, satellite launch systems, multistage rocket launchers and their performance.

UNIT II: ELEMENTS OF COMMUNICATION SATELLITE DESIGN
Spacecraft subsystems, reliability considerations, spacecraft integration.

UNIT III: MULTIPLE ACCESS TECHNIQUES
FDMA, TDMA, CDMA, Random access techniques, Satellite onboard processing.

UNIT IV: SATELLITE LINK DESIGN
Performance requirements and standards, design of satellite links, DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite-based personal communication.

UNIT V: EARTH STATION DESIGN
Configurations, antenna and tracking systems, satellite broadcasting.

TEXTBOOKS

1. Dennis Roddy, Satellite Communications, 4/e, Tata McGraw Hill, 2006.
2. T. Pratt, S. W. Bostian, Satellite Communication, 2/e, John Wiley and Sons, 2006.

REFERENCE

1. Dharma Raj Cheruku, Satellite Communication, 1/e, IK International Publishing, 2010.
2. D. C. Agarwal, Satellite Communication, 1/e, Khanna Publishers, 1991.

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SEMESTER-VI

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 329	Optical Communication	TE	3	0	0	3

UNIT I: OVERVIEW OF OPTICAL FIBER COMMUNICATION

The general system, advantages of optical fiber communications. Optical fiber wave guides- introduction, ray theory transmission, total internal reflection, acceptance angle, numerical aperture, skew rays. Cylindrical fibers- modes, V number, mode coupling, step index fibers, graded index fibers.

UNIT II: SINGLE MODE FIBERS

Cut off wavelength, mode field diameter, effective refractive index. Signal distortion in optical fibers- attenuation, absorption, scattering and bending losses, core and cladding losses. Group delay, types of dispersion - material dispersion, wave-guide dispersion, polarization mode dispersion, intermodal dispersion. Pulse broadening.

UNIT III: FIBER SPLICING

Splicing techniques, splicing single mode fibers. Fiber alignment and joint loss multimode fiber joints, single mode fiber joints. Optical fiber connectors: connector types, single mode fiber connectors, connector return loss. Fiber materials: Glass, halide, active glass, chalgenide glass, plastic optical fibers. Source to fiber power launching - output patterns, power coupling, power launching, equilibrium numerical aperture, laser diode to fiber coupling.

UNIT IV: OPTICAL SOURCES

LEDs, structures, materials, quantum efficiency, power, modulation, power bandwidth product. Injection laser diodes- Modes, threshold conditions, external quantum efficiency, laser diode rate equations, resonant frequencies. Reliability of LED and ILD. Optical detectors: physical principles of PIN and APD, detector response time, temperature effect on avalanche gain, comparison of photodetectors.

UNIT V: OPTICAL SYSTEM DESIGN

Considerations, component choice, multiplexing. Point-to- point links, system considerations, link power budget with examples. Overall fiber dispersion in multi-mode and single mode fibers, rise time budget with examples.

TEXTBOOKS/REFERENCE

1. Kodali, Engineering Electromagnetic Compatibility, 2/e, IEEE Press, 2000.
2. Clayton R Paul, Introduction to Electromagnetic Compatibility, John Wiley and Sons, 2010.
3. Electromagnetic Interference and Compatibility IMPACT series, IIT Delhi. (Modules1-9)

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SEMESTER-VII

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SEMESTER-VII

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 411	Embedded Systems for design	TE	3	0	2	4

UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS

Introduction to embedded systems, examples of embedded systems, Components of embedded systems hardware, Design process in embedded system, Design metrics, design metrics optimization, Time to market, The NRE and unit cost design metrics, The performance design metrics, Von Neumann and Harvard Architecture, CISC and RISC architectures, Introduction to different controllers: Atmel 89C52, ATMEGA 32, Microchip PIC16F877, ARM 7.

UNIT II: CUSTOM PROCESSOR DESIGNS

Processor technology – General-purpose processor, single-purpose processor, and application specific processors. IC Technology – PLD, semi-custom, full custom, Design Technology – RT Synthesis. RT-level combinational and sequential components, Finite state machine with data (FSMD), Finite state machines (FSM), controller and data path design, Optimization of design, Operation of general-purpose processors – Instruction execution, pipelining, superscalar and VLIW architectures. Design of Soda Vending machine. Design of Elevator controller.

UNIT III: ARM PROCESSOR – ARCHITECTURE AND INTERFACING

Introduction to ARM core, ARM extension family, LPC 2148 architecture, ARM core dataflow model, ARM Core extension, overview of instruction set, register bank of ARM processor, ARM instruction pipeline, memory management, Bus architecture (AMBA Bus), interrupt structure, operating modes, Exception Handling, ARM-based embedded devices, ARM peripherals, other ARM7 features: timer, ADC, DAC, RTC, WDT, PWM etc.

UNIT IV: COMMUNICATION PROTOCOLS

Concept of protocols. Study of serial and parallel communication protocols – UART, SPI, SCI , I2C, CAN, USB, PCI, Ethernet, Study of wireless protocols - IrDA, Bluetooth, IEEE802.11, Zigbee, RF modules, GSM modem for AT command study.

UNIT V: BASICS OF REAL-TIME OPERATING SYSTEM

Need of RTOS in Embedded system software, RTOS services in contrast with computer OS. Features of μCOS II, Foreground/Background systems, Kernel architecture, Task, Task scheduler, context switching, Scheduling algorithms – First come first serve, Round Robin, Round Robin with Priority, Shortest job first, Multitasking, Interrupt service routine (ISR), Semaphores, Mutexes, Events, Inter process communication (IPC) - mailbox, message queues, pipes, timers, memory management.

LIST OF EXPERIMENTS

1. Interfacing of the ARM Cortex M3 with LED using timers and switches.
2. Interfacing of a buzzer and relays with ARM Cortex M3.
3. Display key number pressed on a 4x4 keypad matrix onto a 7-segment display.
4. Modulation of stepper motor speed with PWM.
5. Program RTC of ARM Cortex M3 and display the time on LCD display using I2C protocol.

6. Implementation of ADC and DAC with ARM Cortex M3.
7. UART RS232 serial communication.
8. Study of Zigbee and CAN protocols.
9. Study of interrupts with ARM Cortex M3.
10. Create a task to blink LEDs using μC/OS-II on ARM Cortex M3.
11. Study of scheduling algorithms using μC/OS-II on ARM Cortex M3.
12. Study of semaphore and mutex using μC/OS-II on ARM Cortex M3.
13. Display different messages on LED, LCD, and 7-segment displays simultaneously.

TEXTBOOKS/REFERENCE

1. Vahid and Givargis,"Embedded system design : A unified hardware/software introduction", John Wiley & Sons, Inc. 2002.
2. Raj Kamal, "Embedded Systems : Architecture, Programming, and Design", The McGraw-Hill Companies, Edition 2, 2008.
3. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey "PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008
4. Dogan Ibrahim, "Advanced PIC Microcontroller Projects in C: From USB to RTOS with PIC18F Series", Newnes 2008.
5. Jean J. Labrosse, "MicroC/OS-II : The Real-Time Kernel", CMP Books, Edition 2, 2002
6. S.V. Iyer and P. Gupta, "Embedded Realtime Systems Programming", The McGraw-Hill Companies, 2004.

LIST OF EXPERIMENTS

1. Assembly language programming for PIC microcontrollers.
    - Arithmetic Operations.
    - Port I/O Programming.
2. Timers and Counter Programming and usage of CCP module.
3. ADC and Data EEPROM Programming.
4. Asynchronous Serial Communication UART Programming.
5. Peripheral Interfacing using synchronous serial communication (SPI/ I2C)
6. Program for making PIC's USB as virtual COM Device (CDC class device)
7. Controller Area Network (CAN) Interface.
8. RTOS program to demonstrate Task management.
9. RTOS program to demonstrate Inter task communication and inter task synchronization.
10. Mini Capstone Project.

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SEMESTER-VII

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 419	Fundamentals of wireless communication	OE	3	1	0	4

UNIT I

Mobile radio propagation, Free space propagation model, Ground reflection model, Large scale path loss, small scale fading and multipath propagation, Impulse response model of a multipath channel, parameters of a mobile multipath channel, Multipath delay spread, Doppler spread, coherence bandwidth.

UNIT II

Digital communication through fading multipath channels, Frequency nonselective, Slowly fading channels, Frequency selective, Slowly fading channels, Calculation of error probabilities, Tapped delay line model, The RAKE receiver performance.

UNIT III

Diversity techniques for mobile wireless radio systems concept of diversity branch and signal paths, combining methods, Selective diversity combining, Pre-detection and post detection combining, switched combining, Maximal ratio combining, Equal gain combining.

UNIT IV

Cellular concept, frequency reuse, Cochannel interference, adjacent channel interference, Power control for reducing interference, improving capacity in cellular systems, Cell splitting, sectoring, Hand off strategies, Channel assignment strategies, Call blocking in cellular networks.

UNIT V

Fundamental concepts of spread spectrum systems, Pseudo noise sequence, performance of direct sequence spread spectrum systems, Analysis of direct sequence spread spectrum systems, The processing gain and anti-jamming margin, Frequency hopped spread spectrum systems, Time hopped spread spectrum systems, Synchronization of spread spectrum systems.

TEXTBOOKS/REFERENCE

1. Rappaport Thoedore S., Wireless Communications, Principles and Practice, 2/e, Prentice Hall of India, 2003.
2. Haykin, S., Moher M., Modern Wireless Communications,1/e, Pearson Education, 2011.
3. Kamilo Feher, Wireless Digital Communications, 1/e, Prentice Hall of India, 1995.
4. Lee W.C.Y., Mobile Cellular Telecommunication, 2/e, Tata McGraw Hill, 2002.

SRM UNIVERSITY AP
Andhra Pradesh

SEMESTER-VII

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 410	Adaptive Signal Processing	OE	3	0	0	3

UNIT I: ADAPTIVE SYSTEMS

Definition and Characteristics; areas of application; general properties, open- and closed-loop adaptation; applications of closed-loop adaptation. Adaptive Linear Combiner: General description, Input signal and weight vectors; desired response and error, The performance function; gradient and minimum mean-square error, Alternative expression of the gradient; decorrelation of error and input components.

UNIT II: PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE

Normal form of the input correlation matrix; eigenvalues and eigenvectors of the input correlation matrix, geometrical significance of eigenvectors and eigenvalues; (i) Searching the Performance Surface, Methods of searching the performance surface; basic ideas of gradient search methods, A simple gradient search algorithm and its solution; stability and rate of convergence the learning curve; gradient search by Newton's Method; Newton's Method in multidimensional space. gradient search by the Method of Steepest Descent; comparison of learning curves.

UNIT III: GRADIENT ESTIMATION AND ITS EFFECT ON ADAPTATION

Gradient component estimation by derivative measurement, the performance penalty; derivative measurements and performance penalties with multiple weights, variance of the gradient estimate; effects on the weight-vector solution, excess mean-square error and time constants, Mis adjustment; comparative performance of Newton's and Steepest-Descent Methods, Total mis adjustment and other practical considerations.

UNIT IV: OTHER ALGORITHMS

Derivation of the LMS algorithm; convergence of the weight vector, An example of convergence; learning curve, noise in the weight-vector solution; mis adjustment; performance, normalized and other LMS-based adaptive filters, Discrete Kalman filter; recursive least squares algorithm.

UNITV: APPLICATIONS

Applications: Adaptive Modeling and System Identification: General description, adaptive modeling of a multipath communication channel, adaptive modeling in FIR digital filter synthesis, Adaptive Interference Cancellation: Concept of adaptive noise cancelling, stationary noise-cancelling solutions; effects of signal components in the reference input, Term Project: Matlab implementation of the various learning algorithms with applications.

TEXTBOOKS/REFERENCE

1. B. Widrow and S. D. Stearns, Adaptive Signal Processing, Pearson Education Asia, 1985.
2. M. H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley, 2002.
3. S. Haykin, Adaptive Filter Theory, 4th edition, Pearson Education Asia, 2002.
4. T Adali, S Haykin, Adaptive Signal Processing, Wiley-India, 2010.
5. Selected papers on adaptive signal processing and applications.

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SEMESTER-VII

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 416	Network Control System	OE	3	0	2	4

UNIT I
Introduction to the world of networks, how internet was developed and current state of networking.

UNIT II
Making sense of Internet based linkages, Innovations in the changed nature of linear and nonlinear, System with Internet based linkages.

UNIT III
Issues of communication delays and propagation problems, A new kind of robustness and remote activity.

UNIT IV
A new kind of estimation of delay problems, Optimal control in the presence of delay.

UNIT V
Numerical simulations of network-based control and integration of NS-2/NS-3 with Matlab/Scilab, Hardware interfaces.

TEXTBOOKS/REFERENCE

1. Networked Embedded Sensing and Control, edited by P. J. Antsaklis and P. Tabuada, Springer 2006.
2. Graph Theory, by R. Diestel, Springer, 2000.
3. Algebraic Graph Theory, by C. Godsil and G. Royle, Springer, 2001

LIST OF EXPERIMENTS

1. Introduction to Linux and C programming environment/Pointers.
2. Introduction to Network Programming.
3. Client and Server programs.
4. Processing multiple clients on a single server.
5. Using UDP in network programs
6. Programming Peer-To-Peer Networks.
7. Programming using udp chat server/client
8. Writing a simple c client to fetch html webpages.
9. Writing a small DNS program over network.
10. Small routing demonstration in C.
11. Consensus implementation in C using sockets

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SEMESTER-VIII

SEMESTER-VIII

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 421	Capstone Project	PR	0	0	24	12

UNIT I: LITERATURE SURVEY

Do a thorough literature survey in the domain of interest and conceive an idea. Continue the literature survey specifically related to the idea conceived and determine your contribution. Make an abstract of the proposed idea. Preparation of biweekly reports.

UNIT II: METHODOLOGY

Device project plan. Acquire necessary components, software, dataset etc requirements. Testing the existing algorithms, tools, or components. Preparation of biweekly reports and test plans.

UNIT III: RESULTS

Development of complete methodology. Prototype building. Preparation of biweekly reports and test plans.

UNIT IV: DISSERTATION AND DEMONSTRATION OF THE PROJECT

Completion of project dissertation. Demonstration of the project.

UNIT V: WRITING AND SUBMITTING A RESEARCH ARTICLE/PATENT

Writing of a technical paper / patent, Writing and submission of a journal research paper.

TEXTBOOKS/REFERENCE

As deem appropriate by the student under guidance of project faculty guide.

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HS ELECTIVES

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
COM 001	Contemporary Issues in Finance	HS	3	0	0	3

UNIT I

Introduction to Budget, Budgeting, Preparation of Budget: Flexible Budget, Cash Budget, Production Budget, Sales Budget, Capital Budget.

UNIT II

Analyzing Financial Performance of Companies, Financial Statement Analysis through Ratios: Liquidity Ratios, Profitability Ratios, Turnover Ratios, Solvency Ratios.

UNIT III

Leverage Analysis: Leverage Analysis: Developing the Concept of Leverage in Finance. Computation and inferences of Degree of Operating Leverage, Financial Leverage and Combined Leverage.

UNIT IV

The Time Value of Money: Introduction to Simple Interest and Compound Interest, Present Value, Future Value, Illustrate the use of Time Value of Money Tables, shows a Matrix Approach to solving Time Value of Money Problems, and Introduces the concepts of Intra- Year Compounding, Annuities due, and Perpetuities.

UNIT V

Risk and Return: Define risk and return and measure them by calculating expected return, standard deviation, and coefficient of variation. Discuss the different types of investor attitudes toward risk. Explain risk and return in a portfolio context and distinguish between individual security and portfolio risk. Distinguish between avoidable (unsystematic) risk and unavoidable (systematic) risk and explain how proper diversification can eliminate one of these risks.

REFERENCES

1. Financial Management- Prasanna Chandra.
2. Financial Management- Van Horne, James C.
3. Principles of Corporate Finance- Brealey, Myers.
4. Financial Management- Khan and Jain.
5. Corporate Finance Fundamentals- Ross, Westerfield & Jordan.
6. Principles of Financial Management-R.P. Rustagi.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECON 331	Macroeconomics and International Trade	HS	3	0	0	3

UNIT I: PRINCIPLES OF MACROECONOMICS

How people make decisions; How the economy as a whole works, Interdependence and gains from trade; Comparative advantage; Absolute advantage, Market supply and demand. Supply, Demand, and Government policies; Price Ceiling, Price Floors; How taxes affect market outcomes. Measuring national income, Measuring cost of living.

UNIT II: CLOSED ECONOMY MODELS

Inflation, Unemployment, Labor market models, the monetary system, Money growth and Inflation, Money market models; Money demand and money supply, Derivation of aggregate demand (AD) and aggregate and supply (AS) curves, what causes AD to shift? What causes AS to shift? Potential output; Inflationary gaps and Recessionary gaps. Interaction of aggregate demand and aggregate supply.

UNIT III: MACROECONOMIC POLICIES

Fiscal policies, how monetary policies influence MD/MS; AD/AS, how fiscal policies influence MD/MS; AD/AS, how policies influence the labor markets; transition of labor market shocks to growth models, Short-run tradeoff between inflation and unemployment; Phillips's curve; costs of reducing inflation.

UNIT IV: OPEN ECONOMY MODELS AND EXCHANGE RATES

Open Economy Macroeconomics: Basic Concepts, the basic tools of finance; Measuring the time value of money, managing risk; Market irrationality, Balance of payments; Trade balance; Why do some countries have a positive current account balance, should we be concerned about CA deficits; Possible ways of trying to lower a current account deficit, The foreign exchange markets; Foreign exchange markets in India; appreciation and depreciation of INR. Exchange rate movement; Demanders and Suppliers of Currency in Foreign Exchange Markets. Arbitrage; hedging; How do exchange rate Movements affect each group of demanders and suppliers of foreign exchange. Purchasing power parity; Fixed vs floating exchange rates; Macroeconomic consequences of exchange rate policies; Tradeoff of exchange rate policies. Demand and supply models for foreign exchange markets; graphing movements. Determinants of shifts in the demand and supply of foreign exchange markets; Role of people's expectations in exchange rate movements. Policy interventions to support currency; handling balance of payment crisis; Asian Financial Crisis Effects.

UNIT V: INTERNATIONAL TRADE

Policy goals in an open economy, Trade theories: Specific factors and income distribution; winners and losers of trade policies, Resources and Trade: The Heckscher-Ohlin Model, Firms in the Global Economy: Export Decisions, Outsourcing, and Multinational Enterprises, The instruments of trade policy, Trade policy in developing countries. India's new economic policy reforms in 1991; globalization gains and costs. Financial Globalization; Opportunity and Crisis. Growth, Crisis and reform in developing countries. Growth, crisis and reform in developing countries: Case Studies; What did East Asia do right; China's undervalued currencies. Connecting trade theories with contemporary trade policies.

TEXTBOOKS/REFERENCES

1. N. Gregory Mankiw, Principles of Macroeconomics, Cengage Learning, 6th edition, 2012.
2. Paul R. Krugman, Maurice Obstfeld and Marc Melitz, International Economics, Pearson Education Asia, 9th edition, 2012.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
HIS 100 A	Idea of India	HS	3	0	0	3

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, India, Aryavarta or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, what is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BME 002	Marketing Management	HS	3	0	0	3

UNIT I

Introduction to Marketing: Meaning and Definition, Importance of Marketing Understanding core concepts-Needs, Wants, Demands, Value and Satisfaction, Exchange, and transactions. Different approaches- Production, Product, Selling, Marketing and Societal Marketing.

UNIT II

Marketing Research: meaning and importance, Steps in marketing research, Scope/areas of marketing research.

UNIT III

Consumer Behavior: meaning and Importance of consumer behavior. Factors affecting consumer Serious.

UNIT IV

Market Segmentation: Meaning and Importance of market segmentation. Basis for market segmentation. Requisites of sound market segmentation.

TEXTBOOKS

1. Marketing Management – Philip Kotler.
2. Marketing Management – Sontaki & Sontaki.
3. Marketing Management – Nair. N. Rajan.
4. Marketing Management – Sherlekar.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BBA 001	Organizational Dynamics	HS	3	0	0	3

UNIT I: ORGANIZATIONAL BEHAVIOR AND OPPORTUNITY & CHALLENGES FOR MANAGERS

Understanding human behavior, Interdisciplinary influences, Behavior in times of change, Types of Organizational Behavior & Quality at work.

UNIT II: INDIVIDUAL PROCESSES & BEHAVIOR

Personality, Perception & Attribution, Attitudes, Values & Ethics, Motivation, Learning & Performance Management, Work Life Balance – Stress Management.

UNIT III: INTERPERSONAL PROCESSES & BEHAVIOR

Communication, Team Dynamics, Decision Making- Individual & Groups, Power & Political Behavior, Leadership & Followership, Conflict & Resolution.

UNIT IV: ORGANIZATIONAL PROCESSES & STRUCTURE

Jobs & the Design at work, Organizational Design & Structure, Organizational Structure, Career Management, Managing Change.

UNIT V

Mini Project on any one of the topics from the above 4 units.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ENL 233	Modern Indian Theatre	HS	3	0	0	3

UNIT I

Drama: Introduction, Different Types of Drama: Tragedy, Comedy, etc, Indian Theatre Vs Western Theatre, Modern Indian Theatre: Definition and Nuances, *Kanyasulkam*: Early Modernist Indian Dramatic Writing.

UNIT II

Folk tale and Theatre, Ancient Sanskrit Theatre Vs Folk Theatre, *Charandas Chor*: A Play Based on a Folk Tale from Rajasthan.

UNIT III

Folk Theatre and Anthropomorphism, *Naga-Mandala*: A Play Based on a Folk Tale from Karnataka.

UNIT IV

Political Theatre: A Voice from the Margins, Indian People's Theatre Association, *Silence! The Court is in Session*: A Political Play from Maharashtra.

UNIT V

Existentialism, *Evam Indrajit*: An Existentialist from Play from West Bengal.

TEXTBOOKS/REFERENCES

1. Bhatia, Nandi, ed. (2009). *Modern Indian Theatre: A Reader*. New Delhi: Oxford University Press.
2. Apparao, Gurajada. (1892). *Kanyasulkam* (*Girls for Sale*): *A Play from Colonial India*. Trans. Velcheru Narayana Rao. Bloomington: Indian University Press.
3. Hansen, Kathryn. (1983). "Indian Folk Traditions and the Modern Theatre." *Asian Folklore Studies*. 42.1 (1983): 77-89.
4. Bharata. (1950). *The Natyasastra: A Treatise on Hindu Dramaturgy and Histrionics*. Trans. Manmohan Ghosh. Vol. I. Calcutta: The Royal Asiatic Society of Bengal.
5. Tanvir, Habib. (1975). *Charandas Chor* in *Charandas Chor and Other Plays*. Calcutta: Seagull Books.
6. Schlesinger, Alfred. (1936). "The Literary Necessity of Anthropomorphism." *The Classical Journal*. 32.1 (1936): 19-26.
7. Karnad, Girish. (1988). *Naga-Mandala* in *Collected Plays Volume 1: Tughlaq, Hayavadana, Bali: the Sacrifice, Naga-Mandala*. Delhi: Oxford University Press.
8. Dutt, Utpal. (2009). *Towards a Revolutionary Theatre*. Calcutta: Seagull.
9. Tendulkar, Vijay. (1967). *Silence! The Court is in Session* in *Five Plays: Kamala, Silence! The Court is in Session, Sakharam Binder, The Vultures, Encounter* I. Delhi: Oxford University Press.
10. Sartre, Jean Paul. (2007). *Existentialism is a Humanism*. Trans. Carol Macomber. New Haven: Yale University Press.
11. Sircar, Badal. (1974). *Evam Indrajit* in *Three Plays*. Calcutta: Seagull Books.

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OPEN ELECTIVES
VI-SEMESTER

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 411	Big Data Analytics	OE	3	0	2	4

UNIT I

Big Data introduction - definition and taxonomy - big data value for the enterprise - The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.

UNIT II

Introduction to Map Reduce framework - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem- Streaming in Hadoop- Improving the performance using combiners- Chaining Map Reduce jobs- Joining data from different sources.

UNIT III

Querying big data with Hive - Introduction to Hive QL- Hive QL: data definition- data manipulation

UNIT IV

Querying big data with Hive – Hive QL queries- Hive QL Views – Hive QL indexes

UNIT V

Data Analytics using R: Introduction to R, creating a dataset, Getting started with graphs, Basic data management, Advanced data management.

TEXTBOOKS/REFERENCES

1. Big Data Fundamentals: concepts, Drivers and Techniques: Person Education, 2016
2. Hadoop The Definitive Guide, IV edition, O'Reilly publications
3. Hadoop in Action, Chuck lam, Manning publications
4. Programming, Hive, O'Reily publications
5. Apache Hive Cookbook, PACKT publications
6. R in Action, Robert I. Kabacoff, Manning publications
7. Practical Data Science with R, Nina Zumel John Mount, Manning publications

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LIST OF PRACTICAL EXPERIMENTS

1. a. Hadoop Installation
   b. Hadoop Shell Commands
2. a. Writing a file from local file system to Hadoop Distributed file system (HDFS)
   b. Reading a file from HDFS to local file system.
3. a. Implementation of Word Count program using Map Reduce without combiner logic
   b. Implementation of Word Count program using Map Reduce with combiner logic
4. Implementation of Map-Reduce program using partitioner
5. a. Implementation of Maximum temperature program using Map Reduce without combiner logic
   b. Implementation of Maximum temperature program using Map Reduce with combiner logic
6. a. Create a managed table and load the data from LFS
   b. Create a managed table and load the data from HDFS
   c. Create an external table and load the data from LFS
   d. Create an external table and load the data from HDFS
   e.Drop a managed table and check the result in HDFS
   f. Drop an external table and check the data from HDFS
7. Use HiveQL to analyse the stock exchange dataset and calculate the covariance between the stocks for each month. This will help a stock-broker in recommending the stocks to his customers.
8. a.create Hive table
   b. Load data into Hive table

c. Calculate the covariance

9. Implement JOINS using HIVE
   a. Inner Join
   b. Left outer join
   c. Right outer Join
   d) Full outer join
10. Write a R program to create student record using Vector concept.
11. Write a R program to create medical patients' status using data frame

i) Patient age ii) Gender iii) Symptoms iv) Patient Status

12. Write R program to visualize student marks of various subjects using Bar-chart and Scatter plot

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 202	Web Technology	OE	3	0	0	3

UNIT I: WEB ESSENTIALS

Introduction to World Wide Web (WWW) Introduction to Communication Models. Web site design principles, planning the site and navigation. Introduction to Hypertext Markup Language (HTML) Form design using HTML. Basics of Extensible Hypertext Markup Language (XHTML) Basics of W3C Markup Validation Service.

UNIT II: CLIENT-SIDE SCRIPTING

Introduction to Cascading Style Sheets (CSS) Style sheets in HTML. Introduction to Java scripts.

UNIT III: HOST OBJECTS

Syntax variables and data types in Java scripts. Operators in Java scripts. Arrays and user defined functions in Java script. Java script objects.

UNIT IV: BROWSERS AND THE DOM

XML-Documents and Vocabularies. XML Namespaces. Ajax in web development. Event based parsing in XML. XPath and XSLT. Introduct
ion to JSP. JSP and Servlets. Standard Tag Library in JSP.

UINT V: WEB SERVICES

Web Servers (IIS, PWS and Apache). HTTP Request Types. Accessing Web Servers. Database connectivity. Applets and Servlets. JDBC connectivity. JSP and Web development Frameworks. Application programming interface (API) for Remote Procedure Calls (RPC). Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) APIs

TEXTBOOKS/REFERENCES

1. Deitel, Deitel and Nieto, Internet, and Worldwide Web - How to Program, 5th Edition, PHI, 2011.
2. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education
3. Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and
4. II, Pearson Education, 2001. 4. Bates, "Developing Web Applications", Wiley, 2006.
5. Kalin, Martin. Java Web Services: Up and Running: A Quick, Practical, and Thorough, Introduction. " O'Reilly Media, Inc.", 2013.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 202 L	Web Technology Lab	OE	0	0	2	1

LIST OF EXPERIMENTS

1. Familiarize all the basic HTML tags.
2. Implement a static HTML personal webpage by using all the possible basic tags. [Each student can develop his own bio-data page]
3. To create an html file to link to different html page which contains images, tables, and also link within a page use Frames, Forms, etc. also.
4. Create an HTML file by applying the different styles using inline, external and internal style sheets.
5. a. Create an html page to change the background color for every click of a button using Java script. write a Java script program to define a user defined function for sorting the values in an array.
   b. Create an html page with 2 combo box populated with month & year, to display the calendar for the selected month & year from combo box using java script.
6. Develop a webpage with HTML and Java Script to read name and marks of five subjects obtained for that particular student using forms. Further, it should compute the Grade and display it as a message box.
7. Create a form to collects the name, email, user id, password and confirms password from the user. All the inputs are mandatory and email address should be entered in standard format. Also, the values entered in the password and confirm password textboxes should be the same. For the security reasons make sure that the password entered by the contains both small letters and capital letters, digits, special symbols also. If the given password does not contain all these give an error message to the user. After validating all the details using JavaScript display a message like “You have successfully entered all the details”.
8. Design an XML document to store information about the student of SRM University AP. The information must include Roll No Name, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
9. Develop a registration form with various graphical user component interfaces like Text boxes (Roll No), Text boxes (Name) option buttons (gender), Qualification (Check boxes), State (Combo), etc. and store the information given by the user into a MySql database using JSP.
10. Develop a webpage to display the details of a student. For this the user will enter Roll Number in the text box given and the details of that particular student should be retrieved from the database and display it on the same webpage. Use JSP to solve this problem.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 324	Computer Architecture and Organization	OE	3	0	0	3

UNIT I: OVERVIEW OF REGISTER TRANSFER AND ALU DESIGN

Register transfer language, register transfer, Bus and memory transfer, Arithmetic micro-operations, Logic micro-operations, Shift micro-operations, Arithmetic logic shift unit.

UNIT II: ARITHMETIC UNIT

Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Integer division, Floating point numbers and operations.

UNIT III: COMPUTER DESCRIPTION

Instruction codes, Computer registers, Computer instructions, Instruction cycle, Memory-references instructions, Input-output and interrupt, Complete computer description.

UNIT IV: CHANNEL CODING

Fundamental concepts, Execution of a complete instruction, Hardwired control, Micro programmed control, Pipelining operation, Superscalar operation.

UNIT V: MEMORY ORGANIZATION

Memory hierarchy, Main memory, Cache memory, Virtual memory, Modes of data transfer, Direct memory access.

TEXTBOOKS/REFERENCE

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5/e, McGraw-Hill, 2002.
2. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2000.
3. William Stallings, Computer Organization and Architecture, 6/e, Pearson Education Asia, 2000.
4. David A. Patterson, John L. Hennessy, Computer Organization and Design: The hardware / software interface, 3/e, Morgan Kaufmann, 2002.
5. John P. Hayes, Computer Architecture and Organization, 3/e, McGraw-Hill, 1998.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 325	Digital Image Processing	OE	3	0	0	3

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING

Image acquisition, image sampling and quantization, Relationships between pixels, image geometry, gray level transformations, Histogram processing: histogram equalization, Histogram specification, Color image processing: Color fundamentals, color models, Color transformations, applications of image processing.

UNIT II: IMAGE TRANSFORMS

2-D DFT, properties. Walsh transform, Hadamard transform, discrete cosine transforms, Haar transform, Slant transform, KL transform, Comparison of different transforms.

UNIT III: IMAGE ENHANCEMENT

(by spatial domain methods) Arithmetic and logical operations, point processing, Image smoothing and sharpening filters in spatial domain, Enhancement: (by frequency domain methods) Image smoothing and image sharpening filters in frequency domain. Homomorphic filter, Comparison of filters in frequency domain and spatial domain.

UNIT IV: IMAGE COMPRESSION FUNDAMENTALS

Types of redundancy, Lossless compression: Variable length coding, LZW coding, Bit plane coding, predictive coding-DPCM, Lossy compression: Transform coding, Basics of image compression standards: JPEG, JPEG 2000, Basics of vector quantization.

UNIT V: IMAGE SEGMENTATION

Region based segmentation, Detection of discontinuities, Edge linking and boundary detection, thresholding, Image Restoration: Degradation model, Estimation of degradation function, Restoration in the presence of noise only, Restoration filters: Inverse filter, wiener filter, Constraint least square filtering.

TEXTBOOKS/REFERENCE

1. R.C. Gonzalez, R.E. Woods, Digital Image processing, 3/e, Pearson Education, 2009.
2. Anil K. Jain, Fundamentals of Digital Image processing, Prentice Hall of India, 1989.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L., Digital Image Processing using MATLAB, Pearson Education, 2004.
4. William K. Pratt, Digital Image Processing, 3/e, John Wiley and Sons, 2004.
5. S. Jayaraman, S. Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 410	Adaptive Signal Processing	OE	3	0	0	3

UNIT I: ADAPTIVE SYSTEMS

Definition and Characteristics; areas of application; general properties, open- and closed-loop adaptation; applications of closed-loop adaptation. Adaptive Linear Combiner: General description, Input signal and weight vectors; desired response and error, The performance function; gradient and minimum mean-square error, Alternative expression of the gradient; decorrelation of error and input components.

UNIT II: PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE

Normal form of the input correlation matrix; eigenvalues and eigenvectors of the input correlation matrix, geometrical significance of eigenvectors and eigenvalues; (i) Searching the Performance Surface, Methods of searching the performance surface; basic ideas of gradient search methods, A simple gradient search algorithm and its solution; stability and rate of convergence the learning curve; gradient search by Newton's Method; Newton's Method in multidimensional space. gradient search by the Method of Steepest Descent; comparison of learning curves.

UNIT III: GRADIENT ESTIMATION AND ITS EFFECT ON ADAPTATION

Gradient component estimation by derivative measurement, the performance penalty; derivative measurements and performance penalties with multiple weights, variance of the gradient estimate; effects on the weight-vector solution, excess mean-square error and time constants, Mis adjustment; comparative performance of Newton's and Steepest-Descent Methods, Total mis adjustment and other practical considerations.

UNIT IV: OTHER ALGORITHMS

Derivation of the LMS algorithm; convergence of the weight vector, An example of convergence; learning curve, noise in the weight-vector solution; mis adjustment; performance, normalized and other LMS-based adaptive filters, Discrete Kalman filter; recursive least squares algorithm.

UNITV: APPLICATIONS

Applications: Adaptive Modeling and System Identification: General description, adaptive modeling of a multipath communication channel, adaptive modeling in FIR digital filter synthesis, Adaptive Interference Cancellation: Concept of adaptive noise cancelling, stationary noise-cancelling solutions; effects of signal components in the reference input, Term Project: Matlab implementation of the various learning algorithms with applications.

TEXTBOOKS/REFERENCES

1. B. Widrow and S. D. Stearns, Adaptive Signal Processing, Pearson Education Asia, 1985.
2. M. H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley, 2002.
3. S. Haykin, Adaptive Filter Theory, 4th edition, Pearson Education Asia, 2002.
4. T Adali, S Haykin, Adaptive Signal Processing, Wiley-India, 2010.
5. Selected papers on adaptive signal processing and applications

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ME 416	Surface Engineering	OE	3	0	0	3

UNIT I: INTRODUCTION TO SURFACE ENGINEERING

Differences between surface and bulk, Properties of surfaces, surface energy concepts, degradation of surfaces, wear and its type, Adhesive, Abrasive, Fretting, Erosion wear, Surface fatigue,

UNIT II: FRICTION AND LUBRICATION

Fundamentals, Types and measurement of solid, liquid and gaseous friction. Friction heat and calculation. Lubricants and additives, mechanism of solid, liquid and gaseous lubricants.

UNIT III: CORROSION

Different types of Corrosion and its prevention, Galvanic corrosion, Passivation, Pitting, Crevice, Mircobial, High-temperature corrosion, Corrosion in nonmetals, polymers and glasses, Protection from corrosion through surface modifications.

UNIT IV: CHANGING THE SURFACE METALLURGY

Localized surface hardening (flame, induction, laser, electron-beam hardening, Laser melting, shot peening), Changing the surface chemistry: Phosphating, Chromating, Anodizing (electrochemical conversion coating), Carburizing, Nitriding, Ion implantation, Laser alloying, boriding, Organic coatings (paints and polymeric or elastomeric coatings and linings), Hot-dip galvanizing (zinc coatings), Ceramic coatings (glass linings, cement linings, and porcelain enamels), Advanced surface coating methods: Gaseous State (CVD, PVD etc), Solution State (Chemical solution deposition, Electrochemical deposition, Sol gel, electroplating), Molten or semimolten State (Laser cladding and Thermal spraying)

UNIT V: CHARACTERIZATION OF SURFACE AND COATINGS

Surface Characterization (physical and chemical methods, XPS, AES, RAMAN, FTIR etc), Structural Characterization, Mechanical Characterization (Adhesion, Hardness, Elastic Properties, Toughness, Scratch and Indentation etc.), Tribological Characterization, Corrosion tests.

TEXTBOOKS/REFERENCES

1. Introduction to Surface Engineering and Functionally Engineered Materials, Peter Martin; Wiley, 2011.
2. Materials and Surface Engineering: Research and Development, J. Paulo Davim; Woodhead Publishing review, 2012.
3. Pradeep L. Menezes, “Tribology for Scientists and Engineers”, Springer, 2013.
4. Handbook, Friction, Lubrication and Wear Technology, Vol. 18, ASM.
5. Krishna, R., Anantraman, T.R., Pande, C.S., Arora, O.P., Advanced techniques for microstructural characterization (ed), Trans Tech Publication.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ME 562	Mechanical Behavior of Materials	OE	3	0	0	3

COURSE OBJECTIVES

The central theme of this course is the mechanical behavior of engineering materials, such as metals, ceramics, polymers, and composites, subjected to different types of loading. The main objectives are to provide students with basic understanding of phase transformation by heat treating and stress-induced hardening, linear and nonlinear elastic behavior, deformation under multiaxial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, brittle versus ductile fracture, fracture mechanisms at different scales, fatigue, contact deformation, and wear.

DESIRED COURSE OUTCOMES

Understand various types of deformation and failure of engineering materials subjected to various static and dynamic loadings. Correlate microscopic and macroscopic material behaviors. Learn how to engineer the material properties to meet certain specifications. Determine the safety factor for various possible failure modes and loadings. Obtain hands-on-experience with standardized mechanical testing techniques and learn how to present/interpret the measurements in a formal report.

UNIT I

Introduction, Structure property relationship. Elasticity, Isotropic/Anisotropic.

UNIT II

Viscoelasticity. Elastic-Plastic Deformation. Mechanical testing.

UNIT III

Heat Treatment. Strain Hardening. Strain Rate and Temperature Effects on Deformation. Slip, Dislocations, Twinning, and Hardening.

UNIT IV

Ductile and Brittle Fracture. Fracture Mechanics. Creep. Fatigue. Cumulative Fatigue Damage. Wear processes.

UNIT V

Special topics: Residual Stresses, Ceramics, Glasses, Polymers, Composites, Mechanical Working, and Micromechanics

TEXTBOOKS

1. Meyers and Chawla, Mechanical Behavior of materials, Cambridge publication

REFERENCES

1. N. E. Dowling, Mechanical Behavior of Materials, Prentice-Hall.
2. R.W. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, 4th Ed., John Wiley & Sons, 1995.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ME 223	Alternative Sources of Energy	OE	3	0	0	3

UNIT I: SOLAR ENERGY

Solar radiation and its measurements, Types of solar thermal collectors, Solar thermal applications for water heaters, solar stills and solar pond, Solar thermal applications for refrigeration and air- conditioning system, Solar thermal applications for solar dryer, solar cookers and solar furnaces, Sensible and latent heat thermal energy storage systems, Solar thermal power generation systems, Solar photovoltaic systems: basic working principle and components, Applications of solar photovoltaic systems.

UNIT II: WIND ENERGY

Basic principle of wind energy conversion system, Wind data, site selection and energy estimation, Components of wind energy conversion systems, Types of Horizontal axis and Vertical axis wind turbine, Design consideration of horizontal axis wind turbine, Aero foil theory, Analysis of aerodynamic forces acting on the blade, Performance of wind turbines, Introduction to solar and wind hybrid energy systems, environmental issues of wind energy.

UNIT III: OCEAN, HYDRO AND GEOTHERMAL ENERGY

Wave characteristics and wave energy, Tidal energy and its types, Estimation of energy and power in single basin tidal system, Ocean thermal energy conversion for open system, Ocean thermal energy conversion for closed system, Hydro power plants for small, mini and micro system, Exploration of geothermal energy, Geothermal power plants, Challenges, availability, geographical distribution, scope and economics for geothermal plant.

UNIT IV: BIOMASS

Sources of biomass, Pyrolysis, combustion and gasification process, Updraft and downdraft gasifier, Fluidized bed gasifier, Fermentation and digestion process, Fixed and floating digester biogas plants, Design considerations of digester, Operational parameter of biogas plants, Economics of biomass power generation.

UNIT V: DIRECT ENERGY CONVERSION SYSTEMS

Basic principle of thermo electric and thermionic power generations, Fuel cell principles and its classification, Phosphoric acid fuel cell, polymer electrolyte membrane fuel cell, molten carbonate fuel cell and solid oxide fuel cell, Fuel cell conversion efficiency, applications of fuel cell, Magneto hydrodynamic power generation for open cycle, Magneto hydrodynamic power generation for closed cycle, Hydrogen energy: properties and its production methods, Electrolysis, thermo-chemical methods, fossil fuel methods and solar energy methods, Hydrogen storage, transportation and applications.

TEXTBOOKS

1. Tiwari.G.N, Ghosal.M.K, "*Fundamentals of renewable energy sources"*,1st Edition, UK, Alpha Science International Ltd, 2007.
2. Godfrey Boyle, "*Renewable energy"*, 2nd Edition, Oxford University Press, 2010.
3. Twidell.J.W and Weir.A.D, "*Renewable Energy Resources"*,1st Edition, UK,E.&F.N. Spon Ltd, 2006.
4. Domkundwar.V.M, Domkundwar. A.V, "*Solar energy and Non-conventional sources of energy"*, Dhanpat rai & Co. (P) Ltd, 1st Edition, New Delhi, 2010.
5. G.D Rai, "*Non-Conventional Energy Sources"*, Khanna Publishers, 5th Edition, New Delhi, 2011.
6. B.H Khan, "*Non-conventional Energy Resources"*, 2nd Edition, New Delhi, Tata McGraw Hill, 2009.
7. S.P. Sukatme, J.K. Mayak, "*Solar Energy-Principles of thermal collection and storage*", 3rd edition, New delhi, McGraw Hill,2008.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 314	Nuclear Power Generation	OE	3	0	0	3

UNIT I: INTRODUCTION TO NUCLEAR ENGINEERING

Why Nuclear power, atomic nuclei, atomic mass, atomic number, isotopes, Radioactivity and radioactive change, rate of radioactive decay, mass energy equivalence, Binding Energy, Release of Energy by Nuclear Reaction. Types of Nuclear Reactions, Nuclear Cross – section, Nuclear Fission, Fission Chain Reaction, Fertile Materials and Breeding.

UNIT II: NUCLEAR REACTOR POWER GENERATION

Nuclear Power Systems, Classification of Nuclear Reactors, General Components of nuclear reactors, Power of a nuclear reactor, Comparison of nuclear plants and thermal plants, India's 3 stage Nuclear Power programme.

UNIT III: TYPES OF NUCLEAR REACTORS

Different types of reactors, Pressurized Water Reactor (PWE), Boiling Water Reactor (BWR), CANDU (Canadian Deuterium Uranium) Reactor, Gas cooled reactor.

UNIT IV: NUCLEAR MATERIALS

Introduction, Fuels, Cladding and Structural Materials Coolants, Moderating and reflecting materials, Control Rod and Shielding Materials.

UNIT V: NUCLEAR WASTE, DISPOSAL, AND SAFETY

Nuclear Radiation-Unit, Types of Nuclear Waste, Effects of nuclear radiation, Radioactive waste disposal system, Personal Monitoring, Radiation Protection, Radiation Dose.

TEXTBOOKS/REFERENCES

1. P.K. Nag "Power Plant Engineering ", Tata McGraw Hill
2. R.K. Rajput "Power Plant Engineering ", Khanna Publishers
3. John R. Lamarsh & Anthony J. Baratta "Introduction to Nuclear Engineering", Pearson

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 307M	Special Theory of Relativity	OE	3	0	2	4

UNIT I: INTRODUCTION TO RELATIVITY

Inertial Frames, Universality of Newton's second law in all inertial frames, Classical Relativity, does universal rest (ether) exists? Michelson Morley Experiment Principle, Michelson Morley Experiment, Postulates of Special Theory of Relativity, Concept of transformation, Galilean Transformation, Simultaneity of two events in different inertial frames of reference and its frame dependence, Tutorial I, Tutorial II, Tutorial III.

UNIT II: LORENTZ TRANSFORMATION

Clock Synchronization in an Inertial Frame, Lorentz Transformation, Length Contraction, Time dilation, Examples of Length Contraction and Time dilation, Simultaneity Part I, Simultaneity Part II, Transformation of Velocities Part I, Transformation of Velocities Part II, Tutorial IV, Tutorial V, Tutorial VI.

UNIT III: RELATIVISTIC VELOCITY AND MOMENTUM

Velocity Transformation, Relative velocity with examples, Time like and Space Like intervals, Causality, need to redefine Momentum, Vector and Four-Vectors, Proper time interval, Velocity and Momentum-Energy Four Vector, Example on Relativistic velocity and momentum, Tutorial VII, Tutorial VIII, Tutorial IX.

UNIT IV: MASS ENERGY RELATION

Mass-Energy Relationship, Relationship between new energy and momentum, Relativistic Dynamics Part I, Relativistic Dynamics Part II, zero mass particles, Relativistic Mass, Geometry of Space-time, Spacelike and time-like interval, Light cone, Tutorial X, Tutorial XI, Tutorial XII

UNIT V: GEOMETRY OF SPACE-TIME

Four-Dimensional form of Maxwell's equations, Four-dimensional Vector Potential.Stress-Energy Momentum Tensor, Conservation Laws, Lagrangian formulation of Electrodynamics Part I, Lagrangian formulation of Electrodynamics Part II, Relativistic treatment of Radiation, Four Dimensional form of Maxwell's equations, Four dimensional Vector Potential, Tutorial XIII, Tutorial XIV, Tutorial XV.

TEXTBOOKS:

1. Resnick, Robert. *Introduction to Special Relativity.* New York, NY: Wiley, 1968. ISBN: 9780471717256.
2. French, Anthony Philip. *Special Relativity.* New York, NY: Norton, 1968. ISBN: 9780393097931.
3. Einstein, Albert A. *Relativity: The Special and the General Theory.* New York, NY: Three Rivers Press/Random House, 1995. ISBN: 9780517884416. (recommended)

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PSY 111	Psychology for Everyday Living	OE	4	0	0	4

UNIT I: MYTHS AND MISCONCEPTIONS IN PSYCHOLOGY

Definition, nature and goals of psychology, Common myths and misconceptions about psychology, Schools of psychology; Basic and applied areas of psychology

UNIT II: THE ROLE OF PERCEPTION AND ATTITUDE TOWARDS UNDERSTANDING THE WORLD

Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement, Attitude formation, Attitude change.

UNIT III: INTELLIGENCE AND LEARNING

Definitions and nature of intelligence, Emotional and social intelligence; Measuring IQ, EQ and SQ, Fundamentals of learning and its applications, Memory techniques.

UNIT IV: UNDERSTANDING THE SELF

Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Identity; Self-concept, self-esteem and self-efficacy.

UNIT V: STRESS, COPING AND QUALITY OF LIFE

Nature, sources of stress and its reactions, Factors influencing stress, coping with and managing stress - cognitive and behavioral techniques, Improving quality of life.

TEXTBOOKS/REFERENCES

1. Baron, R. A. (2001). Psychology. New Delhi: Pearson Education India.
2. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014). Atkinson &Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.
3. Morgan, C. T., King, R. A., & Schopler, J. (2004). Introduction to Psychology. New Delhi: Tata McGraw Hill.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
HIS 200	India and its People	OE	4	0	0	4

UNIT I: THE MAKING OF MODERN INDIA; THROUGH THE EYES OF THE CONSTITUTION

Why do we need a constitution? Beginning of constitutionalism in India: Colonial and Anti-colonial legacies, Locating constituent Assembly debate: Consensus and Discontent. Reading preamble of the Indian constitution.

UNIT II: FUNDAMENTAL RIGHTS AND DIRECTIVE PRINCIPLES OF STATE POLICY

The crafting of Fundamental Rights and Directive Principles and their various interpretations, the centrality of Fundamental Rights in the Indian Constitution, Counter- hegemonic imagination of justice: Defining liberty and non- discrimination, The peculiarity of the Directive Principles of State Policies, The idea of constitutional insurgency, Cultural and educational rights to minorities in the Constitution.

UNIT III: ASYMMETRICAL FEDERALISM: CENTER-STATE RELATIONS

What is federalism? Constitutional provisions related to federalism, Relationship between State and Centre, Deliberative ambiguities of Indian Federalism, Special Provisions for Jammu and Kashmir, Himachal Pradesh, Northeastern states and tribal areas.

UNIT IV: FOUNDATIONS OF GOVERNANCE

Division of Power: Legislative, Executive, and Judiciary, Parliamentary form of government in India, Government of the Union and Government of the State, Role of Supreme Court and Judicial Activism in India.

UNIT V: CONSTITUTION AS A LIVING DOCUMENT

Constitution as a dialogue, Constitutional Amendments and the basic structure of the Indian constitution, Insertion of the 9^{th} schedule in the constitution, the role of judiciary and citizen in defending, negotiating and interpreting the constitution.

TEXTBOOKS/REFERENCES

1. Arjun Thiruvengadam, Origin and Crafting of the Constitution, in The Constitution of India, a Contextual Analysis, Hart Publishing.
2. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, Oxford, 1966.
3. Kalpana Kannabiran, Tools of Justice: Non- discrimination and the Indian Constitution, Routledge, 2012.
4. Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.
5. Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.
6. Zoya Hassan, E. Sridharan, and R. Sudarshan (eds), India's Living Constitution: Ideas Practices, Controversies, Permanent Black, New Delhi, 2002.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
HIS 005	Introduction to Gender	OE	4	0	0	4

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, Hindia, Aryavarta or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, what is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 355	Calculus of Variation	OE	4	0	0	4

UNIT I: METHOD OF VARIATIONS IN PROBLEMS WITH FIXED BOUNDARIES

Introduction – Functionals, Variation and Its Properties, Euler's Equation, Functionals Dependent on Higher-Order Derivatives, Variational Problems in Parametric Form, Some Applications.

UNIT II: VARIATIONAL PROBLEMS WITH MOVING BOUNDARIES

Elementary Problem with Moving Boundaries, One-Sided Variations.

UNIT III: SUFFICIENT CONDITIONS FOR AN EXTREMUM

Field of Extremals, The Function $E(x, y, p, y')$, Transforming the Euler Equations to the Canonical Form,

UNIT IV: VARIATIONAL PROBLEMS INVOLVING A CONDITIONAL EXTREMUM

Constraints of the Form $\varphi(x, y_1, y_2, \cdots y_n)$, Constraints of the Form $\varphi(x, y_1, y_2, \cdots y_n, y_1', y_2', \cdots y_n')$, Isoperimetric Problems.

UNIT V: DIRECT METHODS IN VARIATIONAL PROBLEMS

Introduction to Direct Methods, Euler's Finite-Difference Method, Rayleigh-Ritz Method, Kantorovich's Method.

TEXTBOOKS/REFERENCES

1. L. Elsgolts, *Differential Equations and the Calculus of Variations*, University Press of the Pacific, 2003.
2. A S Gupta, Calculus of Variations, Prentice-Hall of India Pvt. Ltd., New Delhi, 2008.
3. I. M. Gelfand and S. V. Fomin, *Calculus of Variations,* Dover Publications. 1963.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
IDEA 103	User Experienced Design	OE	3	0	0	3

DESCRIPTION

This course aims at introducing students to basics of User Experience and Interaction Design. This course will give an understanding that both the human user and user experience is the key to limiting, and potentially eradicating, frustrating, time-consuming and poorly designed technology, which restricts our productivity and sometimes even tests the limits of our sanity.

User Experience Design course will help keep the user at the forefront of students' mind and ensure one never feel such a disconnection. They will develop an understanding of the user and their limitations, capabilities and quirks to aid you in their task of designing products free from the mistakes committed by the competitors, so they can get one step ahead of the pack. The overall aim is to support, encourage and aid students - to guarantee the development of user-friendly technologies, as this will ultimately improve everyone's quality of life.

The course is a blend of theory and practice to learn the basics of UX and Design Thinking and does not require any prerequisite. This course will be useful to understand a systematic approach to solving problems, building meaningful products and usage of tools that leads to innovation.

COURSE OUT COMES & GOALS

- Understand the importance of User Experience Design and Interaction Design
- Learn about Gestalt principles of perceptual organization
- Learn about Visual perception and color vision
- How to handle User Error: who is to blame?
- Apply Usability testing methods
- Formulate and successfully communicate the solutions to problems

WHAT IS UX DESIGN

MODULE 1: INTRODUCTION TO USABILITY, INTERACTION DESIGN, DESIGN THINKING

- The principle of 'Visibility', 'Findability', 'Learnability'
- Affordances
- Mapping
- Constraints
- Feedback
- Hick's law
- Fitt's law
- Interactive experience
- Design thinking overview

MODULE 2: DESIGN PRINCIPLES & DESIGN GUIDELINES

- Gestalt Principles
- 10 rules of thumb
- UI design failures

USER RESEARCH METHODS

- Qualitative user research
- Best practices of qualitative user research
- Conducting ethical user research
- Basics of recruiting participants for user research

MODULE 3: VISUAL PERCEPTION AND COLOR VISION

- Visual Perception
- Vision and Design using color
- Color blindness
- Context and other influences

MODULE 4: USABILITY CONSIDERATIONS

- Task structure
- Simplicity in design
- Designing with experience in mind
- Chunking
- Banner blindness
- Preventing errors
- Context of use
- Focus on users
- The value of UX

UX DESIGN PROCESS

MODULE 5: PROJECT-I (in teams)

- Applying Design thinking
- Empathy & Ideation principles & tools

STORYTELLING

- Role of Storytelling in Design thinking

INSTRUCTIONAL METHOD

- The course delivery method will be through online platforms (Zoom is preferred due to the breakout rooms options) depend upon the requirement of content and need of students. This will be an experiential learning throughout the course.
- The internal evaluation will be done based on continuous evaluation of students in the hands-on workshop assignments and classroom.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in their given projects and also through questionnaire-based exam

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
IDEA 104	Dream-Discover-Disrupt	OE	3	0	0	3

MODULE 1: VENTURE IDEATION.
MODULE 2: MARKETING.
MODULE 3: CUSTOMER SEGMENTATION.
MODULE 4: CUSTOMER DISCOVERY.
MODULE 5: SOLUTION DESIGN.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 315	Artificial Neural Networks	OE	3	0	0	3

UNIT I: FUNDAMENTALS AND SINGLE-LAYER NETWORKS

Neuronal model; neural networks as directed graphs; feedback; network architectures: feedforward neural networks (FFNNs) and recurrent networks. Linear Neuron: Linear least-squares filter; Wiener filter; Adaptive filters: Newton's, steepest-descent, and least mean squares algorithms Nonlinear neuron: McMulloch-Pitts model; perceptron convergence theorem; limitations.

UNIT II: MULTI-LAYER NETWORKS

Motivation; Back-propagation learning, Heuristics; generalization; cross-validation; network pruning; limitations Supervised learning as an optimization problem Extreme learning machine (sequential and batch processing). Online sequential learning algorithm Applications to function approximation and pattern classification, identification and control.

UNIT III: RADIAL BASIS FUNCTION NETWORKS

Cover's theorem on the separability of patterns; interpolation problem; XOR problem revisited. Learning strategies. Supervised learning as an ill-posed hypersurface reconstruction problem, regularisation theory. Regularisation networks; generalized RBFN Approximation properties; comparison of RBF and multilayer perceptrons.

UNIT IV: UNSUPERVISED AND REINFORCEMENT LEARNING

Principal component analysis; the PCA problem Hebbian learning; Hebbian-based maximum eigenfilter; Hebbian-based PCA Introduction to Reinforcement Learning; Markov processes; Markov decision process Bellman's optimality criterion; dynamic programming for static and dynamic scenario. Policy and value iterations; approximate dynamic programming (direct methods).

UNIT V: RECURRENT NETWORKS

Dynamic systems; stability of equilibrium states; attractors; neuro-dynamic models. Hopfield networks: continuous- and discrete-time. Recurrent network architectures; controllability and observability Back-propagation through time; implementation with dynamical systems and static back-propagation algorithm.

TEXTBOOKS/REFERENCES

1. S. Haykin, "Neural Networks and Learning Machines," 3rd edition, Prentice Hall of India, 2009.
2. T. Hagan, H. B. Demuth and M. Beale, "Neural Network Design,", Thomson Learning, 2002.
3. M. M. Gupta, L. Jin and N. Homma, "Static and Dynamic Neural Networks: From Fundamentals to Advanced Theory," John Wiley-IEEE Press, 2003.
4. R. S. Sutton and A. G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2nd edition, 2018.
5. Selected papers on artificial neural networks and their applications

SRM UNIVERSITY AP
Andhra Pradesh

OPEN ELECTIVES
VII-SEMESTER

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 202	Web Technology	TE	3	0	0	3

UNIT I: WEB ESSENTIALS

Introduction to World Wide Web (WWW) Introduction to Communication Models. Web site design principles, planning the site and navigation. Introduction to Hypertext Markup Language (HTML) Form design using HTML. Basics of Extensible Hypertext Markup Language (XHTML) Basics of W3C Markup Validation Service.

UNIT II: CLIENT-SIDE SCRIPTING

Introduction to Cascading Style Sheets (CSS) Style sheets in HTML. Introduction to Java scripts.

UNIT III: HOST OBJECTS

Syntax variables and data types in Java scripts. Operators in Java scripts. Arrays and user defined functions in Java script. Java script objects.

UNIT IV: BROWSERS AND THE DOM

XML-Documents and Vocabularies. XML Namespaces. Ajax in web development. Event based parsing in XML. XPath and XSLT. Introduction to JSP. JSP and Servlets. Standard Tag Library in JSP.

UINT V: WEB SERVICES

Web Servers (IIS, PWS and Apache). HTTP Request Types. Accessing Web Servers. Database connectivity. Applets and Servlets. JDBC connectivity. JSP and Web development Frameworks. Application programming interface (API) for Remote Procedure Calls (RPC). Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) APIs

TEXTBOOKS/REFERENCES

1. Deitel, Deitel and Nieto, Internet, and Worldwide Web - How to Program, 5th Edition, PHI, 2011.
2. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education
3. Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and
4. II, Pearson Education, 2001. 4. Bates, "Developing Web Applications", Wiley, 2006.
5. Kalin, Martin. Java Web Services: Up and Running: A Quick, Practical, and Thorough,Introduction. " O'Reilly Media, Inc.", 2013.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 202 L	Web Technology Lab	OE	0	0	2	1

LIST OF EXPERIMENTS

1. Familiarize all the basic HTML tags.
2. Implement a static HTML personal webpage by using all the possible basic tags. [Each student can develop his own bio-data page]
3. To create an html file to link to different html page which contains images, tables, and also link within a page use Frames, Forms, etc. also.
4. Create an HTML file by applying the different styles using inline, external and internal style sheets.
5. a. Create an html page to change the background color for every click of a button using Java script. write a Java script program to define a user defined function for sorting the values in an array.
   b. Create an html page with 2 combo box populated with month & year, to display the calendar for the selected month & year from combo box using java script.
6. Develop a webpage with HTML and Java Script to read name and marks of five subjects obtained for that particular student using forms. Further, it should compute the Grade and display it as a message box.
7. Create a form to collects the name, email, user id, password and confirms password from the user. All the inputs are mandatory and email address should be entered in standard format. Also, the values entered in the password and confirm password textboxes should be the same. For the security reasons make sure that the password entered by the contains both small letters and capital letters, digits, special symbols also. If the given password does not contain all these give an error message to the user. After validating all the details using JavaScript display a message like “You have successfully entered all the details”.
8. Design an XML document to store information about the student of SRM University AP. The information must include Roll No Name, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
9. Develop a registration form with various graphical user component interfaces like Text boxes (Roll No), Text boxes (Name) option buttons (gender), Qualification (Check boxes), State (Combo), etc. and store the information given by the user into a MySql database using JSP.
10. Develop a webpage to display the details of a student. For this the user will enter Roll Number in the text box given and the details of that particular student should be retrieved from the database and display it on the same webpage. Use JSP to solve this problem.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 418	Machine Learning	OE	3	0	2	4

UNIT I

Introduction to machine learning, Supervised and Unsupervised Learning, Linear Regression, Logistic Regression, Generalized Linear Models.

UNIT II

Gaussian Discriminant Analysis (GDA), Naive Bayes, Support Vector Machines, K-Nearest Neighbor, Decision Trees, Random forest.

UNIT III

Clustering in Machine Learning, Different Types of Clustering Algorithm, K-Means Clustering, Gaussian Mixture Models, Bias-variance trade off.

UNIT IV

Introduction to Neural Networks, Feed-forward Network, Gradient descent optimization, Error Backpropagation, Evaluation of error-function derivatives, Efficiency of backpropagation, under and over fitting.

UNIT V

Introduction to Convolutional neural network (CNN), Backpropagation in CNN, Sparse Kernel Machines, Markov Chain Monte Carlo, Introduction to Reinforment learning.

TEXTBOOKS/REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. EthemAlpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.

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Andhra Pradesh

LIST OF EXPERIMENTS

1. Implement Linear Regression on the given dataset using python/MATLAB.
2. Implement Naïve Bayes classifier using Python/MATLAB.
3. Implement Logistic Regression on the given dataset using python/MATLAB.
4. Implement SVM algorithm using Python/MATLAB.
5. Implement Decision tree classifier and Random Forest classifier using python/MATLAB.
6. Implement Random Forest classifier using python/MATLAB.
7. Implement K-means algorithm for clustering the data using python/MATLAB.
8. Implement K-Nearest Neighbour classifier using python/MATLAB.
9. Emulate logic gates using neural Network using python.
10. Implement single-Layer Neural Network for image/data analysis using Python/MATLAB.
11. Implement Convolution Neural Network for image/data analysis using Python/MATLAB.
12. Implement Markov model for analysis of stock market data using python/MATLAB

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 422	Optimization Techniques	OE	3	0	0	3

UNIT: I UNCONSTRAINED OPTIMIZATION

Basics: Set-constrained and unconstrained optimization; conditions for local minimizers, One-dimensional search methods: golden section, Fibonacci, bisection, Newton's and Secant methods; bracketing; line search, Gradient methods: steepest descent method; analysis of gradient methods.

UNIT: II METHODS

Newton's method: analysis; Levenberg-Marquardt modification; nonlinear least squares, Conjugate Gradient method: conjugate direction algorithm; conjugate gradient algorithm; non-quadratic problems, Quasi-Newton method: approximating the inverse Hessian; rank-one correction; DFP and BFGS algorithms, Least-squares analysis; RLS; linear equation with minimum norm; Kaczmarz's algorithm; general solution.

UNIT: III LINEAR PROGRAMMING

Linear Programming: standard form; convex polyhedral; basic solutions and properties, Simplex method: canonical augmented matrix; algorithm; matrix form; two-phase; revised method, Duality: Dual linear programs and properties.

UNIT: IV EQUALITY AND INEQUALITY CONSTRAINTS

Equality constraints: Problem formulation; tangent and normal spaces; Lagrange conditions; second-order conditions; minimizing quadratics with linear constraints, Inequality constraints: Karush-Kuhn Tucker conditions; second-order conditions.

UNIT: V CONSTRAINED OPTIMIZATION

Convex optimization: convex functions, convex optimization problems; semi-definite programming, Algorithms: Projections; projected gradient with linear constraints; Lagrangian algorithms; penalty methods, Multi-objective Optimization: Pareto solutions, Pareto front computation, from multi-objective to single-objective optimization; uncertain LP problems.

TEXTBOOKS/REFERENCES

1. E. K. P. Chong and S. H. Zak, "An Introduction to Optimization," 4th edition, Wiley, 2013.
2. D. G. Luenberger and Y. Ye, "Linear and Nonlinear Programming," 4th edition, Springer, 2016.
3. D. P. Bertsekas, "Nonlinear programming," Athena Scientific, 1999.
4. S. Boyd and L. Vandenberghe, "Convex optimization," Cambridge University Press, 2004.
5. M. Fathi and H. Bevarani, "Optimization in Electrical Engineering," Springer, 2019

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ME 418	Introduction to Electric Vehicles	OE	3	0	0	3

UNIT I: INTRODUCTION
History, EV Benefits, EV/HEV subsystems and configurations.

UNIT II: VEHICLE DYNAMICS
Vehicle dynamics, forces acting, power and torque calculations, Simulations, Drive cycles.

UNIT III: BATTERIES
Battery parameters, why Li, SoH & SoC estimation/self-discharge, Battery pack design/development, battery computations, Charging, BMS and its design, future batteries.

UNIT IV: ELECTRICAL COMPONENTS FOR EV AND HEV
EV Motors (IM, PM etc,) D-q circuit, DC-DC converters, DC-AC converters, control system overview.

UNIT V: EV DESIGN
Mechanical, Electrical and Thermal design consideration, Sample design calculations for EV and HEV's.

TEXTBOOKS

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication.

REFERENCES

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2018.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
IDEA 102	Design Thinking	OE	3	0	0	3

UNIT I: INTRODUCTION TO DESIGN THINKING

Design Thinker's mindset, what is Design Thinking and why is it popular? Innovative thinking, what is a wicked problem and how can we solve it? The design thinking stages overview.

UNIT II: DESIGN THINKING - EMPATHISE

Power of Empathy, Probes for context mapping, Power of stories in building empathy for the target group, User Research methods -Qualitative user research, best practices of qualitative user research, best practices of qualitative user research. Conducting ethical user research. Basics of recruiting participants for user research.

UNIT III: DESIGN THINKING – DEFINE/REDEFINE THE CHALLENGE

Define problem, Frame insights, Understand context.

UNIT IV: DESIGN THINKING – IDEATE

Brainstorm and ideate, Divergence to Convergence, Creative confidence.

UNIT V: DESIGN THINKING – PROTOTYPE & TEST

Prototype to product, Prototyping methods, Heuristic Evaluation, Project 1 (in teams)-Applying Design thinking, Empathy & Ideation, principles & tools. Project 2 (in teams)-Applying Design thinking/Innovation principles and approach using specific tools. Storytelling -Role of Storytelling in Design thinking.

INSTRUCTIONAL METHOD

1. The course delivery method will be through online platforms (Zoom is preferred due to the breakout rooms options) depend upon the requirement of content and need of students. This will be an experiential learning throughout the course.
2. The internal evaluation will be done based on continuous evaluation of students in the hands-on workshop assignments and classroom.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in their given projects and also through questionnaire-based exam.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 305	Introduction to Science and Technology Studies	OE	4	0	0	4

UNIT I: PHILOSOPHY OF SCIENCE: ISSUES AND PERSPECTIVES

What is science? Some Historical Background, Scientific reasoning- Induction, deduction and the problem of Hume, Scientific Explanation and Causality, Popper's Philosophy of Science, Scientific Revolutions.

UNIT II: PERSPECTIVES FROM SOCIOLOGY OF SCIENCE AND TECHNOLOGY

Questioning Functionalism in the Sociology of Science, The strong program, The social construction of Scientific and technological realities, Studying laboratories.

UNIT III: SCIENCE, TECHNOLOGY AND DEVELOPMENT: A CRITICAL ENQUIRY

Medicine, Agriculture, Environment, War.

UNIT IV: EXCLUSIONS IN SCIENCE AND TECHNOLOGY INSTITUTIONS

Under presentation of women in Science and Technology Institutions in India and abroad, Autobiographical Accounts, The Caste of Merit- excerpts.

UNIT V: FEMINIST AND OTHER CRITIQUES OF SCIENCE

The Mis-measure of Man IQ tests, Craniometry, Examples of how gender figures in doing science, The Medical Construction of gender: The case of Intersex babies, Feminist epistemologies of Science, Hidden Figures Movie

TEXTBOOKS/REFERENCES

1. Samir Okasha (2003). Philosophy of science: A very short introduction.
2. Sismondo, S. (2010). An introduction to science and technology studies.
3. S G Kulkarni. Philosophy of Science: issues and Perspectives.
4. Mary Wyer et al (2000) Women Science and Technology.
5. Ajantha Subramanian (2018) The Caste of Merit.
6. Stefan Jay Gould The Mismeasure of Man.
7. Ashish Nandy Science Hegemony and Violence.
8. Gita Chadha and Asha Achuthan (Eds) Review of Women Studies, Economic and Political Weekly.
9. Jayasree Subramanian (2007) Perceiving and Producing Merit: Gender and Doing Science in India.
10. Sumi Krishna & Gita Chadha (Eds) Feminists and Science

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PSY 111	Psychology for Everyday Living	OE	4	0	0	4

UNIT I: MYTHS AND MISCONCEPTIONS IN PSYCHOLOGY

Definition, nature and goals of psychology, Common myths and misconceptions about psychology, Schools of psychology; Basic and applied areas of psychology

UNIT II: THE ROLE OF PERCEPTION AND ATTITUDE TOWARDS UNDERSTANDING THE WORLD

Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement, Attitude formation, Attitude change.

UNIT III: INTELLIGENCE AND LEARNING

Definitions and nature of intelligence, Emotional and social intelligence; Measuring IQ, EQ and SQ, Fundamentals of learning and its applications, Memory techniques.

UNIT IV: UNDERSTANDING THE SELF

Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Identity; Self-concept, self-esteem and self-efficacy.

UNIT V: STRESS, COPING AND QUALITY OF LIFE

Nature, sources of stress and its reactions, Factors influencing stress, coping with and managing stress - cognitive and behavioral techniques, Improving quality of life.

TEXTBOOKS/REFERENCES

1. Baron, R. A. (2001). CE, CBology. New Delhi: Pearson Education India.
2. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014).Atkinson &Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.
3. Morgan, C. T., King, R. A., & Schopler, J. (2004). Introduction to Psychology. New Delhi: Tata McGraw Hill

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PSY 116	Fundamentals of Neuro Linguistic Programming-Level 1	OE	3	0	0	3

UNIT I: WHAT IS NLP?

Introduction to NLP, NLP Frames, NLP Presuppositions – Beliefs of Excellence. The Communication Model (Deletion, Distortion and Generalization) Components of the NLP Communication Model.

UNIT II: META PROGRAMS

Sensory Acuity and Calibration, Representation System (Modalities), Sub modalities Practicing Sub modalities, Identifying your primary representational system.

UNIT III: ANCHORING

Eye Accessing Cues Rapport – Unconscious responsiveness. State: Introduction to states, Anchoring Process, State Elicitation Summary, Stacking Anchors, Stacking Anchors Summary (X, Y, Z state).

UNIT IV: WELL-FORMED / WELL-DEFINED OUTCOMES

Pain and Pleasure exercise, Wellness Vision Planning (Wheel of Life) Ardell's model for Wellness Coaching. T-F-A-R Coaching Model Timeline Coaching.

UNIT V: COACHING PATTERNS

New Behaviour Generator, Circle of Excellence – Resourceful States. Walt Disney Strategy, Reframing Coaching using values Perceptual Positions (Relationship Coaching / Leadership Coaching).

TEXTBOOKS/REFERENCES

1. NLP The New Technology of Achievement – Edited by Steve Andreas and Charles Faulkner.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BIO 112	Basic Microbiology	OE	4	0	0	4

UNIT I: INTRODUCTION TO MICROBIOLOGY

History of microbiology, Essential methods to study microbes: sterilization and disinfection: Methods of sterilization- physical methods (heat, filtration), radiation and chemical methods, Principles of microscopy, Spontaneous generation vs. biogenesis. Contributions of Anton von Leeuwenhoek, Louis Pasteur-germ theory of disease, Robert Koch- Koch's postulates, Joseph Lister, Alexander Fleming, Microbial growth, Growth media types - selective and differential media; Influence of environmental factors for microbial growth. Growth phases and kinetics; Maintenance and preservation of bacterial cultures.

UNIT II: BACTERIAL CELLS - STRUCTURE AND FUNCTION

Different groups of microorganisms and their general characteristics, Ultrastructure of Gram positive and Gram-negative bacterial cell wall, Size, shape and arrangement of bacterial cells. cell membrane, cytoplasmic matrix, pili, capsule, flagella Classification & molecular taxonomy-Phylogenetic tree; measuring diversity by 16S/18S rRNA, RAPD, T-RFLP.

UNIT III: MOLECULAR PATHOGENS

Viral structure and classification; Bacteriophage and its life cycle; Viral pathogenesis; Immune response to viral infections; Acute, chronic and latent viral infections; Viral vaccines, Viroid, Prions, Plasmid and transposable elements.

UNIT IV: MICROBIAL DISEASE AND ANTIMICROBIAL AGENTS

Microbial disease: - Tuberculosis, Typhoid, Infection caused by *E. coli*, *Staphylococcus*, *Sterptococcus*, Role of quorum sensing and biofilm in microbial disease, Action of antimicrobial drugs: inhibitors of cell wall synthesis, inhibitors of protein synthesis, inhibitors of nucleic acid synthesis, competitive inhibitors, antifungal, antiviral, anti- protozoan drugs, Mechanism of antibiotic resistance.

UNIT V: APPLIED MICROBIOLOGY

Microorganism of Industrial use, Basics of fermenter design, Primary and secondary metabolites, Strains-screening, adaptation and strain improvement Industrial production of antibiotics – penicillin; alcohol- ethanol. Food microbiology – Microorganisms in food, Introduction to probiotics and prebiotics, Food preservation Environmental microbiology – Bioremediation, Bioleaching, Microbial degradation of textile waste.

TEXTBOOKS/REFERENCES

1. Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International
2. Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International.
3. Stainer R. Y., Ingraham. J. L., Wheelis M. J., Painter P. R. (1999). General microbiology. MacMillan Educational Ltd. London.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 223	Introduction to Quantum Computation	OE	3	1	0	4

UNIT I: MATRIX, TENSOR AND DIRAC NOTATION

Basis vectors and orthogonality, Matrices Hilbert spaces, Inner and outer products, Tensors in index notation, Metric tensors, covariant and contravariant tensors, Unitary operators and projectors, Hermetian operator, Adjoint of operator, Wavefunction as vector and operator as metrics, Dirac notation, Tutorial 1, Tutorial 2, Tutorial 3.

UNIT II: INTRODUCTION AND OVERVIEW OF QUANTUM MECHANICS

Photon, Concept of Planck Constant, Photoelectric effect, Wave particle duality, Wave packet, Davisson and Germer Experiment, Superposition Principle, Young Double slit experiment, Qubits and pieces, Concept of Bloch sphere, Derivation on Bloch sphere representation, Tutorial 4, Tutorial 5, Tutorial 6.

UNIT III: FUNDAMENTALS OF QUANTUM COMMUNICATION

No-cloning theorem, Hidden Information of state, Einstein-Podolsky-Rosen Paradox, Bell states, Bell inequalities, Bell inequalities – Examples, Quantum entanglement, Quantum entanglement considering Heisenberg principal, Quantum teleportation, Tutorial 7, Tutorial 8, Tutorial 9.

UNIT IV: QUANTUM GATE

Pauli Gates, Phase Gate, Controlled phase shift, Hadamard gates, SWAP Gates, CNOT Gates, Toffoli gates, Combination of Gates, Circuit of Gates, Tutorial 10, Tutorial 11, Tutorial 12.

UNIT V: QUANTUM ALGORITHM, KEY DISTRIBUTION AND ERROR

Deutsch algorithm, Deutsch-Josza algorithm, Shor's Algorithm – Periodicity, Shor's period-finding algorithm, Introduction to Quantum key distribution, BB84 protocol, Quantum Error Correction, Quantum Error Correction Example, Physical Qubits, Tutorial 13, Tutorial 14, Tutorial 15.

TEXTBOOKS/REFERENCES

1. Phillip Kaye, Raymond Laflamme, and Michele Mosca (2007). An Introduction to Quantum Computing. Oxford University Press.
2. Michael A. Nielsen and Isaac L. Chuang (2000). Quantum Computation and Quantum information. Cambridge University Press.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
HIS 005	Introduction to Gender	OE	4	0	0	4

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, Hindia, Aryavarta or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, what is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECO 251	Indian Economy	OE	4	0	0	4

UNIT I: PERFORMANCE OF INDIAN ECONOMY SINCE 1947

Growth and Structural Changes, Features/characteristics of Indian economy, Human Development Index Traditional Methodology, Human Development Index: New Methodology, Sustainable Development, Capital Formation, Demographic Transition, Economic Planning in India, Reforms in Indian Economy.

UNIT II: KEY ISSUES OF INDIAN ECONOMY

Issues and Trends of Unemployment, Poverty in India, Problem of Inequality, Issues of Education, Gender Issues in India.

UNIT III: STRUCTURAL PERFORMANCE OF INDIAN ECONOMY

Importance and Features of Indian Agricultural, Trends in Performance and Productivity, Agricultural Markets and Institutions, Land Reforms, Green Revolution in Indian Agriculture, Agricultural Labour, Food Security, Public Distribution System, Trends, Productivity, and Growth of Industries, Industrial Policy in India, Industrial Sickness Small Scale Industries, Foreign Direct Investment in India.

UNIT IV

Trends and Performance in Services, WTO, India Foreign Trade, Monetary Policy, Fiscal Policy, Total contact hours.

TEXTBOOKS/REFERENCES

1. Jean Dreze and Amartya Sen, 2013. An Uncertain Glory: India and its Contradictions, Princeton University Press.
2. Himanshu, 2010, Towards New Poverty Lines for India, Economic and Political Weekly, January.
3. Kaushik Basu, 2009, ―China and India: Idiosyncratic Paths to High Growth, Economic and Political Weekly, September.
4. Gaurav Datt and Ashwani Mahajan, 2019- Indian Economy. S Chand and Company Limited, New Delhi 2019.
5. Puri, V.K. & Mishra S.K, 2019- Indian Economy. Himalaya Publishing House, New Delhi 2019.
6. Jalan, Bimal. Indian Economy: Problems and Prospects. Penguin India; New edition, 2004.
7. Jean Dreze and Angus Deaton, 2009, Food and Nutrition in India: Facts and Interpretations, Economic and Political Weekly, February.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EGL 167	Code Name Language	OE	4	0	0	4

UNIT I: THE REPRESENTATIONAL HIERARCHY

Introduction to the Triune Brain Model, Information Processing by the triune brain, The Visual, Auditory and Kinesthetic Learning Styles. The impact of belief & perception on language.

UNIT II: THE MAP IS NOT THE TERRITORY

The Beliefs of Excellence, Identifying the inner map, Asking Clean question, Arriving at well-formed outcome.

UNIT III: DECODING THE MAP

Introduction to the meta programs, Comprehending the thirteen filters, Sub modalities – an insight, Using sub modalities as a tool for change.

UNIT IV: REPROGRAMMING LANGUAGE

Meta Modelling – an overview, the three critical filters: Deletion, Distortion, Generalization, The Filter and Need connect, The Milton Model: Language to influence.

UNIT V: FROM PROGRAMMING TO REPROGRAMMING

The Role of Tools & Techniques in Language Re programming, The archetypes and corresponding metaphors, Demonstration of a few tools & techniques like Swish, Perceptual Positions, Coach & Crash, and Tetralema, Hands on sessions.

TEXTBOOKS/REFERENCES

1. Brandler Richard, John Grinder. *Frogs into Princes*. US: Eden Grove Editions, 1990.
2. Mukherjee Sudip. *Two Steps Ahead. India*: Notion Press, 2020.
3. Sullivan Wendy and Judy Rees. *Clean Language: Revealing Metaphors and Opening Minds*.UK: Crown House Publishing, 2008.
4. Dilts Robert.Neuro Linguistic Programming: The Study of the structure of subjective experience. USA: Meta Publications, 2009.
5. Brothers Jo Barbara (ed.) *Virginia Satir: Foundational Ideas*. USA: Haworth Press, 1991.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
TLC 101	Cognitive Learning Theories	OE	2	1	0	3

UNIT I: METACOGNITION, BRAIN, MEMORY AND LEARNING

The 3 Cos, where does learning happen? Actions pertaining to learning. What does the brain do? How does the brain learn? Memory, Intelligence, Thinking Levels.

UNIT II: LEARNING THEORIES

Classification of Knowledge, The "Science" of Education, Behaviourism, Cognitivism, Constructivism, Humanism, Dale's cone of Learning, Glenn's holistic thinking pyramid.

UNIT III: LEARNING INFLUENCERS

Discipline, Cognitive Factors, Self-Efficacy, Self-Regulation, Genetic Factors, External Factors, Generational Characteristics.

UNIT IV: Learning Success – 8 Pillars

Beliefs, Habits, Resources, Skills & Strengths, Emotions, Motivation, Goals and Objectives, Mindset.

TEXTBOOKS

1. Schunk, D. H. (2019). Learning Theories: An Educational Perspective. United Kingdom: Pearson.

REFERENCES

1. Carey, B. (2014). How We Learn: The Surprising Truth About When, Where and Why It Happens. United Kingdom: Pan Macmillan.
2. Johnson, A. P. (2019). Essential Learning Theories: Applications to Authentic Teaching Situations. United States: Rowman & Littlefield Publishers.
3. http://www.aussieeducator.org.au/education/theories.html
4. https://sites.google.com/a/nau.edu/educationallearningtheories/home
5. https://crlt.umich.edu/tstrategies/tslt
6. https://www.researchgate.net/publication/347453692_A_Metacognition_Based_8_Pillars_Mindfulness_Model_and_Training_Strategies

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 305	Advanced Control Systems	OE	3	0	0	3

UNIT: I STATE VARIABLE ANALYSIS AND DESIGN

Review of classical control system, Review of classical control system, State variables, State models for physical systems, State variables, State models for physical systems, Solution of state equations. Transfer function, Eigenvalues and eigenvectors, Jacobian linearization technique, State transformations and diagonalization, Transformation to phase-variable canonical form, Controllability and observability, Duality property, Illustrative Problems.

UNIT: II POLE PLACEMENT DESIGN AND STATE OBSERVERS

Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle.

UNIT: III NON-LINEAR SYSTEMS ANALYSIS

Common Nonlinear System Behaviors, Common Nonlinearities in Control Systems, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane, Variable Structure Systems.

UNIT: IV LYAPUNOV'S STABILITY ANALYSIS

Introduction, Lyapunov's Stability Criteria, the direct method of Lyapunov stability, Methods of constructing Lyapunov Function for Non-linear Systems, Illustrative examples.

TEXTBOOKS/REFERENCES

1. "Modern Control Engineering," K.Ogata, Pearson Education Asia/ PHI,4 th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
2. Control Systems Engineering (For the Modules 1 and 2) I.J. Nagarath and M.Gopal New Age 5 th Edition, 2007.
3. Nonlinear Control, Hassan K. Khalil Pearson Education Limited, 2015.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 305 L	Advanced Control Systems Lab	OE	0	0	2	1

LIST OF PRACTICAL EXPERIMENTS

1. DC Motor modeling using LabVIEW
2. Speed control of DC Motor.
3. Position control of DC Motor.
4. Inverted pendulum control.
5. Characteristics of Brushed and Brushless DC motor.
6. Characteristics of Brushed and Brushless DC motor.
7. Position control of servo motor.
8. Tuning of PID controller gains for closed loop converter control.
9. Control system design for power systems.

TEXT BOOKS/REFERENCES

1. "Control Systems Engineering" (For the Modules 1 and 2) I.J. Nagarath and M.Gopal New Age, 5th Edition, 2007.
2. "Modern Control Engineering," K.Ogata, Pearson Education Asia/ PHI,4 th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
3. "Nonlinear Control", Hassan K. Khalil Pearson Education Limited, 2015.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 307	Combinatorics and graph theory	OE	4	0	0	4

UNIT I: COUNTING PRINCIPLES AND TECHNIQUES

Combinatorics and Permutations, Binomial Coefficients and Multinomial Coefficients, The Pigeonhole Principle, the inclusion-Exclusion formula, Generating Functions: Newton's Binomial Theorem, Exponential Generating Functions, Partitions of Integers, Recurrence relations.

UNIT II: SPECIAL COUNTING NUMBERS

Partition number, Bell Numbers, Catalan numbers, Stirling numbers, Ramsey Numbers. System of distinct representatives.

UNIT III: AN INTRODUCTION TO GRAPH THEORY

Euler Circuits and Walks, Hamiltonian Cycles and Paths, Bipartile Graphs, Trees, Plane and planar graphs, Directed graphs.

UNIT IV: MORE ON GRAPH THEORY

Optimal Spanning trees, Connectivity, Colouring Planar Graphs, The Chromatic Polynomials, Graph of Symmetries, Burnside's Theorem.

UNIT V: APPLICATIONS

Problems involving scheduling and assignment, Isomer problem in Chemistry, If time permits, we also discuss a few applications in Computer Science: To prove lower bounds in computational models, Randomized algorithms, and various net- work problems.

TEXTBOOKS

1. Combinatorics and graph theory by J.M. Harris, J.L. Hirst and M.J. Mossinghoff, springer.
2. Introduction to Graph Theory by Douglas West.
3. Graph theory with applications by J. A. Bondy and U. S. R. Murty.
4. Graph Theory with Applications to Engineering and Computer Sciences by Narsingh Deo, Prentice-Hall, 1974.
5. An Introduction to Combinatorics and Graph Theory by David Guichard https://www.whitman.edu/mathematics/cgt_online/cgt.pdf.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 301	Atomic and Molecular Physics	OE	3	0	0	3

UNIT I: ATOMIC STRUCTURE

Rutherford model of atom, Rutherford Model numerical, Electron orbits, Bohr atom, Energy levels and spectra, Numerical on energy level and spectra, Sommerfield's elliptic orbits, Numerical on Somerfield's theory, Relativistic Corrections of Sommerfield's Theory, Tutorial 1, Tutorial 2, Tutorial 3.

UNIT II: VECTOR ATOM MODEL

Vector atom model, Concept of space, Concept of quantization, Electron spin, Magnetic moments of atoms, Numerical on quantization, Stern-Gerlach experiment, atomic excitation and atomic spectra, Numerical on atomic excitation and atomic spectra, Tutorial 4, Tutorial 5, Tutorial 6.

UNIT III: ONE AND TWO VALENCE ELECTRON SYSTEMS

Pauli Exclusion Principle, Electron configuration, Quantum states, Electron spin, Spin-Orbit Interaction, Energy levels of Na atom, Sodium Doublet, Spectral terms of two electron atoms, Terms for equivalent electrons, L-S and J-J coupling schemes, Singlet-Triplet separation for interaction energy of L-S coupling, Landé g-factor Landé Interval rule, Spectra of Helium atom, Zeeman Effect, Tutorial 7, Tutorial 8, Tutorial 9.

UNIT IV: ATOMIC AND MOLECULAR SPECTROSCOPY

EM spectrum, X-ray, Daune and Hunt's Rule, X-ray emission spectra, Bremsstrahlung effect, Mosley's law and its applications, Auger effect, electronic spectra of molecules. Rotational spectra of diatomic molecules, Raman Effect, Molecular Polarizability, Tutorial 10, Tutorial 11, Tutorial 12.

UNIT V: LASERS

Optical absorption and emission, Einstein coefficients, Optical pumping, Masers principles, Lasers principles, Numerical of Lasers, Ruby Laser principles, He-Ne Laser Principles, Solid state and semiconductor lasers, Tutorial 13, Tutorial 14, Tutorial 15.

TEXTBOOKS

1. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, R. Eisberg and R. Resnik 2nd Edison, 2006, Wiley.
2. Concepts of Modern physics, Arthur Besier, S. Rai Choudhury, Shobhit Mahajan, 7th Edition, 2015, Mcgraw Higher Ed.

REFERENCES

1. The Fundamentals of Atomic and Molecular Physics, Brooks, Robert L. 1 Edition, 2013, Springer-Verlag New York.
2. Physics of Atoms and Molecules, B. H. Bransden, C. J. Joachain, 2 Edition, Pearson Education India.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
COM 101	Business Organization and Management	OE	3	0	0	3

UNIT I

Historical Grassroots and Genesis of Business – How to do Business? –Introduction to Business Organization – Various Forms of Business Organization – Sole Trading – Partnership – Company Form of Business – Features of Company- Incorporation of a Company – MOA & AOA - Types of Companies - Case Study Analysis.

UNIT II

Relevance of SWOT/PESTEL analysis in establishing a Business Organization – Objectives of Business – Corporate Social Responsibilities- Sustainability of Business - Corporate Governance - Case Study Analysis.

UNIT III

Introduction to Management – Development of Management Thought – Principles of Management - Professionalization of Management – Relevance of Management to Business – Role of a Manager in Business – Skills and Qualities of a Manager – Successful and Effective Managers – Challenges before today's managers - Case Study Analysis.

UNIT IV

Functions of Management - Overview of Planning – Types of Planning - Organizing (Levels of Management & Organizational Structures) – Directing – Coordinating and Control – Staffing – Reporting and Budgeting – Importance and Techniques of Control – Motivating Function of Manager - Case Study Analysis.

UNIT V

Best Practices in Management – Evidences from Indian and Western Counterpart – Contemporary Issues in Management – Knowledge Management – Innovation – Team Management - Learning Organizations – Case Study Analysis.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
COM 107	Finance for Engineering	OE	3	0	0	3

UNIT I: FINANCIAL REPORTING

Accounting Concept - Financial Records - Accounting Principles and Conventions – Preparation of Financial Statements – Profit and Loss Statement - Balance Sheet - Cash Flow Statement.

UNIT II: FINANCE FUNCTIONS

Introduction, Goals of financial management, Finance functions, Interface between Finance and Other Business Functions - Time Value of Money - Future Value - Effective Rate - Single and Multiple Payments – Discounting.

UNIT III: ENGINEERING ECONOMIC ANALYSIS

Classification of Capital Projects - Cost of Capital – Measurement of Cost of Capital - Evaluation Criteria for Capital Projects - Economic Analysis Techniques: Traditional and Discounted Cashflow methods - NPV vs. IRR.

UNIT IV: RISKS ANALYSIS AND MEASUREMENT

Concepts of Risk and Return - Types of Risks - Measurement of Return and Risk –

Risk analysis in Engineering Projects: Risk-adjusted Discount Rate - Certainty Equivalent Approach - Capital Rationing: Approaches to Capital Rationing - Practical Issues in the Evaluation of Projects.

UNIT V: FINANCING OF CAPITAL PROJECTS

Sources of Finance: Lenders, Borrowers and Financial Institutions – Forms of Finance: Equity Instruments - Debt Instruments - Types of Loans - Long-term Debt - Short-term Debt - Public Issue and Private Placement of Financial Securities - Financial Markets - Equity Markets - Bond Markets - Futures and Derivatives Markets

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
JOU 001	Media Through the Ages: From Print to social media	OE	3	0	0	3

UNIT I

Introduction to Communication, Definition of Communication, Types: Intra-personal, Inter-personal, Group, Public and Mass Communication. Means of Communication, Process of Communication, Functions of Communications, Seven C's of Communication.

UNIT II

Definition of Mass Communication – Nature and process, Functions and types, Print, Electronic and Digital, Communication and Public Opinion: Nature, Meaning and Process.

UNIT III

Newspapers and Freedom Struggle, Colonial Rule and the Struggle for Press Freedom, Press and the Civil Liberties.

UNIT IV

Evolution of television, Prasar Bharati and Public Service Broadcasting, Growth of Satellite channels, 24x7 News channels.

UNIT V

Characteristics of New Media, New media as a form of communication, Evolution of Internet in India, Web Blogs, Online News Streaming.

TEXTBOOKS/REFERENCES

1. Hasan Seema., (2010), *Mass Communication: Principles and Concepts*. Chennai, India: CBS Publisher.
2. Mcquail Denis, (2010) *Mass Communication Theory* (Sixth Edition). London, England: Sage Publications.
3. Narula Uma, (2009),*Mass Communication Theory and practice*. New Delhi, India: Her-Anand Publication.
4. Chandra Bipan (2016) *India's Struggle for Independence: 1857-1947* (reprint). New Delhi, India: Penguin Random House.
5. Desai A.R, (2016) *Social Background of Indian Nationalism* (reprint). India: Sage Publication.
6. Mehta Nalin (2015) *Behind a Billion Screens: What Television Tells Us About Modern India* (2015 edition): HarperCollins.
7. Mehta Nalin (2008) *India on Television*. New Delhi, India: HarperCollins.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CSE 411	Big Data Analytics	OE	3	0	2	4

UNIT I

Big Data introduction - definition and taxonomy - Big data value for the enterprise - The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.

UNIT II

Introduction to Map Reduce framework - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem- Streaming in Hadoop- Improving the performance using combiners- Chaining Map Reduce jobs- Joining data from different sources.

UNIT III

Querying big data with Hive - Introduction to Hive QL- Hive QL: data definition- data manipulation

UNIT IV

Querying big data with Hive – Hive QL queries- Hive QL Views – Hive QL indexes

UNIT V

Data Analytics using R: Introduction to R, Creating a dataset, Getting started with graphs, Basic data management, Advanced data management.

TEXTBOOKS/REFERENCES

1. Big Data Fundamentals: concepts, Drivers and Techniques: Person Education, 2016
2. Hadoop The Definitive Guide, IV edition, O'Reilly publications
3. Hadoop in Action, Chuck lam, Manning publications
4. Programming, Hive, O'Reily publications
5. Apache Hive Cookbook, PACKT publications
6. R in Action, Robert I. Kabacoff, Manning publications
7. Practical Data Science with R, Nina Zumel John Mount, Manning publications

SRM UNIVERSITY AP
Andhra Pradesh

LIST OF PRACTICAL EXPERIMENTS

1. a. Hadoop Installation
   b. Hadoop Shell Commands
2. a. Writing a file from local file system to Hadoop Distributed file system (HDFS)
   b. Reading a file from HDFS to local file system.
3. a. Implementation of Word Count program using Map Reduce without combiner logic
   b. Implementation of Word Count program using Map Reduce with combiner logic
4. Implementation of Map-Reduce program using partitioner
5. a. Implementation of Maximum temperature program using Map Reduce without combiner logic
   b. Implementation of Maximum temperature program using Map Reduce with combiner logic
6. a. Create a managed table and load the data from LFS
   b. Create a managed table and load the data from HDFS
   c. Create an external table and load the data from LFS
   d. Create an external table and load the data from HDFS
   e.Drop a managed table and check the result in HDFS
   f. Drop an external table and check the data from HDFS
7. Use HiveQL to analyse the stock exchange dataset and calculate the covariance between the stocks for each month. This will help a stock-broker in recommending the stocks to his customers.
8. a.create Hive table
   b. Load data into Hive table

c. Calculate the covariance

9. Implement JOINS using HIVE
   a. Inner Join
   b. Left outer join
   c. Right outer Join
   d) Full outer join
10. Write a R program to create student record using Vector concept.
11. Write a R program to create medical patients status using data frame

i) Patient age ii) Gender iii) Symptoms iv) Patient Status

12. Write R program to visualize student marks of various subjects using Bar-chart and Scatter plot

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EEE 421	Linear Systems	OE	3	0	0	3

UNIT I: LINEARITY, LINEAR SPACES AND LINEAR OPERATORS

Review of fields, vector spaces, basis, vector representation, linear transformations, rank and nullity, linear operators and diagonalisablity, inner and normed vector spaces, Continuity, linearity, linear systems, time invariance, characteristics, Laplace transform, generalised initial-value theorem, Dirac delta impulse, transforms, superposition integral, frequency domain perspective, Canonical forms: controller, phase variable, controllability, observer, observability, parallel and cascade, Jordan canonical forms. Markov parameters, duality, discrete-time dynamical systems; general state-space descriptions; non-uniqueness; packed matrix representations, Frequency domain: identities and resolvent formulae, transfer function, External and internal descriptions, nonlinear systems and linearization.

UNIT II: SOLUTIONS OF STATE-SPACE DESCRIPTIONS

Existence and uniqueness of solutions of CT systems; examples of nonlinear systems; fundamental theorem, Linear time-varying continuous time systems: Wronskian; state transition matrix and its properties; homogeneous and nonhomogeneous differential equations, Linear time-invariant continuous-time systems; evaluation of state transition matrices; Jordan form; matrix exponentials, Linear discrete-time systems; state transition matrix, Modes of oscillations and modal decomposition; sampled-data systems.

UNIT: III CONTROLLABILITY AND OBSERVABILITY

Determining the initial conditions: observability; setting up initial conditions: observability, Canonical forms revisited, duality, Hankel matrix revisited, connections, Definitions of controllability and observability, characteristics; joint controllability and observability, characteristics, connections; Popov Belevitch Hautus tests; Kalman decomposition, Controllability and observability of discrete-time systems; subtle issues.

UNIT IV: STABILITY OF SOLUTIONS

External and internal stability, Equilibrium points, Stability in the sense of Lyapunov for CT systems, Lyapunov equation; linearised systems; Sylvester's criterion, Stability in the sense of Lyapunov for DT systems.

UNIT V: STATE-SPACE COMPENSATOR DESIGN

Stabilisation by output feedback; stabilisation by cascade compensation, State variable feedback for CT systems: Bass-Gura formula, modal controllability, Ackermann formula, Mayne-Murdoch formula; Transfer function analysis; effect on zeros; noncontrollable modes, Regulator problem; integral-error feedback; Quadratic regulator theory for CT systems, DT systems: Modal controllability, controllability to the origin, state-variable feedback, discrete-time regulator, Asymptotic observers; Combined observer-controller compensators; Reduced-order observers; optimality criterion.

TEXTBOOKS/REFERENCES

1. T. Kailath, Linear Systems, Prentice-Hall, 1980.
2. M. Gopal, "Modern Control Systems Theory." 3rd edition New Age International Publishers, 2014.
3. C.-T. Chen, Linear System Theory and Design, 2nd edition Holt, Rinehart and Winston, 1984.
4. P. J. Antsaklis and A. N. Michel, Linear Systems, Birkhauser, 2006.
5. W. T. Brogan, Modern Control Theory, 3rd edition, Prentice-Hall, 1990

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ME 433	Introduction to High Performance Computing	OE	3	0	0	3

UNIT I

Introduction to HPC Systems, architecture and OS concepts, Multi-core CPUs, GPU, systems and High-performance clusters.

UNIT II

Introduction to basic numerical methods (stencil computations (_nite di_erences),linear system solutions, integration). Sequential implementation.

UNIT III

Programming paradigms: OpenMP and MPI, Thread Management, CUDA / OpenCL.

UNIT IV

Data Dependency Reduction. Data flow, Loop reordering. Purely Parallel Algorithms, Block Decomposition Methods, Parallel Programming Packages.

TEXTBOOKS

1. Introduction to High Performance Computing for Scientists and Engineers. Chapman & Hall/CRC Computational Science Series.

REFERENCES

1. J. J. Dongarra, I. B. Du_, D. C. Sorensen and H. A. van der Vorst, Solving Linear Systems on Vector and Shared Memory Computers, SIAM, 1991.
2. K. Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 1993.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 355	Calculus of Variation	OE	4	0	0	4

UNIT I: METHOD OF VARIATIONS IN PROBLEMS WITH FIXED BOUNDARIES

Introduction – Functionals, Variation and Its Properties, Euler's Equation, Functionals Dependent on Higher-Order Derivatives, Variational Problems in Parametric Form, Some Applications.

UNIT II: VARIATIONAL PROBLEMS WITH MOVING BOUNDARIES

Elementary Problem with Moving Boundaries, One-Sided Variations.

UNIT III: SUFFICIENT CONDITIONS FOR AN EXTREMUM

Field of Extremals, The Function $E(x, y, p, y')$, Transforming the Euler Equations to the Canonical Form,

UNIT IV: VARIATIONAL PROBLEMS INVOLVING A CONDITIONAL EXTREMUM

Constraints of the Form $\varphi(x, y_1, y_2, \cdots y_n)$, Constraints of the Form $\varphi(x, y_1, y_2, \cdots y_n, y_1', y_2', \cdots y_n')$, Isoperimetric Problems.

UNIT V: DIRECT METHODS IN VARIATIONAL PROBLEMS

Introduction to Direct Methods, Euler's Finite-Difference Method, Rayleigh-Ritz Method, Kantorovich's Method.

TEXTBOOKS/REFERENCES

1. L. Elsgolts, *Differential Equations and the Calculus of Variations*, University Press of the Pacific, 2003.
2. A S Gupta, Calculus of Variations, Prentice-Hall of India Pvt. Ltd., New Delhi, 2008.
3. I. M. Gelfand and S. V. Fomin, *Calculus of Variations,* Dover Publications. 1963

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAT 306	First course in cryptography	OE	4	0	0	4

UNIT I: ELEMENTARY NUMBER THEORY AND ABSTRACT ALGEBRA

Group-theoretic background: Cyclic group and _nding a generator of a cyclic Group. Integer arithmetic: Basic operations, The Euclidean algorithm. Modular arithmetic: Basic operations, computing modular inverses. Chinese Remainder Theorem, Primality testing, Factoring algorithms, Elliptic curves.

UNIT II: INTRODUCTION AND CLASSICAL CIPHERS

Definition of Cryptography: Classical and Modern Cryptography, The setting of Private-key Encryption, Historical ciphers and their crypto-analysis, Basic Principles of modern Cryptography: Formation of exact definitions, Reliance on precise assumptions and Rigorous Proofs of Security.

UNIT III: PERFECTLY SECRET ENCRYPTION

Definitions and Basic Properties, The One-Time Pad (Vernams Cipher), Limitations of Perfect Secrecy.

UNIT IV: PRIVATE-KEY (SYMMETRIC) CRYPTOGRAPHY

Private-Key Encryption and Pseudo randomness, Message Authentication Codes and Collision-Resistant Hash Functions, Pseudorandom Objects in Practice: Block Ciphers, Private-Key Cryptography Necessary and Sufficient Assumptions.

UNIT V: PUBLIC KEY (ASYMMETRIC) CRYPTOGRAPHY

One-Way Functions and Permutations, Constructing Collision-Resistant Hash Functions, Private-Key Management and the Public-Key Revolution, Public-Key Encryption.

TEXTBOOKS

1. Introduction to Modern Cryptography by Jonathan Katz and Yehuda Lindell, CRC Press.
2. Lecture Notes on Cryptography by Sha_ Goldwasser and Mihir Bellare.
3. A Course in Cryptography by Rafael Pass and Abhi Shelat.
4. A Course in Number Theory and Cryptography by Neal Koblitz.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BBA 606	Corporate Social responsibility	OE	3	0	0	3

UNIT I: INTRODUCTION TO CORPORATE SOCIAL RESPONSIBILITY

History of Corporate Social Responsibility, Definitions of CSR, Global and Indian Context of Corporate Social Responsibility.

UNIT II: PRINCIPLES OF CSR

Sustainability, Accountability and Transparency, Changing emphasis in companies, Externalizing costs, Ethical Principles of CSR, corporate behavior and reputation.

UNIT III: STAKEHOLDERS AND THE SOCIAL CONTRACT

Types and classification of stakeholders, Stakeholder theory, Regulation and its implications, Due diligence of stakeholders.

UNIT IV: ISSUES IN CSR AND CASE STUDIES

Sustainability, CSR themes and case studies.

UNIT V: CONDUCTING CSR PROJECTS

Planning CSR projects, Steps in Implementation of CSR; challenges and risks, Monitoring and evaluation, Reporting projects.

TEXTBOOKS/REFERENCES

1. Crowther, D. & Aras, G. (2008). Corporate Social Responsibility. Ventus Publishing APS.
2. Shrivastava, L.. (2014). Corporate Social Responsibility. JRU publication.
3. Bansal, P. Roth, R. 2000. Why Companies Go Green: A model of Ecological Responsiveness. The Academy of Management Journal, Vol.43, No.4, pg 717-736. [6]
4. Fry, LW. Keim.GD. Meiners, RE. 1982. Corporate Contributions: Altruistic or for Profit? The Academy of Management Journal, Vol.25, No.1, pg.94 -106.[10]
5. Grace, D, Cohen, S.2005. Business Ethics; Problems and Cases. Australia. Oxford University.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BIO 113	Biochemistry I - Biomolecules	OE	4	0	0	4

UNIT I: BIOENERGETICS

Biomolecules: water- structure and properties, buffers and its biological importance's. Principles of bioenergetics- Laws of thermodynamics – entropy and enthalpy - standard free energy changes- standard reduction potentials – thermodynamics of coupled reaction.

UNIT II: CARBOHYDRATES

Carbohydrates: definition and functions, classification, properties, monosaccharides, disaccharides, oligosaccharides, polysaccharides- homo- and hetero- polysaccharides. Quantitative and qualitative methods.

UNIT III: LIPIDS

Lipids- Classification- structure and properties- phospholipids- glycolipids- sphingolipids- cholesterol. Fatty acids- saturated and unsaturated fatty acids- biosynthesis and essential fatty acids.

UNIT IV: AMINO ACIDS AND PROTEINS

Amino Acids-Classification and properties. structure and properties of amino acids, Essential and nonessential amino acids, Proteins-classification and functions, levels of protein structure, haemoglobin and myoglobin.

UNIT V: NUCLEIC ACIDS

Nucleic acids- Structure, Purine and Pyrimidine bases structure, Properties and functions of nucleic acids (DNA, RNA). Different forms of DNA and RNA.

TEXTBOOKS/REFERENCES

1. Harper's Illustrated Biochemistry, V. W. Rodwell, D. Bender, K.M. Botham, P.J. Kennelly and P.A. Weil (2018) 31st edition, McGraw Hill-Medical.
2. Lehninger Principles of Biochemistry, D. L. Nelson and M. M. Cox, (2017) 7th edition, W.H. Freeman & Company.
3. Biochemistry: D. Voet and J.G. Voet (2011), 4th edition, Wiley
4. Biochemistry, J M Berg and J.L. Tymoczko, G. J. Gatto Jr., L Stryer (2015), 8th edition, W.H. Freeman & Company.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
PHY 224	Introduction to Optics	OE	3	0	0	3

UNIT I: PHYSICAL OPTICS

The propagation of light and Rayleigh scattering, Laws of reflection and refraction, Fermat's principle, The electromagnetic approach of light propagation. The Fresnel equations. Total internal reflection and evanescent waves. Optical properties of metals, Interaction of light and matter. Stokes treatment of reflection and refraction, Photons and the laws of reflection and refraction, Tutorial 1, Tutorial 2, Tutorial 3.

UNIT II: GEOMETRICAL OPTICS

Prisms: dispersion and reflection properties, Planar and aspherical mirrors, Thick lenses and lens systems, Newton formula, lateral magnification, Analytical ray tracing and development of Matrix methods, Matrix analysis of system of two thin lenses, Unit and Nodal planes, Matrix analysis of mirror systems, Monochromatic aberrations – Spherical aberration, Coma, Astigmatism, Field curvature, Distortion, Chromatic aberrations, Thin achromatic doublets, GRIN Systems and optical glasses, Tutorial 4, Tutorial 5, Tutorial 6.

UNIT III: INTERFERENCE OF LIGHT

Coherence and Interference of Light Waves by Division of Wave Front, Interference pattern and intensity distribution, Fresnel Biprism and Interference with white light, Displacement of fringes, Interference by a plane parallel film illuminated by a plane wave and Cosine law, High reflectivity from deposited thin film and reflection by a periodic structure, Interference by a plane parallel film when illuminated by a point source, Interference by a film with two nonparallel reflecting surfaces Color of Thin Films and Newton's Rings. The Michelson Interferometer, Multiple reflections from a plane parallel film, Fabry–Perot etalon and resolving power of Fabry–Perot interferometer, Tutorial 7, Tutorial 8, Tutorial 9.

UNIT IV: DIFFRACTION OF LIGHT

Fraunhofer diffraction - single-slit diffraction pattern, Two-slit Fraunhofer diffraction pattern, N-slit Fraunhofer diffraction pattern, The Diffraction Grating and its resolution, The Fresnel diffraction integral, and Fraunhofer approximation. Fraunhofer Diffraction by a Long Narrow Slit, Rectangular Aperture and Circular Aperture, Array of Identical Apertures and Spatial Frequency Filtering. The free propagation of a spherical wave - Fresnel diffraction, half-period zones. Diffraction at circular apertures, the Zone plate. Diffraction of a plane wave by a long narrow slit and transition to the Fraunhofer region. Tutorial 10, Tutorial 11, Tutorial 12.

UNIT V: POLARIZATION OF LIGHT

The Nature of Polarized Light, Types of polarization - plane, circular Elliptical Polarization, Polarizers, Malus's Law of Polarization, Dichroism, Dichroic Crystals and Polaroid, Birefringence, Ordinary and extraordinary light, Birefringent Crystals and Birefringent Polarizers. Polarization by Reflection, The Fresnel Equations and Brewster's Law of Polarization, Circular Polarizers, Half and full wave plates, Theory of Optical Activity and Polarimetry, Induced Optical Effects—Optical Modulators, The Faraday Effect, The Kerr and Pockels Effects. Tutorial 13, Tutorial 14, Tutorial 15.

TEXTBOOKS/REFERENCES

1. Introduction to Geometrical and Physical Optics, B. K. Mathur, 7 Edition, 1967, Gopal Printing.
2. Fundamentals of Optics, Francis Jenkins, Harvey White, 4 edition, 2017 McGraw Hill Education.
3. A Textbook on Light, K G Mazumdar and B Ghosh, 3rd revised Edition, 2010, Sreedhar Publication, India.
4. Optics, Eugene Hecht, 5th Global Edition, 2017, Pearson Education Limited.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
HIS 100	Idea of India	OE	4	0	0	4

UNIT I: THE NATION AND ITS MANY ROOTS

What is a Nation? –Theories of Nationalism, The many names of India: India, India, Aryavarta or Bharat, Mother India: Iconising a Nation

UNIT II: UNEARTHING THE PAST

The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, what is a civilization? Theories of Civilization, Indus Valley Civilization

UNIT III: STORIES OF GODS AND PEOPLE

The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

UNIT IV: POLITY AND GOVERNANCE

Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

UNIT V: TOWARDS UNDERSTANDING THE NATION

The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

TEXTBOOKS

1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
TLC 102	Teaching and Learning	OE	3	0	0	3

UNIT I: INTRODUCTION TO TEACHING AND LEARNING

Teaching Methodologies, Understanding the Learners, Learning Theories -Behaviourism, Cognitivism, Constructivism. Innovative Instructional Methods.

UNIT II: TEACHER VS STUDENT CENTRIC INSTRUCTION

Introduction to teacher centric instruction, Passive Learning- Direct Instruction, Lecture Mode and Demonstration Mode, Active Learning- Learning by doing, Interactive Mode and Seminar Mode, Learners Generations – Introduction and needs of current generation learners.

UNIT III: TEACHING METHODOLOGIES

Meaningful Learning, Zone of Proximal Development, Flipped Classroom, Deep Planning Methods, Peer Learning Method, Gagne's 9 Events of Instruction.

UNIT IV: LEARNING STRATEGIES

John Dewey's Experiential Learning, Albert Bandura's Social Learning Theory, Howard Gardner's Multiple Intelligence Theory, Ubiquitous Learning Theory.

UNIT V: ACTIVE-COOPERATIVE LEARNING TECHNIQUES

Project Based Learning, Enquiry Based Learning, Case Studies – Concept and Analysing, Role Play Method, Collaborative Learning Methods.

TEXTBOOKS/REFERENCES

1. Driscoll, M. P., & Burner, K. J. (2005). Psychology of learning for instruction.
2. VanGundy, A. B. (2008). 101 activities for teaching creativity and problem solving. John Wiley & Sons.
3. https://ocw.metu.edu.tr/pluginfile.php/9013/mod_resource/content/1/driscoll-ch10%20(1).pdf
4. https://journals.healio.com/doi/abs/10.3928/00220124-20090522-07
5. https://marcprensky.com/writing/Prensky%20-%20Ch2-Digital%20Game-based%20Learning.pdf
6. https://files.eric.ed.gov/fulltext/EJ1153685.pdf
7. https://files.eric.ed.gov/fulltext/EJ1127696.pdf

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EGL 333	Thing Theory	OE	4	0	0	4

UNIT I: THEORETICAL FOUNDATIONS
Martin Heidegger – The Thing, Bill Brown and his work, Timothy Morton – Hyper objects, Ian Bogost – Alien Phenomenology.

UNIT II: THEORY & POPULAR CULTURE
Jane Benett – Vibrant Matter, Karin Knorr Cetina – Sociality with Objects, Understanding Consumerism, Remo Bodei – The Life of Things, the Love of Things.

UNIT III: APPLICATIONS
Sumathi Ramaswamy – Terrestrial Lessons, Victorian Studies, The History of the World in 100 Objects.

UNIT IV: LITERARY READINGS
Poetry Robert Frost, William Carlos Williams, Objects in Works of Fantasy, Detective Fiction.

UNIT V: VISUAL CULTURE
Animation Movies, Photography, Advertising and Consumerism, NFTs.

TEXTBOOKS/REFERENCES

1. Brown, Bill (ed). *Things*. University of Chicago Press, 2004.
2. Daston, Lorraine (ed). *Things that Talk: Object Lessons from Art and Science*. Zone Books (MIT Press), 2004.
3. Edwards, Elizabeth, and Janice Hart (eds). *Photographs Objects Histories: On the Materiality of Images*. Routledge, 2004.
4. Cetina, Karin Knorr. "Sociality of Objects: Social Relations in Postsocial Knowledge Societies" in *Theory, Culture and Society* 14 (1997), 4.
5. Daly, Suzanne.*The Empire Inside: Indian Commodities in Victorian Domestic Novels*. University of Michigan Press, 2011.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
COM 108	Investment Analysis	OE	3	0	0	3

UNIT I: FUNDAMENTALS OF INVESTMENTS

Meaning of Investment, Objectives of investment, Investment, and speculation, Features of a good investment, Investment Process, Elements of Investment, Investment Avenues, Scope, and Importance of investment management.

UNIT II: INVESTMENTS AVENUES

Types of Investment: Features - Physical and Financial forms of Investments **-** Bank Products, Bonds, Stocks - Features of Equity, Preference Shares, Debenture, Investment in Real Estates, Important features of Investment in Real Estate.

UNIT III: SECURITIES MARKET

Primary Market - Factors to be considered to enter the Primary Market, Modes of raising funds, Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures.

UNIT IV: VALUATION OF SECURITIES

Bond and its features, Types, Determinants of interest rates, Bond Valuation, Bond Duration. Valuation of Preference Shares, Equity shares- Valuation, Dividend Valuation models.

UNIT V: MACRO-ECONOMIC AND INDUSTRY ANALYSIS

Fundamental Analysis - E I C Framework, Economy, Industry and Company Analysis - Financial Statement Analysis, Ratio Analysis. Technical Analysis – Theories - Dow Theory, Elliot Wave Theory. Charts-Types, Trend and Trend Reversal Patterns. Moving averages, ROC, RSI, and Market Indicators.

TEXTBOOKS

1. Bodie, Zvi, Alex Kane, and Alan J. Markus, Investments (2005), McGraw Hill, (Sixth Edition) or a Later Edition.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, 2nd Edition, Tata McGraw Hill, New Delhi.
3. Punithavathy Pandian, Security Analysis and Portfolio Management, Vikas Publication, New Delhi.

REFERENCES

1. Curley, Anthony J., and Bear, Robert M., Investment Analysis and Management (1999), Harper & Row, New York.
2. Fischer, D.E. and Jordan, R.J. Security Analysis and Portfolio Management. Pearson Education.
3. Fuller, Russel J., and Farrell, Jr., James L., *Modern Investments and Security Analysis (1987),* New York: McGraw-Hill Book Company.
4. Kevin. S. Security Analysis and Portfolio Management (2019), 2nd Edition, Prentice Hall of India, New Delhi.
5. V K Bhalla, Investment Management: Security Analysis and Portfolio Management (2019), 19th Edition, S Chand, New Delhi.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BBA 304	Human Resource Management	OE	4	0	0	4

UNIT I: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

Meaning, Function, Significance & Challenges of HRM, HR Policies, Introduction to Human Resource Planning, Various Methods of HRP, Forecasting and HR Effectiveness – Case Study Analysis.

UNIT II: RECRUITING, SELECTING & SOCIALIZING INTRODUCTION

Recruitment Policy, Issues, sources of people, selection process & tests, Socialization, Internal Mobility, Career Planning – Case Study Analysis.

UNIT III: TRAINING & DEVELOPING

Workforce and Organizational Development Concept, need, method, importance & evaluation of training & development; principle of learning; Introduction to and Interventions in OD – Case Study Analysis.

UNIT IV: PERFORMANCE AND COMPENSATION MANAGEMENT SYSTEM

Definition, importance, objectives, components and methods of performance management system, Principal compensation issue, job evaluation, pay-structure, individual & group incentives – Case Study Analysis.

UNIT V: SOCIAL SECURITY AND LABOUR WELFARE

Concept of Social Security and Industrial Relations, Workers Participation in Management Significance, and various social security legislations in India – Case Study Analysis.

TEXTBOOKS

1. "Managing Human Resources" by Bohlander and Snell Thomson Publications.
2. "HumanResource Management" Gary Dessler and Biju Varkkey Pearson Publications.

REFERENCES

1. Human Resource Management, Gary Dessler, Pearson Education.
2. Human Resource Management, Casio Jaico Publishing House.
3. Human Resource Management, Ivancevich McGraw Hill.
4. The Management of People at Work Dale S.Beach Tata McGraw-Hill.
5. Personnel Management, CB Memoria, Himalaya Publishing House.
6. Human Resource Management Mizra S.Saiyadain Tata McGraw Hill.
7. Human Resource Management, VSP Rao Excell Books.
8. Human Resource Management, P.Subba Rao,Him.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
IDEA 104	Dream-Discover-Disrupt	OE	3	0	0	3

MODULE 1: VENTURE IDEATION.
MODULE 2: MARKETING.
MODULE 3: CUSTOMER SEGMENTATION.
MODULE 4: CUSTOMER DISCOVERY.
MODULE 5: SOLUTION DESIGN.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
CHE 202	RENEWABLE ENERGY	OE	3	0	0	3

UNIT I: INTRODUCTION TO ENERGY

Definition, units, and various forms of energy. First and Second laws of thermodynamics, Conservation of energy. Flow diagrams of Energy, Conventional energy sources, Sustainability, fossil fuels. Role of energy in economic development and social transformation. Global energy production and utilization, impact on environment. Global warming, Biological damage due to pollution. Importance of Renewable energy.

UNIT II: SOLAR, WIND, AND TIDEL ENERGIES

Solar Energy: Introduction. Spectral distribution of radiation, Photons, Photovoltaic effect. Solar Cells: Advantages and applications of Solar cells, Solar cooker, Solar water heating systems. Introduction of wind energy, principle of wind energy conversion. Applications of wind energy, advantage and disadvantages of wind energy. Blue economy: Principle of ocean thermal energy conversion. Energy from tidel waves, advantages and disadvantages.

UNIT III: HYDROGEN ENERGY

Hydrogen gas, different methods to generate hydrogen gas: electrolysis of water and Methane reforming. Advantages hydrogen as fuel. Challenges of hydrogen storage and transportation. Hydrogen storage methods. Hydrogen storage systems: metal hydrides and Metal organic frameworks. Fuel Cells: Types of fuel cells

UNIT IV: BIOMASS ENERGY

Difference between biomass and other fossil fuels. Conversion of biomass into methanol. Conversion of biomass into ethanol: Fisher-Tropsch Reaction, disadvantages of biomass.

UNIT V: ENERGY STORAGE DEVICES

Energy Density and Power Density. Classification of Energy Storage systems. Electrochemical Cells, Primary and Secondary Batteries. Introduction to Super capacitors. Dry Cells, Li-ion Batteries and Beyond.

TEXTBOOKS/REFERENCES

1. Energy Sources: Fundamentals of Chemical Conversion processes and Applications by B. Viswanathan, Elsevier, 2016.
2. Renewable Energy: Power for a Sustainable Future, Godfrey Boyle. Oxford University Press, 1996.
3. Renewable Energy Resources Third Edition by John Twidell and Tony Weir, 2015.
4. Ru-shiliu, Leizhang, Xueliang sun, “Electrochemical technologies for energy storage and conversion”, Wiley Publications, 2012.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
BIO 102	Introductory Biology	OE	4	0	0	4

UNIT I: BIOMOLECULES

Why study biology; Life on earth and evolution; Biomolecules - carbohydrates, lipids and fats, nucleic acids, proteins. vitamins and minerals.

UNIT II: CELL BIOLOGY

Diversity of life: virus, bacteria, archea and eukarya; Concept of unicellular and multicellular organisms; Prokaryotic cell structure, Eukaryotic cell (Animal and Plant) - structure and functions of organelles; Membrane transport; Cellular respiration and energy generation; Brief account on Photosynthesis.

UNIT III: MOLECULAR BIOLOGY

DNA and Chromosomes: structure and organization, transcription, translation and DNA replication; Cell division – mitosis and meiosis; mutations and genetic diseases.

UNIT IV: HUMAN BIOLOGY

Introduction to human body; Cells and tissue organization; Electrolytes and body fluids; Physiology of Blood; Immune system; digestive system; respiratory system; endocrine system; nervous system; sensory systems - hearing, taste, smell and visual receptors, reproduction.

UNIT V: BIOLOGICAL SEQUENCES AND DATABASES

DNA and protein sequences; Concept of genomics, transcriptomics, proteomics and metabolomics; File formats of sequence storage: FASTA file; Biological databases – NCBI; Usefulness of biological metadata - array expression and 1000 genomes; Application of BLAST and protein/Gene ID conversion.

TEXTBOOKS/REFERENCES

1. Thrives in Biochemistry and Molecular Biology, Edition 1, 2014, Cox, Harris, Pears, Oxford University Press.
2. Thrives in Cell Biology, Ed. 1, 2013, Qiuyu Wang, Chris Smith and Davis, Oxford University Press.
3. Genetics: A Molecular Approach by Peter J Russell, 3rd edition, Pearson International Edition.
4. Bioinformatics Introduction – Mark Gerstein

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
EGL 102	Technical Writing	OE	4	0	0	4

UNIT I

Sentence Structure (English), Paragraph Writing, Coherence, Cohesion, and Unity, Construction of an Argument and Counter-Argument, Deducing a Conclusion,

UNIT II

The Concept of 'BASIC' (Brief, Appropriate, Simple, Intelligible, and Complete), Writing Vs Drafting, The process of 'Technical' writing, Difference between 'General' and 'Technical' writing (the nuances of technical writing),

UNIT III

What is a Definition? The process / structure of a Definition, What is a Description?, The process / structure of a Scientific Description, Describing an Object, Describing a Process, What is an Explanation?, The mechanism of writing an 'Explanation',

UNIT IV

Synopsis, Research Proposal, Abstract Vs Summary, Referencing and Citations, Bibliography.

UNIT V

Planning a Research Write-up, Structure of a Paper, Designing an effective Abstract, Introduction Section, Discussion, Conclusion.

TEXTBOOKS/REFERENCES

1. Dudley Evans, T. (1998). Developments in English for Specific Purposes: A multidisciplinary approach. U.K: Cambridge University Press.
2. Hutchinson, T., & Waters, A. (1987). English for Specific Purposes: A learner-centered approach. U.K: Cambridge University Press.
3. Jain, A. K. (2001). Professional Communication Skills. New Delhi: S. Chand & Company Limited.
4. Raman, Meenakshi, and Sangeetha Sharma. (2008). Technical Communication: English Skills for Engineers. New Delhi: Oxford University Press.
5. Raman, Meenakshi, and Sangeetha Sharma. (2004) Technical Communication: Principles and Practice. New Delhi: Oxford University Press.
6. Trimble, Louis. English for Science and Technology - A Discourse Approach. (1985). Cambridge: Cambridge University Press.
7. Williams, Phil. Advanced Writing Skills for Students of English. (2018). Brighton: Rumian Publishing.
8. Wilson, Paige and Teresa Ferster Glazier. (2013). The Least You Should Know About English: Writing Skills, Form C (11th Edition). Boston: Cengage Learning

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
MAN 001	Mandarin	OE	3	0	0	3

COURSE DESCRIPTION

This course is the first semester of four that forms an introduction to standard Mandarin Chinese and is designed for students with no previous background in spoken or written Mandarin. Students in this course focus on learning essential vocabulary, practicing pronunciation, and understanding simple grammatical structures. This knowledge prepares students to effectively communicate in Mandarin on a limited range of topics related to everyday situations and examine how culture and language interact. In-class activities and course assignments aim to assist students as they develop the oral proficiency and confidence necessary to initiate simple conversations. Out-of-classroom experiences such as cultural activities or guided interactions with native speakers supplement formal classroom instruction and provide ample opportunities for practical engagement.

TEXTBOOK & COURSE MATERIALS

1. A Course in Contemporary Chinese Volume 1 《當代中文課程 1》by the Mandarin Training Center at National Taiwan Normal University. Publisher: Sanctum Books; First Indian edition (31 March 2021)
2. Supplementary vocabulary & cultural materials

METHOD OF INSTRUCTION

This course is delivered through a series of classroom instruction sessions, activities, homework, in-class practice, and non-classroom structured activities. All four skills of language learning (listening, speaking, reading, and writing) will be covered, with a particular focus on communication skills necessary in Chinese culture.

PART 2: OUTCOMES

1. This course will help student master Mandarin pronunciation, basic reading and writing skills, and to develop the ability to participate in simple, practical conversations on everyday topics.
2. In this course, students will learn to greet, to introduce themselves, to communicate with other people in Mandarin Chinese, and have basic knowledge and ability in Mandarin Chinese.

STUDENT LEARNING OUTCOMES

1. By the completion of this course, students will be able to:
2. Use Mandarin Chinese to confidently communicate on a range of topics related to everyday situations such (e.g. to introduce themselves, discuss family, hobbies, likes and dislikes).
3. Recognize and write approximately 150 Chinese characters.
4. Read and write simple sentences in Chinese.
5. Demonstrate listening comprehension in a number of simple circumstances

KNOWLEDGE OUTCOMES

1. This course is designed to assist students to acquire and demonstrate knowledge about:
2. Essential vocabulary, pronunciation, and grammatical structures.

3. Understand how Chinese culture and Mandarin Chinese interact.
4. The differences and similarities between Chinese and the student's native language.

SKILLS OUTCOMES

1. This course is designed to assist students in acquiring or enhancing the following skills:
2. Basic communication skills in Mandarin Chinese.
3. Competency with the Pinyin-Chinese phonetics system.
4. Ability to read and write Chinese characters.
5. Confidence to initiate simple conversations with other people.

PART 3: TOPIC OUTLINE/SCHEDULE

WEEK 01: INTRODUCTION, GREETING.

1. Introduction of Mandarin Chinese & Pinyin (the Chinese phonetic system)
2. Greetings in normal and polite ways.

WEEK 02: LEARNING TO INTRODUCE PEOPLE.

1. Basic sentences with "是shi"
2. Answering question with "什麼shéme"
3. Way to ask questions with A-not-A and "嗎ma" in Chinese

WEEK 03: LEARNING TO DISCUSS LIKES/DISLIKES.

1. Answering question in Chinese (Affirmative and Negative answers with "不bù")
2. Modification Marker "很hěn"
3. Contrastive question with "呢ne"

WEEK 04: LEARNING TO TALK ABOUT PEOPLE IN MY FAMILY MEMBERS AND THEIR NAMES.

1. Asking question with "幾jǐ"
2. Basic sentences with "有yǒu"

WEEK 05: LEARNING TO DESCRIBE PEOPLE, PLACES, AND POSSESSIONS.

1. Possessive word "的de"
2. Modifier Marker "的de"

WEEK 06: LEARNING TO TALK ABOUT THE NUMBER OF PEOPLE IN A FAMILY, PARTIAL EXAM.

1. Totality "都dōu"
2. Measure word "個ge" and "張zhāng"
3. Partial exam for Oral & writing

WEEK 07: LEARNING TO DESCRIBE LIKES/DISLIKES (E.G., SPORTS AND MOVIES).

1. Time words & Hobbies
2. To go do something with "去qù"
3. Placement of time words

WEEK 08: LEARNING TO EXPRESS WHAT TWO GROUPS HAVE IN COMMON.

1. Topic sentences
2. Word order in sentences (Chinese sentence orders, difference between English and Chinese)
3. The word order of Adverbs "也yě", "都dōu" and "常cháng"

WEEK 09: LEARNING TO POLITELY ASK OTHERS OPINIONS AND MAKE SIMPLE SUGGESTIONS.

1. Asking question with "怎麼樣zěnmeyàng"
2. Particles with "吧ba" and "啊a"

WEEK 10: LEARNING TO FORM CHOICE QUESTIONS, FINAL EXAM

1. Asking choice question with "還是háishì"
2. Making sentences with "覺得juéde"
3. Final exam for Oral & writing

PART 4: GRADING POLICY
EVALUATION CRITERIA
The grade for this course will be based on the following table.

Percentage (%)	**Evaluation Area**
60	Classroom performance (including performance of the basic conversation, participation in class activities, quizzes, and / or homework)
10	Partial Exam – Oral
10	Partial Exam – Writing
10	Final Exam – Oral
10	Final Exam – Writing
100	Total Points Possible

LATE WORK POLICY
Be sure to pay close attention to deadlines—there will be no make up assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

GRADING SCALE
Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Corresponding Percentage Points	Performance
A	93-100%	Excellent Work
A-	90-92%	Nearly Excellent Work
B+	87-89%	Very Good Work
B	83-86%	Good Work
B-	80-82%	Mostly Good Work
C+	77-79%	Above Average Work
C	73-76%	Average Work
C-	70-72%	Mostly Average Work
D+	67-69%	Below Average Work
D	60-66%	Poor Work
F	0-59%	Failing Work

PART 5: COURSE POLICIES

ATTEND CLASS

Students are expected to attend all regularly scheduled classes and come prepared to participate fully in class activities. Students are further expected to be on time for all classes. Arriving late for class or an activity is disrespectful of both the instructor and fellow students.

PARTICIPATE

The participation grade will depend on both the quality and the quantity of student's comments and questions and shall account for a portion of the total course grade.

BUILD RAPPORT

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that they can help you find a solution.

COMPLETE ASSIGNMENTS

Assignments must be submitted by the given deadline or special permission must be requested from instructor before the due date. Extensions will not be given beyond the next assignment except under extreme circumstances.

All discussion assignments must be completed by the assignment due date and time. Late or missing discussion assignments will affect the student's grade.

SRM UNIVERSITY AP
Andhra Pradesh

ELECTIVES

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 330	Communication Electronics	TE	3	0	0	3

UNIT I

Elements of a communication system, Types of communications, electromagnetic spectrum, Examples of a few communication systems, Issues involved, differential amplifier modulator, Low level and high-level AM, Diode AM detector filter SSB modulator, Crystal lattice filter, phasing SSB modulator, Synchronous detector, varactor FM modulator, Reactance FM modulator.

UNIT II

VCO FM modulator, FET phase modulator, Foster-Seeley FM discriminator, Ratio detector, pulse averaging discriminator, Comparison of various FM demodulators problems based on frequency modulation scheme, CW transmitter, AM transmitter, FM transmitter, SSB transmitter frequency multipliers.

UNIT III

TRF radio receiver, Superheterodyne receiver, Selectivity, sensitivity, fidelity, RF section, mixer, IF section, Image frequency, dual conversion, AGC, Squelch, SSB transceiver, frequency synthesizer, Special features in communication receiver, Software defined radio.

UNIT IV

Video and television signals, television broadcasting, TV channels, cable channels, picture elements, TV scanning picture qualities, Indian TV standards, Video signal, frame and field frequencies, horizontal and vertical scanning frequencies, Synchronization, blanking signal, 6/7 MHz TV broadcast channel, Construction of composite video signal, blanking time, front and back porch, Video signal frequencies, vertical detail, DC component, Colour information basic operation of TV camera, Vidicon, plumbicon, single tube colour camera, Interlaced scanning pattern, raster distortions, sync pulses.

UNIT V

RGB video signals, colour addition. Colour matrix, I and Q signals, Chrominance modulation, negative transmission,VSB transmission, FM sound signal, Tricolour picture tubes, decoding the picture information, Y signal matrix, functional blocks of TV receiver, Video detector and amplifier, sound IF section, synch separator, Vertical synch integrator, horizontal sync, Producing luminance image in colour TV receiver, Chroma section, colour killer circuit. Colour TV standards, digital TV fundamentals.

TEXTBOOKS/REFERENCE

1. Louis E Frenzel, Communication Electronics: Principles and Applications, 3/e, McGraw Hill Int. Singapore, 2001.
2. George Kennedy, Bernard Davis, Electronic Communication Systems, 4/e, Tata McGraw Hill, 2000.
3. Bernard Grob, Basic Television and Video Systems, 6/e, McGraw Hill, Singapore, 2000.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 331	Digital Design with Verilog	TE	3	0	0	3

UNIT I: INTRODUCTION TO VERILOG

Verilog as HDL, Levels of design description, concurrency, Simulation and synthesis, Functional verification, System tasks, programming language interface (PLI). Module, simulation and synthesis tools. Test benches, Language constructs and conventions.

UNIT II: GATE LEVEL AND BEHAVIORAL MODELING

Introduction, AND gate primitive, Other gate primitives, illustrative examples, Tri-state gates, array of instances of primitives, Design of flip-flops with gate primitives, delays, Strengths and contention resolution, net types, Design of basic circuits, Behavioral modeling: introduction, operations and assignments, Functional bifurcation, initial construct, Always construct, examples, assignments with delays, Wait construct, multiple always blocks, Designs at behavioral level, Blocking and non-blocking assignments, Case, if, assign, repeat.

UNIT III: DATA FLOW LEVEL AND SWITCH LEVEL MODELING

Introduction, continuous assignment structures, Delays and continuous assignments, Assignment to vectors, operators, Switch level modeling: introduction, Basic transistor switches, CMOS switch, Bi-directional gates, time delays with switch primitives, Instantiations with strengths and delays, Strength contention with trireg nets.

UNIT IV: DIGITAL DESIGN WITH STATE MACHINE CHARTS

State machine charts, Derivation of SM charts, Realization of SM charts, Implementation of the dice game, Alternative realizations for SM charts using microprogramming.

UNIT V: DESIGNING WITH FPGAS AND CPLDS

Xilinx 3000 Series FPGAs, Designing with FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FLEX 10K Series CPLDs, Verilog Models: Static RAM memory, A simplified 486 bus model, Interfacing memory to a microprocessor bus, UART design.

TEXTBOOKS/REFERENCE

1. T.R. Padmanabhan, B. Bala Tripura Sundari, Design through Verilog HDL, Wiley Student Edition, 2004.
2. Stephen. Brown, ZvonkoVranesic, Fundamentals of Logic Design with Verilog, 3/e, Tata McGraw Hill, 2005.
3. Michael D. Ciletti, Advanced Digital Design with Verilog HDL, Prentice Hall of India, 2005.
4. J. Bhaskar, A Verilog Primer, BS Publications, 2003.
5. Charles H Roth, Lizy Kurian John, Digital Systems Design using VHDL, 2/e, Cengage Learning, 2012.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 325	Digital Image Processing	TE	3	0	0	3

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING

Image acquisition, image sampling and quantization, Relationships between pixels, image geometry, Gray level transformations, Histogram processing: histogram equalization, Histogram specification, Color image processing: Color fundamentals, color models, Color transformations, applications of image processing.

UNIT II: IMAGE TRANSFORMS

2-D DFT, properties. Walsh transform, Hadamard transform, discrete cosine transforms, Haar transform, Slant transform, KL transform, Comparison of different transforms.

UNIT III: IMAGE ENHANCEMENT

(by spatial domain methods) Arithmetic and logical operations, point processing, Image smoothing and sharpening filters in spatial domain, Enhancement: (by frequency domain methods) Image smoothing and image sharpening filters in frequency domain. Homomorphic filter, Comparison of filters in frequency domain and spatial domain.

UNIT IV: IMAGE COMPRESSION FUNDAMENTALS

Types of redundancy, Lossless compression: Variable length coding, LZW coding, Bit plane coding, predictive coding-DPCM, Lossy compression: Transform coding, Basics of image compression standards: JPEG, JPEG 2000, Basics of vector quantization.

UNIT V: IMAGE SEGMENTATION

Region based segmentation, Detection of discontinuities, Edge linking and boundary detection, thresholding, Image Restoration: Degradation model, Estimation of degradation function, Restoration in the presence of noise only, Restoration filters: Inverse filter, wiener filter, Constraint least square filtering.

TEXTBOOKS/REFERENCE

1. R.C. Gonzalez, R.E. Woods, Digital Image processing, 3/e, Pearson Education, 2009.
2. Anil K. Jain, Fundamentals of Digital Image processing, Prentice Hall of India, 1989.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L., Digital Image Processing using MATLAB, Pearson Education, 2004.
4. William K. Pratt, Digital Image Processing, 3/e, John Wiley and Sons, 2004.
5. S. Jayaraman, S. Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 403	Digital Switching and Multiplexing	TE	3	0	0	3

UNIT I: INTRODUCTION

Evolution of telecommunication, Basics of switching system, Step-by-step switching, Design considerations, Principles of crossbar switching, Electronic space division switching, Stored program control, Software architecture, Switching functions.

UNIT II: DIGITAL TRANSMISSION

Frequency division multiplexing, Time division multiplexing, statistical division multiplexing, switching hierarchy, synchronous digital hierarchy both USA and European standards, Message switching, circuit switching and packet switching, space division switching, Time division switching. Two-dimensional switching, grade of service. Non-blocking, digital cross connect, Concentrators, expanders and distributors, Two stage networks, Three stage networks, n-stage networks.

UNIT III: Time Division Switching

Time division space switching, Time division time switching, Time multiplexed space switching, Time multiplexed time switching, Space-time combination switching, Three stage combination switching, N-stage combination switching, Signaling techniques.

UNIT IV: TELECOMMUNICATION TRAFFIC

Units of traffic, network traffic load and parameters, Grade of service and blocking probability, Traffic measurement, mathematical model, Incoming traffic and service time characteristics, Blocking models and loss estimates, delay systems, Digital subscriber access– ISDN, High data rate digital subscriber loops, Digital loop carrier systems, fibre in the loop, voice band modems, Digital satellite services, broadband switching systems.

UNIT V: NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT

Timing, timing inaccuracies, Network synchronization, network control and management, SONET/SDH – SONET multiplexing overview, frame formats, Operation, administration and maintenance, Frequency justification and payload framing, Virtual tributes, DS3 payload mapping, E4 payload mapping, SONET optical standards, SONET rings and networks.

TEXTBOOKS/REFERENCE

1. Viswanathan, Thiagarajan, Bhatnagar, Manav, Telecommunication Switching Systems and Networks, 2/e, Prentice Hall of India, 2015.
2. John C. Bellamy, Digital Telephony, 3/e, Wiley Student Edition, 1999.
3. J E Flood, Telecommunications Switching, Traffic and Networks, Pearson Education, 2004.
4. Gokhale, Introduction to Telecommunications, 2/e, Cengage Learning, 20.
5. Robert G. Winch, Telecommunication Transmission Systems, 2/e, Tata McGraw Hill, 2004.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 332	Digital System Design	TE	3	0	0	3

UNIT I: REVIEW OF LOGIC DESIGN FUNDAMENTALS

Combinational logic, Boolean algebra and algebraic simplification, Karnaugh maps, Designing with NAND and NOR gates, Hazards in combinational circuits, Flip-flops and latches, Mealy sequential circuit design, Design of a Moore sequential circuit, Sequential circuit timing.

UNIT II: INTRODUCTION TO VHDL

Computer-Aided design, Hardware Description Languages, VHDL description of combinational circuits, VHDL modules, sequential statements and VHDL processes, Modeling flip-flops using VHDL processes, Processes using wait statements, Transport and inertial delays, VHDL data types and operators, VHDL libraries.

UNIT III: DESIGN EXAMPLES FOR DIGITAL CIRCUITS

Multiplexers, BCD to 7-segmentdisplay decoder, BCD adder, 32-Bit adders, Shift-and-add multiplier, Array multiplier, Modeling registers and counters using VHDL processes.

UNIT IV: INTRODUCTION TO PROGRAMMABLE LOGIC DEVICES

Brief overview of programmable logic devices, Simple programmable logic devices (SPLDs), Complex programmable logic devices (CPLDs), Field-programmable gate arrays (FPGAs), State machine charts, Derivation of SM charts.

UNIT V: DESIGNING WITH FIELD PROGRAMMABLE GATE ARRAYS

Implementing functions in FPGAs, Implementing functions using shannon's decomposition, Carry chains in FPGAs, Cascade chains in FPGAs, FPGAs and one-hot state assignment, FPGA capacity: Maximum gates versus usable gates, Design translation (Synthesis), Mapping, placement, routing.

TEXTBOOKS/REFERENCE

1. Charles H. Roth Jr., Lizy Kurian John, Digital System Design using VHDL, 2/e, Cengage Learning, 2008.
2. Stephen Brown and ZvonkoVranesic, Fundamentals of Digital Logic with VHDL Design, 3/e, McGraw-Hill Higher Education, 2008.
3. S.Trimberger, Field Programmable Gate Array Technology, 1/e, Kluwer Academic Publications, 1994.
4. J. Bhasker, A VHDL Primer, 3/e, Prentice Hall of India, 2009.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 333	DSP Processors and Architectures	TE	3	0	0	3

UNIT I: COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS

Number formats for signals and coefficients in DSP systems, Dynamic range and precision, Sources of error in DSP implementations, A/D conversion errors, DSP computational errors, D/A conversion errors, Compensating filter.

UNIT II: ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES

Basic architectural features, DSP computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation module, Programmability and program execution, Speed issues, Features for external interfacing.

UNIT III: EXECUTION CONTROL AND PIPELINING

Hardware looping, interrupts, stacks, Relative branch support, pipelining and performance, Pipeline depth, interlocking, branching effects, Interrupt effects, pipeline programming models, Programmable Digital Signal Processors: Commercial digital signal-processing devices, Data addressing modes of TMS320C54XX processors, Memory space, program control, Instructions and programming, On-chip peripherals, interrupts and pipeline operation of TMS320C54XX processors.

UNIT IV: IMPLEMENTATIONS OF BASIC DSP ALGORITHMS

The Q-notation, FIR filters, IIR filters, interpolation filters, decimation filters, PID controller, adaptive filters, 2-D signal processing, An FFT algorithm for DFT computation, A butterfly computation, Overflow and scaling, Bit- reversed index generation, An 8-point FFT implementation on the TMS320C54XX, computation of the signal spectrum.

UNIT V: INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES

Memory space organization, External bus interfacing signals, Memory interface, parallel I/O interface, Programmed I/O, interrupts and I/O, Direct memory access (DMA), A multichannel buffered serial port (McBSP), McBSP programming, CODEC interface circuit, COURSE CODEC programming, A COURSE CODEC-DSP interface example.

TEXTBOOKS/REFERENCE

1. Avtar Singh, S. Srinivasan, Digital Signal Processing, Cengage Learning, 2.
2. Phil Lapsley, DSP Processor Fundamentals: Architectures and Features, IEEE Press, 1997.
3. Sen M. Kuo, Real-Time Digital Signal Processing, 2/e, Wiley Student Edition, 2010.
4. B. Venkata Ramani, M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, Tata Mc Graw Hill, 2004.
5. Jonatham Stein, Digital Signal Processing, Wiley Student Edition, 2005.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 334	EMI and EMC Techniques	TE	3	0	0	3

UNIT I: INTRODUCTION, NATURAL AND NUCLEAR SOURCES OF EMI / EMC
Electromagnetic environment, History, concepts, Practical experiences and concerns, Frequency spectrum conservations, An overview of EMI / EMC, Natural and nuclear sources of EMI.

UNIT II: EMI FROM APPARATUS, CIRCUITS AND OPEN AREA TEST SITES
Electromagnetic emissions, Noise from relays and switches, Non-linearities in circuits, Passive inter modulation, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites and measurements.

UNIT III: RADIATED AND CONDUCTED INTERFERENCE MEASUREMENTS AND ESD
Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents /voltages, Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients/bursts. Electrical surges.

UNIT IV: GROUNDING, SHIELDING, BONDING AND EMI FILTERS
Principles and types of grounding, Shielding and bonding, Characterization of filters, Power lines filter design.

UNIT V: CABLES, CONNECTORS, COMPONENTS AND EMC STANDARDS
EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, Opt isolators, National / international EMC standards.

TEXTBOOKS/REFERENCE

1. Kodali, Engineering Electromagnetic Compatibility, 2/e, IEEE Press, 2000.
2. Clayton R Paul, Introduction to Electromagnetic Compatibility, John Wiley and Sons, 2010.
3. Electromagnetic Interference and Compatibility IMPACT series, IIT Delhi. (Modules1-9).

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 419	Fundamentals of wireless communication	TE	3	0	0	3

UNIT I

Mobile radio propagation, Free space propagation model, Ground reflection model, Large scale path loss, small scale fading and multipath propagation, Impulse response model of a multipath channel, parameters of a mobile multipath channel, Multipath delay spread, Doppler spread, coherence bandwidth.

UNIT II

Digital communication through fading multipath channels, Frequency nonselective, Slowly fading channels, Frequency selective, Slowly fading channels, Calculation of error probabilities, Tapped delay line model, The RAKE receiver performance.

UNIT III

Diversity techniques for mobile wireless radio systems concept of diversity branch and signal paths, combining methods, Selective diversity combining, Pre-detection and post detection combining, switched combining, Maximal ratio combining, Equal gain combining.

UNIT IV

Cellular concept, frequency reuse, Cochannel interference, adjacent channel interference, Power control for reducing interference, improving capacity in cellular systems, Cell splitting, sectoring, Hand off strategies, Channel assignment strategies, Call blocking in cellular networks.

UNIT V

Fundamental concepts of spread spectrum systems, Pseudo noise sequence, performance of direct sequence spread spectrum systems, Analysis of direct sequence spread spectrum systems, The processing gain and anti-jamming margin, Frequency hopped spread spectrum systems, Time hopped spread spectrum systems, Synchronization of spread spectrum systems.

TEXTBOOKS/REFERENCE

5. Rappaport Thoedore S., Wireless Communications, Principles and Practice, 2/e, Prentice Hall of India, 2003.
6. Haykin, S., Moher M., Modern Wireless Communications,1/e, Pearson Education, 2011.
7. Kamilo Feher, Wireless Digital Communications, 1/e, Prentice Hall of India, 1995.
8. Lee W.C.Y., Mobile Cellular Telecommunication, 2/e, Tata McGraw Hill, 2002.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 319	Microcontrollers and Applications	TE	3	0	0	3

UNIT I: OVERVIEW OF ARCHITECTURE AND MICROCONTROLLER RESOURCES

Introduction to microcontroller, resources in advanced and next generation microcontrollers, 8051microcontroller architecture, internal and external memories and interface, internal RAM, and SFRs, counters and timers, synchronous serial-cum, asynchronous serial communication, interrupts and priorities.

UNIT II: 8051 FAMILY MICROCONTROLLERS INSTRUCTION SET

Basic assembly language programming, data transfer instructions, data and bit- manipulation instructions, arithmetic instructions, instructions for logical operations on the test among the registers, program flow control instructions, interrupt control flow.

UNIT III: REAL TIME CONTROL

Interrupt handling structure of MCU, interrupt latency and interrupt deadline, multiple sources of the interrupts, non-maskable interrupt sources, enabling or disabling of the sources, polling mode and priority assignment, interrupt interval and density constraints, real time control, timers, programmable timers, free running counter and real time control.

UNIT IV: SYSTEMS DESIGN

Keypad and keyboard interfacings, keyboard-cum-display controller (8279), alphanumeric devices, display systems and its interfaces, printer interfaces, interfacing with the flash memory, analog input interfacing, ADC interfacing with microcontroller.

UNIT V: 16/32 - BIT MICROCONTROLLERS

Introduction to 16/32 bit microcontrollers, MSP430 Microcontroller Architecture and memory organization, ARM 32 bit MCUs, ARM programming model and addressing modes, ARM thumb programming model, ARM and Thumb instruction set

TEXTBOOKS/REFERENCE

1. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2/e, Pearson Education, 2005.
2. Kenneth. J. Ayala, The 8051 Microcontroller, 3/e, Cengage Learning, 2004.
3. Ajay V. Deshmukh, Microcontrollers: Theory and Applications, Tata McGraw Hill, 2005.
4. Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems, 2/e, Pearson Education, 2007.
5. John H. Davies, MSP430 Microcontroller Basics, 1/e, Newnes, 2008

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 335	Modern Digital Signal processing	TE	3	0	0	3

UNIT I: LINEAR ALGEBRA

Vectors, linear independence, vector spaces and basis vectors, matrices, matrix inverse, the determinant and trace, linear equations, special matrix forms, quadratic and hermitian forms, eigen values and eigen vectors. Discrete Time Random Process: Introduction, Random Variables: Ensemble averages, jointly distributed random variables, joint moments, independent, uncorrelated orthogonal random variables, linear mean square estimation, Gaussian random variables. Random processes: Ensemble averages, Gaussian processes, stationary processes, auto covariance and auto correlation matrices, ergodicity, white noise, power spectrum, filtering random processes, special types of random processes (ARMA, MA, AR Harmonic processes).

UNIT II: OPTIMUM FILTERS

FIR Wiener Filter: Filtering, linear prediction, noise cancellation, lattice representation for the FIR Wiener filter, causal linear prediction.

UNIT III: ADAPTIVE FILTERS

FIR Adaptive Filters: Steepest descent adaptive filter, LMS algorithm, convergence of LMS algorithm, normalized LMS, application: Noise cancellation. Other LMS based adaptive filters, gradient adaptive lattice filter, joint process estimator, channel equalization, adaptive recursive filters. Recursive Least squares: Exponentially weighted RLS, sliding window RLS.

UNIT IV: SPECTRUM ESTIMATION

Non-Parametric Methods: Periodogram, performance of the periodogram, modified periodogram, Bartlett's method: periodogram averaging. Blackman-Tukey approach: periodogram smoothing. Performance comparisons, minimum variance spectrum estimation, maximum entropy method.

UNIT V: SPECTRUM ESTIMATION

Parametric Methods: AR, MA, ARMA spectrum estimation techniques: Frequency estimation: Eigen decomposition of the autocorrelation matrix, Pisarenko harmonic decomposition, music, other eigen decomposition methods. Principal components spectrum estimation: Bartlett frequency estimation, minimum variance frequency estimation, autoregressive frequency estimation.

TEXTBOOKS

1. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, 1/e, Wiley Student Edition, 1996.
2. Proakis, J. Gard, D.G.Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2006.

REFERENCE

1. D. G. Manolakis, Vijay Ingle, Statistical and Adaptive Signal Processing, 1/e, Artech Book House, 2009.
2. A.V. Oppenheim, R.W.Schafer, Discrete Time Signal Processing, 2/e, Prentice Hall of India, 1999.
3. S.J. Orfanidis, Optimum Signal Processing, 2/e, McGraw Hill, 1989.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 336	Radar Signal Processing	TE	3	0	0	3

UNIT I: INTRODUCTION

History and applications of radar, basic radar functions, elements of a pulsed radar, signal processing concepts and operations, basic radar signal processing. Sampling and quantization of pulsed radar signals: domains and criteria for sampling radar signals, sampling in the fast time domain, sampling in the slow time: selecting the PRI, sampling the Doppler spectrum, sampling in the spatial and angle dimensions, quantization, I/ Q imbalance and digital I/Q.

UNIT II: RANGE PROCESSING

Introduction, the waveform matched filter, matched filtering of moving targets, the ambiguity function, the pulse burst waveform.

UNIT III: RADAR WAVEFORMS

Frequency modulated pulse compression waveforms, range side lobe control for FM waveforms, the stepped frequency waveform, phase modulated pulse compression waveforms, costas frequency codes.

UNIT IV: DOPPLER PROCESSING

Alternate forms of the doppler spectrum, moving target indication (MTI), pulse doppler processing, pulse pair processing, additional doppler processing issues, clutter mapping and moving target detector, MTI for moving platforms: Adaptive displaced phase center antenna processing.

UNIT V: DETECTION FUNDAMENTALS

Radar detection as hypothesis testing, threshold detection in coherent systems, threshold detection of radar signals, introduction to CFAR detection, spatial filtering. **Beamforming:** Adaptive beamforming.

TEXTBOOKS/REFERENCE

1. N. Levanon, and E. Mozeson, Radar Signals, 1/e, Wiley-Inderscience, 2004.
2. P. Z. Peebles, Radar Principles, 1/e, Wiley Student Edition, 2004.
3. M. I. Skolnik, Introduction to Radar Systems, 3/e, Tata McGraw Hill, 2001.
4. F. E. Nathanson, Radar Design Principles, 1/e, Prentice Hall India, 1999.
5. Mark A. Richards, Principles of Modern Radar – Basic Principles, Yesdee, 2012.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 337	Speech Processing	TE	3	0	0	3

UNIT I: INTRODUCTION

Speech signal, signal processing, digital speech processing. Digital Models for Speech Signals: Process of speech production, acoustic theory of speech production, lossless tube models, digital models for speech signals, hearing and auditory perception.

UNIT II: TIME-DOMAIN METHODS FOR SPEECH PROCESSING

Time-dependent processing of speech, short-time energy and average magnitude, short-time average zero-crossing rate, speech vs. silence discrimination, pitch period estimation using the autocorrelation function. Digital Representation of the Speech Waveform: Instantaneous quantization, adaptive quantization, general theory of differential quantization, delta modulation, differential PCM, comparison of systems.

UNIT III: SHORT-TIME FOURIER ANALYSIS

Fourier transform interpretation, linear filtering interpretation, filter-bank summation method of short-time synthesis, spectrographic displays, analysis-synthesis systems. Homomorphic Speech Processing: Homomorphic systems for convolution, complex cepstrum of speech, pitch detection, formant estimation, homomorphic vocoder.

UNIT IV: LINEAR PREDICTIVE CODING OF SPEECH

Basic principles of linear predictive analysis, computation of the gain for the model, solution of the LPC equations, relations between the various speech parameters, synthesis of speech from linear predictive parameters, applications of LPC parameters.

UNIT V: DIGITAL SPEECH PROCESSING FOR MAN-MACHINE COMMUNICATIONS BY VOICE

Voice response systems, speaker recognition systems, speech recognition systems. Speech Enhancement in Noise: Single channel speech enhancement methods, beamforming with microphone array speech, distortion measurement.

TEXTBOOKS

1. Rabiner L.R., Schafer R.W., Digital Processing of Speech Signals, 1/e, Prentice Hall of India, 1978.

REFERENCE

1. Thomas F. Quatieri, Discrete-Time Speech Signal Processing, Principles and Practice, Pearson Education, 2002.
2. Ian McLaughlin, Applied Speech and Audio Processing with MATLAB examples, Cambridge University Press, 2010.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 338	Statistical Theory of Communication	TE	3	0	0	3

UNIT I

System theory, stochastic processes, representation of stochastic processes, likelihood and sufficiency.

UNIT II: DETECTION THEORY

Hypothesis testing, decision criteria, multiple measurements, multiple hypothesis testing, CFAR detection, Wald's test.

UNIT III: DETECTION OF SIGNALS IN NOISE

Detection of known signals in noise (correlation receiver), detection of known signals in colored noise, detection of known signals in noise (maximum SNR criterion), detection of signals with unknown parameters.

UNIT IV: ESTIMATION THEORY

Estimation of parameters, random parameters (Bayesian estimates), estimation of non-random parameters, properties of estimators, linear mean-square estimation.

UNIT V: ESTIMATION OF WAVEFORMS

Linear MMSE estimation of waveforms, estimation of stationary processes (Weiner filter), estimation of nonstationary processes (Kalman filter), relationship between Weiner and Kalman filter.

TEXTBOOKS

1. M.D. Srinath, P.K. Rajasekaran, R. Viswanathan, Statistical Signal Processing with Applications, Prentice Hall of India, 1999.

REFERENCE

1. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol-I Estimation Theory, Pearson Education, 1999.
2. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol-II Detection Theory, Pearson Education, 2000.
3. H.V. Poor, An Introduction to Signal Detection and Estimation, 2/e, Spring Verlag, 1994.
4. M. Mansuripur, Introduction to Information Theory, Prentice Hall, 1987.
5. John G. Proakis, Dimitris Manolakis, Digital Signal Processing, 4/e, Pearson Education, 2007.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 339	Wireless Networks	TE	3	0	0	3

UNIT I: INTRODUCTION

FDMA, TDMA, spread spectrum, multiple access, SDMA, packet radio, packet radio protocols, CSMA protocols, reservation protocols. Introduction to Wireless Networks: Introduction, difference between wireless and fixed telephone networks, development of wireless networks, traffic routing in wireless networks.

UNIT II: WIRELESS DATA SERVICES

CDPD, ARDIS, RMD, common channel signaling, ISDN, BISDN and ATM, SS7, SS7 user part, signalling traffic in SS7. Mobile IP And Wireless Access Protocol: Mobile IP, operation of mobile IP, co-located address, registration, tunneling, WAP architecture, overview, WML scripts, WAP service, WAP, session protocol, wireless transaction, wireless datagram protocol.

UNIT III: WIRELESS LAN TECHNOLOGY

Infrared LANs, spread spectrum LANs, narrow bank microwave LANs, IEEE 802 protocol architecture, IEEE 802 architecture and services, 802.11 medium access control, 802.11 physical layer. Bluetooth: Overview, radio specification, base band specification, links manager specification, logical link control and adaptation protocol, introduction to WLL technology.

UNIT IV: MOBILE DATA NETWORKS

Introduction, data oriented CDPD network, GPRS and higher data rates, short messaging service in GSM, mobile application protocol.

UNIT V: WIRELESS ATM AND HIPER LAN

Introduction, wireless ATM, HIPERLAN, adhoc networking and WPAN.

TEXTBOOKS

1. William Stallings, Wireless Communication and Networking, 2/e, Pearson Education, 2005.
2. Theodore S. Rappaport, Wireless Communications, Principles and Practice, 2/e, Prentice Hall of India, 2002.

REFERENCE

1. Kaveh Pahlaven, P. Krishna Murthy, Principles of Wireless Networks, 1/e, Pearson Education, 2002.
2. Kamilo Feher, Wireless Digital Communications, 1/e, Prentice Hall of India, 1999.

COURSE CODE	COURSE NAME	COURSE CATEGORY	CREDITS			
			L	T	P	C
ECE 410	Adaptive Signal Processing	TE	3	0	0	3

UNIT I: ADAPTIVE SYSTEMS

Definition and Characteristics; areas of application; general properties, open- and closed-loop adaptation; applications of closed-loop adaptation. Adaptive Linear Combiner: General description, Input signal and weight vectors; desired response and error, The performance function; gradient and minimum mean-square error, Alternative expression of the gradient; decorrelation of error and input components.

UNIT II: PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE

Normal form of the input correlation matrix; eigenvalues and eigenvectors of the input correlation matrix, geometrical significance of eigenvectors and eigenvalues; (i) Searching the Performance Surface, Methods of searching the performance surface; basic ideas of gradient search methods, A simple gradient search algorithm and its solution; stability and rate of convergence the learning curve; gradient search by Newton's Method; Newton's Method in multidimensional space. gradient search by the Method of Steepest Descent; comparison of learning curves.

UNIT III: GRADIENT ESTIMATION AND ITS EFFECT ON ADAPTATION

Gradient component estimation by derivative measurement, the performance penalty; derivative measurements and performance penalties with multiple weights, variance of the gradient estimate; effects on the weight-vector solution, excess mean-square error and time constants, Mis adjustment; comparative performance of Newton's and Steepest-Descent Methods, Total mis adjustment and other practical considerations.

UNIT IV: OTHER ALGORITHMS

Derivation of the LMS algorithm; convergence of the weight vector, An example of convergence; learning curve, noise in the weight-vector solution; mis adjustment; performance, normalized and other LMS-based adaptive filters, Discrete Kalman filter; recursive least squares algorithm.

UNIT V: APPLICATIONS

Applications: Adaptive Modeling and System Identification: General description, adaptive modeling of a multipath communication channel, adaptive modeling in FIR digital filter synthesis, Adaptive Interference Cancellation: Concept of adaptive noise cancelling, stationary noise-cancelling solutions; effects of signal components in the reference input, Term Project: Matlab implementation of the various learning algorithms with applications.

TEXTBOOKS/REFERENCE

1. B. Widrow and S. D. Stearns, Adaptive Signal Processing, Pearson Education Asia, 1985.
2. M. H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley, 2002.
3. S. Haykin, Adaptive Filter Theory, 4th edition, Pearson Education Asia, 2002.
4. T Adali, S Haykin, Adaptive Signal Processing, Wiley-India, 2010.
5. Selected papers on adaptive signal processing and applications.