DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout,
Bengaluru 560078, Karnataka.
Kudlu Gate, Hosur Main Road, Bengaluru 560068, Karnataka.

School of Engineering

Bachelor of Technology

B. Tech Scheme, Syllabus and Regulations
(with effect from August 2016)

SEMESTER I SCHEME OF TEACHING AND EXAMINATIONBRANCH: Cycle A

Sl. No.	Course Code	Course	CR/A	No. of Hours of Teaching				Scheme of Evaluation	
				Lecture	Tutorial	Practical	No. of Credits	Continuous	Semester End Examination
1	16MA101	Engineering Mathematics	CR	03	02	--	04	40	60
2	16PH101 (50 Hours)	Introduction to Physical Sciences	CR	03	--	--	03	40	60
3	16EE101	Electrical Engineering	CR	03	02	--	04	40	60
4	16CV101	Engineering Mechanics	CR	03	02	--	04	40	60
5	16CS101	Computer Programming and Problem Solving	CR	02	--	--	02	40	60
6	16HU116	English	CR	02	--	--	02	40	60
7	16ME102	Engineering Drawing	CR	01	--	04	03	40	60
8	16PH171	Physical Sciences Laboratory	CR	--	--	04	02	40	60
9	16CS171	Computer Programming and Problem Solving Laboratory	CR	--	--	04	02	40	60
Grand Total 900				**17**	**06**	**12**	**26**	**360**	**540**
10	16ES191	Environmental Studies	AU	02	--	--	02	25	50
11	16TE191*	Ideation	AU	01	--	--	01	25	50
12	16TET192*	Case Study	AU	01	--	--	01	25	50

Continuous evaluation: Three IA Tests, self-study presentation/survey reports/quiz/surprise test/ assignments/programming exercises/presentation in seminar and workshops. *** For Computer Technology (with emphasis on Entrepreneurship)**

SEMESTER I SCHEME OF TEACHING AND EXAMINATION 2016BRANCH: Cycle B

Sl. No.	CourseCode	Course	CR/ AU	No. of Hours of Teaching				Scheme of Evaluation	
				Lecture	Tutorial	Practical	No. of Credits	Continuous	Semester End Examination
1	16MA101	Engineering Mathematics	CR	03	02	--	04	40	60
2	16CH101	Introduction to Chemical Sciences	CR	03	--	--	03	40	60
3	16BS101	Introduction to Biological Sciences	CR	03	--	--	03	40	60
4	16EC101	Electronics Engineering	CR	03	02	--	04	40	60
5	16ME 101	Mechanical Engineering	CR	03	02	--	04	40	60
6	16HU116	English	CR	02	--	--	02	40	60
7	16CH171	Chemical Sciences Laboratory	CR	--	--	04	02	40	60
8	16ME171	Workshop Practice	CR	--	--	04	02	40	60
Grand Total 800				**17**	**06**	**8**	**24**	**320**	**480**
9	16HU191	Constitution of India	AU	02	--	--	02	25	50
10	16HU192/ 16HU193	Kannada	AU	02	--	--	02	25	50

Continuous evaluation: Three IA Tests, self-study presentation/survey reports/quiz/surprise test/ assignments/programming exercises/presentation in seminar and workshops.

SEMESTER II SCHEME OF TEACHING AND EXAMINATION BRANCH: Cycle A

Sl. No.	Course Code	Course	CR/ AU	No. of Hours of Teaching				Scheme of Evaluation	
				Lecture	Tutorial	Practical	No. of Credits	Continuous	Semester End Examination
1	16MA101	Engineering Mathematics	CR	03	02	--	04	40	60
2	16CH101	Introduction to Chemical Sciences	CR	03	--	--	03	40	60
3	16BS101	Introduction to Biological	CR	03	--	--	03	40	60
4	16EC101	Electronics Engineering	CR	03	02	--	04	40	60
5	16ME 101	Mechanical Engineering	CR	03	02	--	04	40	60
6	16HU116	English	CR	02	--	--	02	40	60
7	16CH171	Chemical Sciences Laboratory	CR	--	--	04	02	40	60
8	16ME171	Workshop Practice	CR	--	--	04	02	40	60
Grand Total 800				**17**	**06**	**8**	**24**	**320**	**480**
10	16HU191	Constitution of India	AU	02	--	--	02	25	50
11	16HU192/ 16HU193	Kannada	AU	02	--	--	02	25	50

Continuous evaluation: Three IA Tests, self-study presentation/survey reports/quiz/surprise test/ assignments/programming exercises/presentation in seminar and workshops.

SEMESTER IISCHEME OF TEACHING AND EXAMINATION **BRANCH: Cycle B**

Sl. No.	Course Code	Course	CR/ AU	No. of Hours of Teaching				Scheme of Evaluation	
				Lecture	Tutorial	Practical	No. of Credits	Continuous	Semester End Examination
1	16MA101	Engineering Mathematics	CR	03	02	--	04	40	60
2	16PH101 (50 Hours)	Introduction to Physical Sciences	CR	03	--	--	03	40	60
3	16EE101	Electrical Engineering	CR	03	02	--	04	40	60
4	16CV101	Engineering Mechanics	CR	03	02	--	04	40	60
5	16CS101	Computer Programming and Problem Solving	CR	02	--	--	02	40	60
6	16HU116	English	CR	02	--	--	02	40	60
7	16ME102	Engineering Drawing	CR	01	--	04	03	40	60
8	16PH171	Physical Sciences Laboratory	CR	--	--	04	02	40	60
9	16CS171	Computer Programming and Problem Solving	CR	--	--	04	02	40	60
Grand Total 900				**17**	**06**	**12**	**26**	**360**	**540**
9	16ES191	Environmental Studies	AU	02	--	--	02	25	50
10	16TE191*	Ideation	AU	01	--	--	01	25	50
11	16TET192*	Case Study	AU	01	--	--	01	25	50

Continuous evaluation: Three IA Tests, self-study presentation/survey reports/quiz/surprise test/ assignments/programming exercises/presentation in seminar and workshops. *** For Computer Technology (with emphasis on Entrepreneurship)**

Course code: 15MA101	Engineering Mathematics	L	T	P	C
		3	2	-	4
Course Objectives	To train the students in basic mathematics essential for modeling and solving engineering problems.				
Course Outcomes	1. An ability to apply knowledge of mathematics, science and engineering. 2. An ability to identify, formulate and solve engineering problems				

Differential Calculus:
Review: Functions and graphs, Limits and Continuity, Differentiation, Maxima and minima of a function, Rolle's Theorem, Mean Value Theorem.

Indeterminate forms and L'Hopital's rule, Infinite sequences and series, Power series, Taylor's and Maclaurin's series, Convergence of Taylor's series, Error Estimates, Polar coordinates and Polar equations.

Functions of two or more real variables, Partial derivatives of second and higher order, Euler's theorem on homogenous function, Total derivatives, Differentiation of composite and implicit functions, Change of variable, Jacobians, Maxima and minima of functions of two or more variable, Lagrange's method of undetermined multipliers.

Integral Calculus:
Estimating with finite sums and limits of finite sums, Definite integral, The fundamental theorem of calculus, Trigonometric substitutions, Integration by reduction formula for powers of some trigonometric functions, Improper integrals, Beta and Gamma integrals.

Double integrals, Triple integrals, Change of order of integration in a double integral, Change of variables in double and triple integrals, Area as a double integral, Volume as a triple integral.

Differential Equations:
Second and higher order linear ODE with constant coefficients, General solution to the homogeneous equations, Method of variation of parameters, Method of undetermined coefficients, Cauchy-Euler and Legendre's linear equations, Power series solution for second order linear ODE.

Note: There will be a computational component to the course, using a mix of computational packages like SCILAB/R/OCTAVE and C/PYTHON, to solve engineering problems using the mathematical concepts developed in the course.

Text Books:

1. Erwin Kreyzsig, Advanced Engineering Mathematics, Wiley, Tenth edition
2. Thomas and Finney, Calculus and Analytic Geometry, Pearson India, Ninth edition

Reference Books:

1. G.F.Simmons and S. Krantz, Differential Equations Theory, Techniques and Practice, Tata McGraw Hill.
2. W.E.Boyce and R.C.DiPrima, Elementary Differential Equations and Boundary Value Problems, Ninth Edition, Wiley Student Edition.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√						√		√	

Course code: 15MA102	Engineering Mathematics	L	T	P	C
		3	2	-	4
Course Objectives	To introduce the students to mathematical tools used in various engineering branches.				
Course Outcomes	1. An ability to apply knowledge of mathematics, science and engineering. 2. An ability to identify, formulate and solve engineering problems. 3. An ability to use the techniques , skills and engineering tools				

COMPLEX VARIABLES:
Complex function, Limits, Continuity, differentiability, Analytic Functions, CR Equations, and Properties of Analytic functions.

LAPLACE TRANSFORMS:
Basic concepts, Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theorem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differential equations**.**

LINEAR ALGEBRA:
Linear spaces, Subspaces, Linear independence, Bases and Dimensions, Orthogonality, Gram Schmidt orthogonalization process.

FOURIER SERIES:

Fourier series, Dirichlet'sconditions, Euler's Formulae, Fourier series of discontinuous functions, Even and odd functions, Change of interval, Parseval's theorem, Complex form of Fourier series.

FOURIER TRANSFORMS:
Fourier transform and Fourier's integral theorem, Fourier cosine integral, Fourier sine integral, Basic properties of Fourier transform.

TEXT BOOKS:

1. Erwin Kreyzsig, Advanced Engineering Mathematics, Wiley, 10^{th} edition.
2. Chandrasekhar Vaidyanathan, Course reader for 15MA102, DSU.

REFERENCE BOOKS:

1. TynMyint-U and LokenathDebnath, Linear partial differential equations for scientists and engineers, Birkhauser, Fourthedition.
2. R.N.Bracewell, The Fourier transform and its applications, Third Edition, McGraw Hill.

Note: There will be a computational component to the course, using a mix of computational packages like SCILAB/R/OCTAVE and C/PYTHON, to solve engineering problems using the mathematical concepts developed in the course.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√						√		√	

Course code: 15PH101	Introduction to Physical Sciences	L	T	P	C
		03	--	--	03
Course objectives	1. To get a brief understanding of basic principles of quantum mechanics and its applications. 2. To know the Physics of semiconductors and the band gap. 3. To understand various semiconductor devices and their working principle. 4. To know about dielectrics and their applications. 5. To get an understanding of the basic crystal structure and methods to obtain diffraction patterns and indexing and to calculate the particle size. 6. To get an idea of the microscopy and techniques used in microscopy. 7. To study the Physics involved in organic semiconductors and their applications. To understand briefly about superconductors and their applications. 8. To learn about the thin films and their properties and few applications. **9.** To study size dependent properties of Nano-materials and their processes of preparation and optical and mechanical properties as nanostructures.				
Course outcomes	**1.** Students can understand the relevance of quantum mechanics. Students are able to apply the semiconductor theory. 2. Students are able to understand dielectrics on the basis of polarization. 3. Students are able to learn the device physics of various electronic devices. 4. Students become capable of indexing the basic crystal structure and to calculate the particle size. 5. Students learn the basic principles of microscopy and the different techniques used to characterize materials. 6. Students learn about organic semiconductors and their applications are realized. 7. Superconductivity and its applications in technology are learnt. 8. Students get an exposure to thin films and its stages of growth and properties. Nanotechnology and properties of nano-materials, processes involved and its applications are understood**.**				

Module 1 **10 Hours**

Quantum Mechanics: Foundation and formulation of quantum theory of free electrons, Wave function, Significance and its properties, One dimensional time

independent Schrodinger wave equation, Importance of Schrodinger wave equation, Potential-well, Eigen values and Eigen functions, Applications: one dimensional motion of a particle under no forces. 05Hrs

Semiconductors: Band Structure, density of electrons and holes in intrinsic semiconductors, Expression for Fermi level. Band gaps: Photonic, electrochemical and electronic. 05Hrs

Module 2 **10 Hours**

Device Physics: Principle and working of diode, Zener diode, LED, photodiode, solar cell. Transistors: BJT and FET. 05Hrs

Dielectrics: Static dielectric constant, electronic, ionic and orientation polarizations – Internal or local fields in solid and liquids. Lorentz field in cubic materials – Clausius- Mosotti equation – Ferroelectric materials and applications. 05Hrs

Module 3 **10 Hours**

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, X-ray diffraction, Bragg's law, Rotating crystal method, Powder method, Scherrer formula for estimation of particle size. 05Hrs

Microscopy: Principle and applications: Optical microscopy, Electron microscopy, Transmission Electron Microscopy (TEM), Scanning Tunnelling Microscopy (STEM) and Atomic Force microscopy (AFM). 05Hrs

Module 4 **10 Hours**

Organic semiconductors: Brief history of conjugated polymers criteria for semiconducting properties, small molecule and polymers with example, charge transport properties and mechanisms: Polarons, bipolarons and solitons, common conjugated polymer processing: spin coating, evaporation, Printing, Applications: OFETs, OLEDs, sensors and solar cells. 05Hrs

Superconductivity: Introduction to superconductivity, Brief explanation of BCS theory, Type I and II superconductors with examples, High temperature superconductors with examples, Applications of superconductors: MRI and SQUID. 05Hrs

Module 5 **10 Hours**

Thin films: Thin films, Stages of thin film growth: nucleation, agglomeration and continuous film, thermal evaporation technique for thin film deposition, applications of thin films (any two). 05Hrs

Nanoscience and technology: Scaling laws in miniaturization (electrical and thermal systems), Size dependant properties of materials, Density of states: Quantum wells, quantum wires, quantum dots, Nano fabrication: Ball milling, Lithography, Self- assembly. 05Hrs

Text Books:

1. Wiley precise Text, Engineering Physics, Wiley India Private Ltd., New Delhi. Book series – 2014, 2.
2. Dr. M.N. Avadhanulu, Dr. P.G.Kshirsagar, Text Book of Engineering Physics, S Chand Publishing, New Delhi - 2012

Reference Book:

1. S. M. Sze, Semiconductor devices, Physics and Technology, Wiley.
2. A Skotheim and John R Reynolds, Theory, Synthesis, Properties & Characterization, CRC press.
3. K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
4. C. Kittel, Introduction to Solid State Physics, 7th edition, John Wiley Student Edition, New York.
5. S. O. Pillai, Solid State Physics, revised edition, New Age International Publishers.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√		√				√				√

Couse code: 15CH101	**Introduction to Chemical Sciences**	L	T	P	C
		3	-	-	3
Course Objectives	To provide students with the knowledge of engineering chemistry for building the technical competence in industries, research and development in the following fields 1. To familiarize the students on application oriented themes like the chemistry of materials used in engineering discipline. 2. To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation. 3. To apply the knowledge in solving these current environmental problems effectively 4. To study on Fuels and alternative to fossil fuels, Non-Conventional Energy Resource, Corrosion and its Control.				
Course outcomes	On completion of this course, the students will have knowledge in: 1. Types of electrodes, electrochemical and concentration cells. Classical and modern batteries and fuel cells 2. Causes and effects of corrosion of metals and control of corrosion. Modification of surface properties of metals to develop resistance to, corrosion, wear, tear, impact etc, by electroplating and electroless plating techniques. 3. Utilisation of solar energy for different useful forms of energy. 4. Replacement of conventional materials by polymers for various applications. 5. Water treatment - Boilers, sewage and desalination of sea water 6. Synthesis, properties and application of ofnanomaterials				

Electrochemical Energy Systems (Electrode potential and Cells): Single electrode potential - definition, origin, sign conventions. Derivation of Nernst's equation. Standard electrode potential- definition. Construction of Galvanic cell.–classification - primary, secondary and concentration cells, EMF of a cell–definition, notation and conventions. Reference electrodes–calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on electrode potentials and EMF. Ion-selective electrode- glass electrode, determination of pH using glass electrode. 05Hrs

Chemical Energy Source:
Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problemson GCV&NCV. Petroleumcracking-fluidizedcatalytic cracking. Reformationof petrol. Knocking - mechanism, octane number, cetane number,

prevention of knocking, anti-knocking agents, unleaded petrol; power alcohol, Biodiesel & Biogas. 07 Hrs

Electrochemical Energy Conversion and Storage:
Battery technology and fuel cells: Basic concepts, battery characteristics. Classification of batteries–primary, secondary and reserve batteries. State of the art Batteries– Construction working and applications of Zn– MnO_2, Lithium-MnO_2,Zn-airlead -acid, Nickel-Metal hydride and Lithium ion batteries, Fuel Cells - Introduction, types of fuel cells Alkaline, Phosphoric acid and Molten carbonate fuel cells. Solid polymer electrolyte and solid oxide fuel cells. Construction and working of $H_2O_2$and Methanol-Oxygen fuel cell. 05 Hrs

Corrosion Science: definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Measurement of corrosion rate. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings – Anodizing and Phosphating, Metal coatings –Galvanization, Tinning and its disadvantages, Corrosion Inhibitors, Cathodic and Anodic protection. 05 Hrs

Solar Energy: Photovoltaic cells- Introduction, definition, importance, working of a PV cell; solar grade silicon, physical and chemical properties of silicon relevant to photo-voltaics, production of solar grade (crystalline) silicon and doping of silicon

03Hrs

Surface Modification Techniques: Definition,Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating –Faraday's laws of electrolysis Process, Effect of plating variables on the nature of electro deposit, surface preparation and electroplating of Cr and Au. Electroless Plating, Distinction between electroplating and electroless plating, advantages of electroless plating. Electroless plating of copper on PCB and Nickel 05Hrs

High Polymers: Definition, Classification - Natural and synthetic with examples. Polymerization – definition, types of polymerization – Addition and Condensation with examples. Mechanism of polymerization - free radical mechanism (ethylene as an example), Methods of polymerization - bulk, solution, suspension and emulsion polymerization. Glass transition temperature, structure and property relationship. Compounding of resins. Synthesis, properties and applications of Teflon. PMMA, Polycarbonate and Phenol – formaldehyde resin. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of Neoprene, Butyl rubber. Adhesives- Manufacture and applications of Epoxy resins. Conducting

polymers - definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline, polymer composites-GRP&FRP. 07Hrs

Water Technology: Impurities in water, Water analysis - Determination of different constituents in water - Hardness, Alkalinity, Chloride, Fluoride, Nitrate, Sulphate and Dissolved Oxygen. Numerical problems on hardness and alkalinity. Biological Oxygen Demand and Chemical Oxygen Demand. Numerical problems on BOD and COD. Sewage treatment. Potable water, purification of water - Flash evaporation, Electro dialysis and Reverse Osmosis. Hazardous chemicals with ill effects. 07 Hrs

Nanotechnology: Introduction, ,properties, synthesis by sol-gel, precipitation, gas condensation, chemical vapor condensation, hydrothermal and thermolysis process, nano-scale materials, nano crystals and clusters, fullerenes, carbon nano-tubes, dendrimers and nano-composites. 03 Hrs

Instrumental Methods of Analysis: Theory, - Instrumentation and Applications of Colorimetry, Potentiometry, Conductometry and Spectroscopic techniques. 03Hrs

Text Books

1. M. M. Uppal, "Engineering Chemistry", Khanna Publishers, Sixth Edition, 2001
2. P.C.Jain and Monica Jain, "A text Book of Engineering Chemistry", S. Chand & Company Ltd. New Delhi,2009

Reference Books

1. Samuel Glasstone, D., Textbook of physical chemistry, Van Nostrandcompany, inc.USA
2. Atkins P.W., Physical chemistry, ELBS IV edition 1998, London
3. F. W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, 1994
4. M. G. Fontana, Corrosion Engineering, Tata McGraw Hill Publications 1994.
5. Stanley E. Manahan, Environmental Chemistry, Lewis Publishers, 2000

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√		√				√				

Course Code: 15BS101	Introduction to Biological Sciences and Engineering	L	T	P	C
		3		-	3
Course Objectives	1. To familiarize the student with the structure and function of important components of biological systems and cellular processes. 2. Biological systems and processes will be analyzed from an engineering perspective, with an emphasis on how these can be re-designed for industrial processes and commercial products.				
Course outcomes	1. Student understands biological systems 2. Student gets the engineering aspects from biological systems				

Biology in the 21st Century: The new world in the post genome era. Past, present and future of our society, industry and life style: impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry. 08Hrs

Career opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology. 05Hrs

Quantitative views of modern biology. Importance of illustrations and building quantitative/ qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse. 08Hrs

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity.

08Hrs

Systems biology and illustrative examples of applications of Engineering in Biology.

07Hrs

Text Books:

1. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell, Garland Science Publishers. 2008. 1st edition.
2. J. B. Reece, L. A. Urry, M. L. Cain, S. A. Wasserman, P.V.Minorsky, and R.B.Jackson. Campbell Biology, Benjamin Cummings publishers. 2010. 9th edition.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√										√

Course Code:15EE 101	Electrical Engineering	L	T	P	C
		3	2	--	4
Course objective	1. Imparting Knowledge of basic circuits 2. Understanding analysis of circuits 3. Basics of electric and magnetic fields 4. working principles of machines, measuring equipments				
Course outcome	1. Able to get the basic knowledge about the Electric and Magnetic circuits. 2. Able to understand the AC fundamentals. 3. Able to understand the working of various Electrical Machines. 4. Able to get the knowledge about various measuring instruments and house wiring.				

Introduction to Electrical Engineering: Essence of electricity, Conductors, semiconductors and insulators Electric field; electric current, potential and potential difference, electromotive force. Introduction to DC circuits, active and passive two terminal elements, ohms law, voltage current relations for resistor, inductor, capacitor, Kirchhoff's laws, mesh analysis, concept of power and energy. Magnetic Circuits. Force on a current carrying conductor placed in a magnetic field, Faradays laws of electromagnetic induction, Lenz's law, Fleming's rules and its applications. Self and mutual inductance. Problems. 10Hrs

Alternating Quantities : Principle of ac voltages , waveforms and basic definitions, concept of root mean square and average values of alternating currents and voltage, form factor and peak factor, phasor representation of alternating quantities, analysis of ac circuits with single basic network element, single phase series circuits, single phase parallel circuits, single phase series parallel circuits, power in ac circuits. Necessity and advantages of 3 phase circuits, star and delta connection, star delta transformation, power in balanced three phase circuits. Problems 10Hrs

Basic Instruments : Introduction, classification of instruments, operating principles, essential features of measuring instruments, Digital ammeter, voltmeter, two-wattmeter method for the measurement of power, Earthing-types, two way & three way control of lamps, systems and methods of wiring, discussion on basic protective devices like MCB's and Fuses. 10Hrs

Principle, construction and operation of DC machines. Types, emf equation of generator, armature reaction, commutation, Interpoles, DC motor working principle,

back emf and its importance. Torque equation. Problems on emf equation and efficiency. Characteristics of dc machines, 3 point starter Principle, construction and operation of synchronous machines. Types, emf equation. 10Hrs

Transformers definition, need and classification. Construction, Working principles and phasor diagrams of Single-phase Transformer, Emf equation, losses, Equivalent circuit, Regulation and efficiency, problems on emf equation. 05Hrs

Induction motors classification and types, concept of Rotating magnetic field. Slip and its significance. Necessity of starter, Types of starters, Problems on slip calculation 05Hrs

Text Books:

1. M. Maria Louis, Elements of Electrical Engineering, fifth edition, PHI Publications, 2014.
2. D.P.Kothari and I.J. Nagrath, Basic Electrical Engineering, TataMcGraw Hill.

Reference books:

1. S.S. Parker Smith and NN Parker Smith, Problems in Electrical Engineering.
2. RajendraPrasad, "Fundamentals of Electrical, PHI Publications, 3RD Edittion.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√	√					√			

Course Code: 15EC101	Electronics Engineering	L	T	P	C
		3	2	-	4
Course objective	1. Imparting knowledge of fundamentals of semiconductor devices 2. Understanding electronic circuits				
Course outcome	1. Analyze and design the basic electronic circuits containing semiconductor devices 2. Identify the need of Integrated Circuits and use them in realizing circuit applications. 3. Analyze and implement basic Digital Electronic circuits for a given application. 4. Identify the applications and significance of electronics in interdisciplinary engineering domains.				

Semiconductors: Semiconductor diodes, Diode types, Bipolar junction transistors BJT, FET characteristics, Packages and coding, Integrated circuits
Power supplies: Rectifiers, Reservoir and smoothing circuits, improved ripple filters Full-wave rectifiers, Voltage regulators, Practical power supply circuits, Related Problems 10Hrs

Amplifiers: Types of amplifier, Gain, Class of operation, Input and output resistance, Frequency response, Bandwidth, Phase shift, Negative feedback, Transistor amplifiers Bias, Predicting amplifier performance, Practical amplifier circuits
Oscillators: Positive feedback, conditions for oscillation, types of oscillators, practical oscillator circuits. , Related Problems 10Hrs

Operational amplifiers: Symbols and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier applications, Related Problems 08Hrs

Circuit simulation: Introduction, types of analysis, netlists and component models 02Hrs

Logic circuits: Logic functions, Switch and lamp logic, logic gates, combinational logic, bistables/flipflops, Integrated circuit logic devices, Logic simulation using SPICE 06Hrs

Microprocessors: Microprocessor and microcontrollers, Microprocessor systems, architecture, operation, microcontroller systems, Related Problems 07Hrs

Radio: The radio frequency spectrum, Electromagnetic waves, a simple CW transmitter and receiver, Modulation, Demodulation, Types of transmitters and receivers, aerials, Related Problems 07Hrs

Text book:

1. Electronic Circuits: Fundamentals and Applications by Michael Tooley BA Elsevier Ltd., Third Edition,2006
2. Electronic Devices and Circuits, Allan Mottershed, PHI.

Reference books:

1. Robert L Boylestad and L.Nashelsky, Electronic Devices and circuit Theory, Pearson Education,9th edition, 2005
2. David A Bell, Electronic Devices and Circuits, PHI,5th edition ,2007
3. Millman&Halkias, Electronics Devices and Circuits, McGraw Hill.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√	√					√			

Course code: 15ME101	Mechanical Engineering	L	T	P	C
		3	2	-	4
Course Objectives	1. To introduce the energy resources and energy conversion. 2. To refrigeration and air conditioning. 3. To introduce motion and force transfer 4. To introduce basic machine tools and their operations.				
Course outcomes	Student will assimilate have fundamental knowledge in 1. Energy resources 2. Energy conversion processes 3. Refrigeration and air conditioning 4. Fundamental knowledge of machine tools and their operation.				

Heat, Internal energy, Enthalpy, Efficiency, Process, path, Cycle, System, Thermodynamic properties, Laws of thermodynamics, Entropy, Fuel combustion, Classification of fuels. 08Hrs

Properties of pure substance, Property diagram for phase change processes, Carnot vapour cycle, Rankine cycle, Air standard assumptions, Otto cycle, Diesel and Dual cycles. I.C. Engine: parts, 2 Stroke and 4 stroke Petrol engines, 4 stroke diesel engine, MP injection engines, indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, and specific fuel consumption, Refrigeration system, Refrigerants, Refrigerators, Air conditioning. 12Hrs

Fluid properties, Fluid energy, Buoyancy and Archimedes principle, Frictionless flow along a stream line, Bernoulli equation for incompressible flow and Applications, Static, Dynamic, Stagnation and Total pressure. 08Hrs

Transmission of Motion and Power: Concept of force, Power, Torque, laws of friction, Sliding and rolling friction, Belt Drives: Types of belts, Types of belt drives, length of belt in for open and cross drive, tension in belt, belt power transmission, Gear nomenclature: spur, helical, bevel. 10Hrs

Machine Tools and Operations:Lathe, Drilling machine, Milling machine, cutting tools and their geometry, work holding devices, cutting operations. 12Hrs

Text Books:

1. V.K.Manglik, Elements of Mechanical Engineering, PHI Publications, 2013.
2. K.P.Roy, S.K.HajraChoudhury, Nirjhar Roy, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt Ltd,Mumbai,7th Edition,2012.

Reference Books:

1. P K Nag, Engineering Thermodynamics, Tata McGraw-Hill Publishing,2009
2. Yunus A. Cengel, Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill Science, 2005.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√							√			

Course code: 15CV101	Engineering Mechanics	L	T	P	C
		3	2	-	4
Course Objectives	1. To solve a few basicproblems in engineering mechanics 2. To calculate the reactive forces. 3. To know the geometric properties of the different shapes. 4. To analyse the structures statically 5. To teach kinematics of particles. 6. To teach the dynamics of particles				
Course outcomes	Student will be able to 1. Solve the engineering problems in static conditions. 2. Understand the geometric properties. 3. Solve the problems involving kinematicsand dynamics of particles.				

Statics of rigid bodies in two dimensions: Free body diagrams, Equivalent force systems, Equations of equilibrium. Statics of rigid bodies in three dimensions: Equivalent force systems, Equations of equilibrium. 10Hrs

Centroids and center of gravity, Moments of inertia of areas, Polar moment of inertia, Radius of gyration, parallel axis theorem, Moments of inertia of composite areas, Product of inertia, Mass moment of inertia of common geometric bodies. 12Hrs

Analysis of two dimensional trusses: reactions

Friction: Laws of friction, sliding friction, rolling friction and problems involving friction. 10Hrs

Kinematics of particles: Rectilinear motion, curvilinear motion, velocities and accelerations in rectilinear and curvilinear motion, work and energy. 06Hrs

Kinematics of rigid bodies: translational and rotational velocities and accelerations, work and energy. 07Hrs

Equations of motion: Newton laws, Euler equations, D'Alembert's principle, principle of work and energy for rigid body, Conservation of energy. 10Hrs

Text Books:

1. Ferdinand P. Beer, E. Russell Johnston, Vector Mechanics for Engineers: Statics and Dynamics (9th Edition), Tata McGraw-Hill International Edition,2010.

2. Irving H. Shames, (2003), Engineering Mechanics – Statics and Dynamics, Prentice Hall of India Private limited.

Reference books:

1. S SBhavikatti, A textbook on Elements of Civil Engineering and Mechanics, New Age International Publishers, 5th edition,2015.
2. J. L. Meriam and L. G. Kraige, Engineering Mechanics: Statics and Dynamics (6th Edition), Wiley Publishers,2006

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√									

Couse code: 15ME102	Engineering Drawing	L	T	P	C
		2	-	4	3
Course Objectives	1. Create awareness and emphasize the need for Engineering Graphics. 2. Follow basic drawing standards and conventions. 3. Introduce free hand sketching as a tool for technical Communication 4. Usage of CAD software to draft.				
Course outcomes	1. Prepare drawings as per standards. 2. To sketch, draft and interpret various projections of 1D, 2D and 3D objects.				

Introduction to Computer Aided Sketching

Introduction, BIS conventions, Lettering, Dimensioning and free hand practicing. Selection size and scale, Line conventions, Material conventions.Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP.

Layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. 06Hrs

Orthographic Projections

Projection of points

Introduction, Definitions, Projections of points in all the four quadrants.

Projection of lines

Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of straight lines (located in First quadrant only), True and apparent lengths, True and apparent inclinations to reference planes,Projection of lines their traces. 12Hrs

Orthographic Projections of Plane Surfaces
(First Angle Projection Only)

Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, pentagon, hexagon and circle, planes in different positions by change of position method only 12Hrs

Projections of Solids (First Angle Projection Only)

Introduction, Definitions – Projections of right regular pentagon, tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. 24Hrs

Sections and Development of Lateral Surfaces of Solids

Introduction, Definition, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. 12Hrs

Development of lateral surfaces of above solids, their frustums and truncations. 12Hrs

Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids. 12Hrs

Text Book:

1. Balveer Reddy , K., and Others, CAED Computer Aided Engineering Drawing, CBS Publishers and Distributors, 2nd Edition, 2014
2. N.D. Bhatt and V. M .Panchal, Engineering Drawin,Charotar publishing house Pvt. Ltd, 49th edition, 2008.

Reference Books:

1. Narayana and Kannaiah, Engineering Drawing, Scitech Publishers

Course code: 15CS101	Computer Programming and Problem Solving	L	T	P	C
		2	-	-	2
Course Objectives	1. To understand programming environment consisting of computer system and operating systems 2. To understand problem solving techniques using algorithms/ flow chart, and coding.				
Course outcomes	At the end of the course student will be able 1. To distinguish between algorithm and a program. 2. Acquire the skills design the algorithms for the problems given, code and execute the program				

Introduction to Operating Systems [Unix, Linux, Windows], Programming Environment, Software Development Life Cycle (SDLC), Problem Solving and Algorithm Development, Flowchart. Introduction to Programming, Writing and executing programs. Use of a high level programming language for the systematic development of programs. 03Hrs

Structure of a C program, standard I/O in C. Fundamental data types: character types, integer, short, long, unsigned, single and double-precision floating point. Operators and expressions: using numeric and relational operators, mixed operands and type conversion, logical operators, bit operations, ternary operator, increment &decrement operators. Evaluation of expressions, operator precedence and associativity 06Hrs

Conditional program execution: applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch. Program loops and iteration: uses of while, do and for loops, multiple loop variables, assignment operators, use of break and continue. 05 Hrs

Array notation and representation, reading and writing array elements, declaration of two dimensional arrays. Sorting techniques: Bubble sort and Selection sort. Searching techniques: linear and binary search. Programs using one-dimensional and two-dimensional arrays.

Strings: definition, declaration, initialization, and representation. String handling functions and character handling functions.

Functions: definition and declaration. Built-in functions and User-defined functions. Categories of functions. Recursion. Programming and problem solving using functions and recursion. 06 Hrs

Definition and declaration of pointers. Accessing values using pointers.Accessing array elements using pointers. Pointers as function arguments. Call-by-value and call-by-reference.

Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures. Declaration and initialization of a union. Difference between structures and unions. Example programs. 06Hrs

Files: Defining, opening and closing of files. Input and output operations. Introduction to data structures: stacks, queues, linked lists, binary trees, and their applications.03Hrs

Text Books

1. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C",Cengage Learning, 2007
2. Brian W. Kernigham and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, PHI, 2012

Reference Books

1. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√	√	√	√							

Course code: 15HU116	English	L	T	P	C
		02	-	--	02
Course Objectives	1. To enable students improve their lexical, grammatical competence. 2. To enhance their communicative skills. 3. To equip students with oral and appropriate written communication skills. 4. To inculcate students with employability and job search skills.				
Course outcomes	1. Students achieve proficiency in English 2. Develop their professional communication skills 3. Acquire skills for placement				

Grammar and Vocabulary: Tense and Concord, word formation, Homonyms and Homophones 08Hrs

Listening and Speaking: Common errors in Pronunciation (Individual sounds); Process description (Describing the working of a machine, and the manufacturing process), use of vocabulary and rendering. 10Hrs

Group Discussion

Writing: Interpretation of data (Flow chart, Bar chart), Referencing Skills for Academic Report writing 08Hrs

Reading: Reading Comprehension, Answering questions, Appreciation of creative writing. 06Hrs

Text Books:

1. Dhanavel.S.P.,English and Communication Skills for Students of Science and Engineering**,** Orient Blackswan Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma**.** Technical Communication- Principles and Practice, Oxford University Press, 2009.

Reference Books:

1. Day.R A., Scientific English:A Guide for Scientists and Other Professional, 2nd ed. Hyderabad: Universities Press, 2000

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives					√		√		√	√	

Course code: 15HU117	English	L	T	P	C
		02	--	--	02
Course Objectives	To teach the elements of effective writing and communicative methods				
Course outcomes	1. The student will be able to communicate effectively orally and in written 2. Draft technical reports and proceedings.				

Preparation of Abstract,Synopsis Notices 06Hrs

Technical Paper writing, Minutes of the meeting 03Hrs

Letter Writing(Letters of enquiry, Permission, Regret, Reconciliation, Complaint, Breaking the ice.) 08Hrs

Drafting Curriculum Vitae, Resume and Covering Letters. Job Applications 08Hrs

Memo, E-mail Etiquette. 05Hrs

Text Books:

1. N. Krishnaswamyand T. Sri Raman, Creative English for communication, Macmillan Publication-2005.
2. Meenakshi Raman &Sangeeta Sharma, Technical Communication – Principles and Practice, oxford University press.

Reference Books:

1. N.KrishnaSwamyandT.Sriraman, Creative English for Communication Business Communication and Report Writing, Macmillan.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives					√		√		√	√	

Course code: 15PH171	Physical Sciences Laboratory	L	T	P	C
		--	--	04	02
Course Objectives	1. To give hands on experience on various experiments. 2. To impart the knowledge in basic science such as in the field of semiconductors and their practical applications. 3. To train students in techniques and principles related to various devices or components. 4. To acquire ability to use measuring instruments. 5. To acquire the ability to find the error in an experiment.				
Course outcomes	1. Students can understand the importance of Physics in the practical applications. 2. Students get an understanding of the characteristics of dielectrics. 3. Students gain knowledge in various techniques and working principles related to devices or components.				

List of experiments:

1. Diffraction grating (Measurement of wavelength of laser source using diffraction grating).
2. Newton's Rings (Determination of radius of curvature of plano convex lens). (Optional: with camera and software).
3. Characteristics of a Transistor (Study of Input and Output characteristics and calculation of input resistance, output resistance and amplification factor).
4. Determination of resistivity of a semiconductor using a four probe technique.
5. Photo Diode Characteristics (Study of I–V characteristics in reverse bias and variation of photocurrent as a function of reverse voltage and intensity).
6. I–V Characteristics of a Zener Diode. (Determination of knee voltage, zener voltage and forward resistance).
7. Dielectric constant (Measurement of dielectric constant using charging and discharging of a capacitor).
8. Determination of Planck's constant using LEDs.
9. Determination of energy gap of a semiconductor.
10. Determination of Fermi energy. (Measurement of Fermi energy in copper).
11. Series and parallel LCR Circuits (Determination of resonant frequency and quality factor).
12. Torsional pendulum (Determination of MI of a circular disc and rigidity modulus of the given wire)

Student outcomes	a	b	c	d	e	f	g	h	i	j	k
Mapping of course objectives	√		√				√				√

Course code: 15CH171	Chemical Sciences Laboratory	L	T	P	C
		--	--	04	02
Course Objectives	To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.				
Course outcomes	The students will gain the knowledge in 1. Handling the different types of instruments for analysis of materials using small quantities of materials for quick and accurate analysis. 2. By carrying out different types of titrations for estimation of concerned materials present in different types materials like, ores, alloys and water etc.				

PART-A: Instrumental

1. Determination of viscosity coefficient of a given organic liquid using Ostwald's
2. viscometer.
3. Estimation of copper by using spectrophotometer.
4. Conductometric estimation of strength of an acidmixture using standard NaOH solution
5. Determination of pKa value of a weak acid using pH meter.
6. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
7. Estimation of Sodium & Potassium by Flame photometric method.

PART-B: Volumetric

1. Determination of Total Hardness of a sample of water using disodium salt of EDTA.
2. Determination of Calcium Oxide (CaO) in the given sample of cement by Rapid EDTA method.
3. Determination of percentage of Copper in brass using standard sodium thiosulphate solution.
4. Determination of Iron in the given sample of Haematite ore solution using potassium
5. Dichromate crystals by external indicator method.
6. Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.
7. Determination of Dissolved Oxygen in the given water sample by Winklers method.

DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout,
Bengaluru - 560078, Karnataka.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS

FOR

BACHELOR OF TECHNOLOGY (B.Tech)

COMPUTER SCIENCE & ENGINEERING

(3rd to 8th Semester)

(With Effect from 2016-17)

SEMESTER – III

SL	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/P	C	CIA	END EXAM
1	16MA201	ENGINEERING MATHEMATICS	CR	03	02	--	--	04	40	60
2	16CS201	DISCRETE MATHEMATICAL STRUCTURES	CR	03	02	--	--	04	40	60
3	16CS202	ELECTRONIC CIRCUITS	CR	03	--	--	02	04	40	60
4	16CS203	DIGITAL CIRCUITS AND LOGIC DESIGN	CR	03	--	--	--	03	40	60
5	16CS204	DATA STRUCTURES AND APPLICATIONS	CR	03	--	--	--	03	40	60
6	16HU106	ECONOMICS FOR ENGINEERS	CR	03	--	--	--	03	40	60
7	16CS271	DATA STRUCTURES LABORATORY	CR	--	--	04	--	02	40	60
8	16CS272	DIGITAL CIRCUITS AND LOGIC DESIGN LABORATORY	CR	--	--	04	--	02	40	60
GRAND TOTAL = 800				**18**	**04**	**08**	**02**	**25**	**320**	**480**

SEMESTER – IV

SL.	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/P	C	CIA	END EXAM
1	16MA202	ENGINEERING MATHEMATICS	CR	03	02	--	--	04	40	60
2	16CS205	FINITE AUTOMATA AND FORMAL LANGUAGES	CR	03	--	--	02	04	40	60
3	16CS206	MICROPROCESSORS AND APPLICATIONS	CR	03	--	--	--	03	40	60
4	16CS207	COMPUTER ORGANIZATION	CR	03	--	--	--	03	40	60
5	16CS208	INTRODUCTION TO OS AND UNIX	CR	03	--	--	02	04	40	60
6	16CS209	ALGORITHMS DESIGN AND ANALYSIS	CR	03	--	--	--	03	40	60
7	16CS273	MICROPROCESSORS AND APPLICATIONS LAB	CR	--	--	04	--	02	40	60
8	16CS274	DESIGN AND ANALYSIS OF ALGORITHMS LAB	CR	--	--	04	--	02	40	60
GRAND TOTAL = 800				**18**	**02**	**08**	**04**	**25**	**320**	**480**

NOTE: CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits, CIA – Continuous Internal Assessment

SEMESTER V

SL.	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/ P	C	CIA	END EXAM
1	16CS301	PROBABILITY MODELS	CR	03	--	--	--	03	40	60
2	16CS302	DATABASE MANAGEMENT SYSTEMS	CR	03	--	--	--	03	40	60
3	16CS303	OPERATING SYSTEMS	CR	03	--	--	--	03	40	60
4	16CS304	SOFTWARE ENGINEERING	CR	02	--	02	--	03	40	60
5	16CS305	OBJECT ORIENTED PROGRAMMING	CR	03	--	--	02	04	40	60
6	16CSXXX	DEPARTMENT ELECTIVE – I	CR	03	--	--	--	03	40	60
7	16CSXXX	DEPARTMENT ELECTIVE – II	CR	03	--	--	--	03	40	60
8	16CS371	DATA BASE MANAGEMENT SYSTEMS LAB	CR	--	--	04	--	02	40	60
9	16CS372	OPERATING SYSTEMS LAB	CR	--	--	04	--	02	40	60
GRAND TOTAL = 900				**20**	**--**	**10**	**02**	**26**	**360**	**540**

DEPARTMENTAL ELECTIVE -1		DEPARTMENTAL ELECTIVE -II	
COURSE CODE	**COURSE TITLE**	**COURSE CODE**	**COURSE TITLE**
16CS321	SIGNALS & SYSTEMS	16CS331	RANDOMIZED AND APPROXIMATE ALGORITHMS
16CS322	VLSI DESIGN AND VERIFICATION	16CS332	NUMERICAL COMPUTING
16CS323	DATA COMMUNICATIONS	16CS350/ 16CT421	CYBER SECURITY
		16CS334/ 16CS430	CLOUD COMPUTING
		16CS333	MINOR PROJECT

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SEMESTER VI

SL.	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/P	C	CIA	END EXAM
1	16CS306	COMPUTER GRAPHICS	CR	03	--	--	02	04	40	60
2	16CS307	COMPILER DESIGN AND SYSTEMS SOFTWARE	CR	03	02	--	--	04	40	60
3	16CS308	COMPUTER NETWORKS	CR	03	02	--	--	04	40	60
4	16CS309	UNIX SYSTEMS PROGRAMMING	CR	03	--	--	--	03	40	60
5	16CSXXX	DEPARTMENT ELECTIVE – III	CR	03	--	--	--	03	40	60
6	16CSXXX	DEPARTMENT ELECTIVE – IV	CR	03	--	--	--	03	40	60
7	16CS373	SYSTEMS SOFTWARE AND COMPILER DESIGN LAB	CR	--	--	04	--	02	40	60
8	16CS374	NETWORKS AND LINUX PROGRAMMING LAB	CR	--	--	04	--	02	40	60
GRAND TOTAL = 800				**18**	**04**	**08**	**02**	**25**	**320**	**480**

DEPARTMENTAL ELECTIVE -III		DEPARTMENTAL ELECTIVE -IV	
COURSE CODE	**COURSE TITLE**	**COURSE CODE**	**COURSE TITLE**
16CS336	DIGITAL IMAGE PROCESSING	16CS343	COMPUTATIONAL GEOMETRY
16CS337	COMPUTER ARCHITECTURE	16CS344	SOFT COMPUTING
16CS338	MOBILE COMPUTING & MOBILE APPS DEVELOPMENT	16CS345	DATA SCIENCE
16CS339	DEEP LEARNING	16CS346	MINOR PROJECT
16CS340	RESEARCH PROJECT PRODUCT DEVELOPMENT FOUNDATION		

NOTE: CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits, CIA – Continuous Internal Assessment

SEMESTER VII

SL.	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/P	C	CIA	END EXAM
1	16CS401	MACHINE LEARNING	CR	03	--	--	--	03	40	60
2	16CS402	EMBEDDED SYSTEMS	CR	02	--	--	02	03	40	60
3	16CS403	OPTIMIZATION TECHNIQUES	CR	03	--	--	--	03	40	60
4	16CSXXX	DEPARTMENT ELECTIVE – V	CR	03	--	--	--	03	40	60
5	16CSXXX	DEPARTMENT ELECTIVE – VI	CR	03	--	--	--	03	40	60
6	16HU401	LAW FOR ENGINEERS	CR	03	--	--	--	03	40	60
7	16IE4XX	INSTITUTIONAL ELECTIVE-I	CR	03	--	--	--	03	40	60
8	16CS471	WEB PROGRAMMING LAB	CR	--	01	03	--	02	40	60
9	16CS481	PROJECT	CR	--	--	--	04	02	40	60
GRAND TOTAL = 900				**20**	**01**	**03**	**06**	**25**	**360**	**540**

DEPARTMENTAL ELECTIVE -V		DEPARTMENTAL ELECTIVE -VI	
COURSE CODE	**COURSE TITLE**	**COURSE CODE**	**COURSE TITLE**
16CS421	PATTERN RECOGNITION	16CS428	DATA WARE HOUSE AND DATA MINING
16CS422	WIRELESS NETWORKS	16CS429	CRYPTOGRAPHY
16CS423	MOBILE COMPUTING AND APPS DEVELOPMENT	16CS431	DISTRIBUTED COMPUTING
16CS424	MULTI CORE ARCHITECTURE	16CS432	RESEARCH PROJECT/PRODUCT DEVELOPMENT
16CS425	IOT		

NOTE: CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits, CIA – Continuous Internal Assessment

SEMESTER VIII

SL.	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
				L	T	P	S/P	C	CIA	END EXAM
1	16CSXXX	DEPARTMENT ELECTIVE - VII	CR	03	--	--	--	03	40	60
2	16IE4XX	INSTITUTIONAL ELECTIVE-II	CR	03	--	--	--	03	40	60
3	16CS482	SEMINAR	CR	--	--	--	02	01	50	--
4	16CS483	PROJECT	CR	--	--	--	20	10	100	100
GRAND TOTAL = 450				**06**	**--**	**--**	**22**	**17**	**230**	**120**

DEPARTMENTAL ELECTIVE -VII	
COURSE CODE	**COURSE TITLE**
16CS336	COMPUTER VISION
16CS337	PARALLEL COMPUTING
16CS338	SOCIAL NETWORKS AND ANALYTICS
16CS339	HUMAN COMPUTER INTERFACE

NOTE: CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits, CIA – Continuous Internal Assessment

INSTITUTIONAL ELECTIVES LIST - B.TECH PROGRAMME

GENERAL COURSE CODE: 16IE4XX

SL.No	COURSE CODE	COURSE TITLE	OFFERING DEPARTMENT
1	16IE401	ARTIFICIAL INTELLIGENCE	CSE
2	16IE402	DATA STRUCTURES& ALGORITHMS	CSE
3	16IE403	WEB TECHNOLOGIES	CSE
4	16IE404	MANAGEMENT INFORMATION SYSTEM	CSE
5	16IE405	SOCIAL NETWORKS AND ANALYTICS (15CS338)	CSE
6	16IE421	SENSORS, NETWORKS AND PROTOCOLS	ECE
7	16IE422	IMAGE PROCESSING AND COMPUTER VISION	ECE
8	16IE423	AUTOMOTIVE EMBEDDED SYSTEMS	ECE
9	16IE424	EVOLUTION OF TELECOMMUNICATIONS	ECE
10	16IE441	ENTREPRENEURSHIP MANAGEMENT	CT
11	16IE442	INNOVATION AND ENTREPRENEURSHIP	CT
12	16IE443	LOGISTICS AND SUPPLY CHAIN MANAGEMENT	CT
13	16IE444	DIGITAL MARKETING	CT
14	16IE445	ADVANCED ORGANIZATIONAL BEHAVIOR(15CT449)	CT
15	16IE461	INDUSTRIAL ROBOTICS & AUTOMATION	ME
16	16IE462	TOTAL QUALITY MANAGEMENT	ME
17	**16IE463**	**FUNDAMENTALS OF AUTOMOBILE ENGINEERING**	**ME**
18	16IE464	RENEWABLE ENERGY SOURCES	ME
19	16IE465	PRODUCT & INDUSTRIAL DESIGN	ME
20	**16IE466**	**PRODUCT ENGINEERING & ENTREPRENEURSHIP**	**CT**
21	**16IE467**	**FUNDAMENTALS OF CLOUD COMPUTING**	**CSE**
22	**16IE468**	**MACHINE LEARNING WITH PYTHON**	**CSE**
23	**16IE469**	**FUNDAMENTALS OF AEROSPACE ENGINEERING**	**ASE**
24	**16IE470**	AIRCRAFT SYSTEM & INSTRUMENTATION	**ASE**
25	**16IE471**	BUSINESS INTELLIGENCE	**CSE**

- **Updated on 09.04.2021**

SEM/YEAR : III SEM
COURSE CODE : 16MA201
TITLE OF THE COURSE : ENGINEERING MATHEMATICS
L: T/A:P: C : 3 : 2 : 0 : 4

Course objectives

1. Understand linear system of equations
2. Understand the structure of Matrices and Determinants
3. Infer different co-ordinate systems and applications of vectors.
4. Know the higher integrations applications in polar coordinates.
5. Learn the concepts of Surface areas and apply to solve numerical problems in engineering domain.

Course outcomes

1. Apply Linear Algebra to solve linear equations for a given linear system.
2. Evaluate numerical problems on matrices and determinants.
3. Analyze vectors in space and solve problems in engineering domain.
4. Apply double and triple integrations to solve engineering problems.
5. Apply Line integration concepts to vectors in space for problems.
6. Calculate surface areas of given distribution functions.

LINEAR EQUATIONS (8 hours)

Linear transformations, Matrix of Linear Transformations, Matrix Operations, Row reduction and echelon forms, Inverse of a matrix, Systems of linear equations, Vector equations, Solution sets of linear equations, Properties of invertible matrices.

MATRICES & DETERMINANTS (10 hours)

Determinants, Eigenvalues and Eigenvectors, Characteristic equation, Diagonalization, Diagonalization of symmetric matrices, Quadratic forms and Singular Value Decomposition

3-D GEOMETRY (8 hours)

3-D Coordinate systems, Vectors, Dot and Cross products, Lines, planes and curves in space, Tangents to curves, Normal vectors of curve, Taylor's formula for two variables.

MULTIPLE INTEGRALS (10 hours)

Double integration in polar form, Triple integration in cylindrical and spherical coordinates, Line integrals, Vector Fields and Line integral

GREEN'S, STOKE'S AND DIVERGENCE THEOREMS (10 hours)

Path independence, Green's theorem, Surfaces and area, Surface Integrals, Stoke's Theorem, Divergence Theorem

Text Books:

1. Linear Algebra and its applications, David Lay, Steven Lay, Judi Mc Donald, Pearson , 5th edition
2. Thomas's Calculus, G.B.Thomas, M.Weir, J. Hass, Pearson , 12th edition

Reference Books:

1. Advanced Engineering Mathematics, E. Kreyzsig, Wiley, 10th Edition
2. Introduction to Linear Algebra, G. Strang, Wellesely- Cambridge Press, 4th edition.

SEM/YEAR : III SEM
COURSE CODE : 16CS201
TITLE OF THE COURSE : DISCRETE MATHEMATICAL STRUCTURES
L: T/A:P: C : 3 : 2 : 0 : 4

Course Objectives

1. Introduce the students to the discrete structures needed in Computer Science & Engineering
2. Provide students' knowledge of proof techniques to prove the theorem so that they appreciate proof techniques and construction leading to algorithms

Course outcomes

At the end of the course student will be able to

1. Understand and use counting principle, use Propositional calculus in Theorem proving
2. Use suitable algebraic structures to model the given scenario/system
3. Use constructions used in proofs as algorithms

Module 1

Relations , Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions sequences, indexed classes of sets, recursively defined functions, cardinality, Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion principle **8hrs**

Module 2

Logic and Propositional Calculus: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications , Introduction to Predicate Calculus

10hrs

Module 3

Graph Theory: Introduction, data structures, graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, the bridges of Konigsberg, traversable multi-graphs, labelled and weighted graphs, complete, regular and bipartite graphs.

6hrs

Module 4

Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations.

10hrs

Module 5

Algebraic Structures : Introduction, operations, semi-groups, groups, subgroups, normal subgroups, isomorphism and homomorphism, rings, integral domains and fields, polynomials over a field.

11hrs

Text Books

1. C L Liu, Elements of Discrete Mathematics, 2nd Edition, Tata McGraw Hill, 2000

Reference Books

1. S. Lipschutz and M. L Lipson, Discrete Mathematics, Schaum's outline, 3rd Edition,
   McGraw Hill Higher Education, 2006
2. K. Rosen. *Discrete Mathematics and Its Applications (4th edition).* McGraw-Hill. 1999
3. Ronald R Graham, D. E. Knuth, and Oren Patashnik, Concrete Mathematics, 2nd Edition, Addision- Wesley Publishing Company, 1994

SEM/YEAR : III SEM
COURSE CODE : 16CS202
TITLE OF THE COURSE : ELECTRONIC CIRCUITS
L: T/A:P: C : 3 : 2 : 0 : 4

Course Objectives

1. Provide students of functional knowledge of analogue electronics to understand the
   circuitry used in the devices and interface units which they use in systems design
2. Give students sufficient knowledge of circuits which they will come across in different industry domains

Course outcomes

At the end of the course student will be able
1. To understand the functionality of diodes and design simple applications
2. To know the Op-amps and their usage in the design of active filters and data convertors
3. To understand the design of power supply units

Module 1

Overview of Diodes and transistors, Applications of Diodes-Clipper circuits, Parallel Clippers, series clippers, clamper circuits **8 hrs**

Module 2

Biasing of Transistors, Small signal model (Hybrid Model) of transistor, simplified Hybrid Model, Transistor as an amplifier, analysis of CE amplifier with (i)collector to base bias, and with (ii) an emitter resistance.
Feedback amplifiers: transfer gain, transfer function, frequency response and bandwidth. Operational Amplifiers: Ideal op-amp, equivalent circuit of practical op-amp, power supply rejection ratio and skew rate . Op-amp IC 741: open loop and closed loop configuration, input offset voltage and its measurement, effect of input bias current, applications of op-amps: voltage summer, comparators **11 hrs**

Module 3

Active Filters: Advantage of active filters, frequency response characteristics of filter, Introduction to Bode Plot, first order low pass butter worth filter, high pass butter worth filter, band pass filter **9 hrs**

Module 4

Data Acquisition and Data Convertors : Need for Data Acquisition, conversion, ADC, Different Types of ADCs, DAC, different types of ADCs. **8 hrs**

Module 5

Regulated Power Supply
Oscillators: Sinusoidal Oscillators, The Wien-Bridge Oscillator, The Colpitts Oscillator, voltage regulators, types of voltage regulators, shunt regulators using op-amp, series

regulator using op-amp, three terminal IC regulator, three terminal fixed voltage regulator, boosting regulator output current, three terminal adjustable regulator, SMPS

9 hrs

Text Books

1. A Malvino, D J Bates, Electronics Principles, 7th Edition, McGraw Hill Education India,
   2007
2. J. Millman, H. Taub and M Prabhakara Rao, Pulse, Digital and Switching Waveforms, 2nd Edition, Tata Mc-Graw Hill Education, 2007

Reference Books

1. Millmann & Halkias , Integrated Electronics, Tata Mc-Graw Hill Education, 2001
2. A P Godse and U A Bakshi, Electronics Circuits, Technical Publications, 2005

SEM/YEAR : III SEM
COURSE CODE : 16CS203
TITLE OF THE COURSE : DIGITAL CIRCUITS AND LOGIC DESIGN
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. This course is designed to provide a comprehensive introduction to digital logic design leading to the ability to understand number system representations, binary codes, binary arithmetic and Boolean algebra, its axioms and theorems, and its relevance to digital logic design.
2. Introduction to combinational circuits(such as Karnaugh maps), synchronous sequential logic and Asynchrnous sequential logic.
3. Analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.

Course outcomes

At the end of the course student will be able

1. To analyze and design combinational systems using standard gates and minimization methods (such as Karnaugh maps, Quine-McCluskey Algorithm).
2. To analyze and design combinational systems composed of standard combinational modules, such as multiplexers and decoders.
3. To analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.
4. To analyze the given problems and design sequential Circuits

Module 1

NUMBER SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES:

Review of number systems-Binary, octal, Hexadecimal. Introduction to Analog and digital signal. The TTL Parameters and Truth table of Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic, Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation

SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS:

Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions

9hrs

Module 2

SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS:

Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.

DESIGN OF COMBINATIONAL LOGIC CIRCUITS:

Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Encoders, Priority encoders, magnitude comparator – BCD converter, Parity Generators And Checkers.

8hrs

Module 3

DESIGN OF COMBINATIONAL LOGIC CIRCUITS (continued):

Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices

INTRODUCTION TO SEQUENTIAL CIRCUITS:

Combinational Vs sequential circuits, Asynchronous Vs synchronous circuits state table and state diagram **10 hrs**

Module 4

INTRODUCTION TO SEQUENTIAL CIRCUITS (continued):

State assignment – Memory elements and their excitation functions –T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements – Design of synchronous sequential circuits like Sequence Detectors and binary counters. **10 hrs**

Module 5

APPLICATION OF LOGIC CIRCUITS SEQUENTIAL CIRCUITS:

Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register, Applications of Shift Registers, Asynchronous and Synchronous Counters, Changing the Counter Modulus, Decade counters, Presettable Counters, Counter Design.

10 hrs

Text Book:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", IV Edition, Pearson Education,2008.
2. Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.

Reference Books

1. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
2. Charles H. Roth:Fundamentals of Logic Design, Jr., 5th Edition,Cengage Learning,2004.

SEM/YEAR	**: III SEM**
COURSE CODE	**: 16CS204**
TITLE OF THE COURSE	**: DATA STRUCTURES AND APPLICATIONS**
L: T/A:P: C	**: 3 : 0 : 0 : 3**

Course Objectives

1. Data structure deals with organizing large amount of data in order to reduce space complexity and time requirement.
2. This course gives knowledge of algorithms, different types of data Structures and the estimation space and time complexity.

Course outcomes

At the end of the course student will be able

1. To understand and explain linear and dynamic allocation of memory using array and linked list
2. To design programs for queue, stacks, sorting, Searching using linear data structures.
3. To use Nonlinear data structures to create make Tree, Graphs.

Module 1

Data structures: Definition, Types. Algorithm design, Complexity, Time-Space Tradeoffs. Use of pointers in data structures. Array Definition and Analysis, Representation of Linear Arrays in Memory, Traversing of Linear Arrays, Insertion And Deletion, Single Dimensional Arrays, Two Dimensional Arrays, Multidimensional Arrays, Function Associated with Arrays, Character String in C, Character String Operations, Arrays as parameters, Implementing One Dimensional Array, Sparse matrix. **9hrs**

Module 2 Introduction to Stacks and queue

Stack: Definition, Array representation of stacks, Operations Associated with Stacks- Push & Pop, Polish expressions, Conversion of infix to postfix, infix to prefix (and vice versa), Application of stacks recursion, polish expression and their compilation, conversion of infix expression to prefix and postfix expression, Tower of Hanoi problem.

Queue: Definition, Representation of Queues, Operations of queues- QInsert, QDelete, Priority Queues, Circular Queue, Deque.

Dynamic Data Structure: Linked list, Introduction to Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list. **9hrs**

Module 3 Dynamic Data Structure (continued):

Linked list: doubly linked list, circular linked list, generalized list. Applications of Linked List polynomial representation using linked list and basic operation. Stack and queue Implementation using linked list.

Trees & Graphs: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, extended binary trees, Traversing binary trees, Searching, Insertion and Deletion in binary search trees **9hrs**

Module 4 Trees and Graphs(continued)

Trees General trees, AVL trees,
Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Graph Transversal, Connected Components and Spanning trees. **8 hrs**

Module 5 Sorting and Searching and file structures

Sorting: Insertion sort, Quick sort, merge sort, and heap sort. Hashing techniques
File structures: Physical storage media, File Organization, Linked organization of file, Inverted file,
Organization records into blocks, Sequential blocks, Indexing & Hashing, Multilevel indexing, Tree Index, Random file, Primary Indices, Secondary Indices, B tree index files.
10hrs

Text Books

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).

Reference Books

1. A M Tannenbaum, Y Langsam, M J Augentien "Data Structures using C ", Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C" PHI
3. File Structures An object-Oriented Approach with C++ by Michael J. Folk, Bill Zoellick, BregRiccardi, Published by Addison Wesley (1st ISE Reprint,1999).
4. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing,2013

SEM/YEAR : III SEM
COURSE CODE : 16HU106
TITLE OF THE COURSE : ECONOMICS FOR ENGINEERS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

The objective of this course is to familiarize the prospective engineers with elementary Principles of economics. It also deals with acquainting the students with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector. It also seeks to create and awareness about the status of the current economic parameters /indicators/ policy debates. All of this is a part of the quest to help the students imbibe soft skills that will enhance their employability.

Course outcomes

At the end of the course student will be able

1. To understand the principles and methodology of economic Demand/ Supply, Basic Macro-Economics concepts
2. To know Price indices, public sector economics, Central bank, capital and debt markets
3. To have an exposure and understanding of Monetary and fiscal policy, And elements of Business/Managerial economics, Investment Analysis
4. To know Indian economy. Challenges and Policy , Debates in Monetary, Fiscal, Social, External sectors

Module 1

Basic Principles and Methodology of Economics. Demand/Supply–elasticity–Government Policies and Application. Theory of the Firm and Market Structure.
Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies.

09Hrs

Module 2

Aggregate demand and Supply(IS/LM).Price Indices (WPI/CPI),Interest rates ,Direct and Indirect Taxes, Public Sector Economics–Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank–Monetary Aggregates; Commercial Banks& their functions; Capital and Debt Markets.

09Hrs

Module 3

Monetary and Fiscal Policy Tools & their impact on the economy–Inflation and Phillips Curve.
Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control–Techniques, Types of Costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. **09Hrs**

Module 4

Investment Analysis– NPV, ROI, IRR, Payback Period, Depreciation, Time value of money. Business Forecasting–Elementary techniques. Statements – Cash flow, Financial. Case Study Method. **08Hrs**

Module 5

Indian economy Brief overview of post-independence period–plans. Post reform Growth, Structure of productive activity. Issues of Inclusion–Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized,Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors. **09Hrs**

Text Books

1. Mankiw Gregory N.(2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta, Managerial Economics, Tata MGH, 2004

Reference Books

1. Misra, S.K. and Puri, *Indian Economy,* Himalaya, 2009
2. Pareek Saroj, *Text book of Business Economics,* Sunrise Publishers, 2003

SEM/YEAR : III SEM
COURSE CODE : 16CS271
TITLE OF THE COURSE : DATA STRUCTURES AND APPLICATIONS LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course Objectives

1. This Lab course is designed to provide a comprehensive introduction designing algorithms by appropriate selection of Data Structures
2. Code the above algorithms and thus implement various data structures

Course outcomes

At the end of the course student will be able

1. Students will demonstrate knowledge of binary number theory, Boolean algebra and binary codes.
2. Students will analyze and design combinational systems using standard gates and minimization methods (such as Karnaugh maps).
3. Students will analyze and design combinational systems composed of standard combinational modules, such as multiplexers and decoders.
4. Students will analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.

Software Required: ANSI C

List of **applications/Expts** based on the following programs/techniques:

1. Design a problem to search an element in two dimensional array.
2. Design a problem to perform following operations on tables using function only addition, Subtraction, Multiplication.
3. Design a program for performing various Basic elementary Operations (Push , Pop , Peek , isfull , isempty) using ARRAY on stack .
4. Design a program for performing various Basic elementary Operations (Enqueue , Dequeue , Peek etc.) using ARRAY on Queue.
5. Write a program using iteration and recursion concept for Quicksort.
6. Design a problem for Linked list creation and perform operations such as insert, delete ,update and reverse on it.
7. Design a problem to simulate following sorting algorithm.
   a)Merge sort, b)Insertion Sort, c) Bubble Sort
8. Design a solution for following Search Techniques.
   a)Linear Search, b)Binary Search
9. Design a Program for various Graph traversal techniques
10. Design a program for various tree traversal techniques.
11. Design a program for Binary Tree and Perform the following operations: Creation, Insertion & Traversal on the tree.
12. Implement Circular Linked list.
13. Design a program for performing various Basic elementary Operations (Push, Pop , Peek , isfull, isempty) using Linked List on Stack .
14. Design a program for performing various Basic elementary Operations (Enqueuer , Dequeue, Peek etc.) using Linked List on Queue.
15. Design a Problem to Evaluate Prefix expression.

SEM/YEAR : III SEM
COURSE CODE : 16CS272
TITLE OF THE COURSE : DIGITAL CIRCUITS AND LOGIC DESIGN LABORATORY
L: T/A:P: C : 0 : 0 : 4 : 2

Course Objectives

1. This course is designed to provide a comprehensive introduction to digital logic design leading to the ability to understand number system representations, binary codes, binary arithmetic and Boolean algebra, its axioms and theorems, and its relevance to digital logic design.
2. Introduction to combinational circuits (such as Karnaugh maps), synchronous sequential logic and Asynchrnous sequential logic.
3. Analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.

Course outcomes

At the end of the course student will be able

1. Students will demonstrate knowledge of binary number theory, Boolean algebra and binary codes.
2. Students will analyze and design combinational systems using standard gates and minimization methods (such as Karnaugh maps).
3. Students will analyze and design combinational systems composed of standard combinational modules, such as multiplexers and decoders.
4. Students will analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.

List of experiments:

a) Checking the ICs and verifying the truth table for ICs
b) Simplification of switching expressions using Karnaugh Maps and implement circuits using AND, OR and NOT gates
c) Simplification of switching expressions using Karnaugh Maps and implement circuits using NAND gates
d) Simplification of switching expressions using Karnaugh Maps and implement circuits using NOR gates
e) Simplification of switching expressions using Quine-McCluskey algorithms and implement circuits
f) Designing combinational circuits using MUXes and Decoders
g) Designing adder/ subtractors and checking for overflow and underflow conditions
h) Design circuits to implement synchronous counters
i) Design circuits to implement asynchronous counters

SEM/YEAR : IV SEM
COURSE CODE : 16MA202
TITLE OF THE COURSE : ENGINEERING MATHEMATICS
L: T/A:P: C : 3 :2: 0 : 4

Course objectives

1. Learn techniques from basic probability
2. Understand complex integration
3. Evaluate real integrals using complex analytic techniques
4. Understand the numerical techniques for differentiation and integration

Course outcomes

1. Analyze basic communication systems model using probabilistic techniques
2. Apply probability for computer network modelling
3. Evaluate real integrals using complex analysis
4. Estimate the integral of complex functions using numerical methods.

ELEMENTARY FUNCTIONS (5 hours)

Exponential and logarithmic functions, Complex powers, Trigonometric and Hyperbolic Functions.

INTEGRATION IN THE COMPLEX PLANE (7 hours)

Complex Integrals, Cauchy-Goursat Theorem, Independence of Path, Cauchy's Integral Formulas and Their Consequences, Cauchy's Two Integral Formulas, Some Consequences of the Integral Formulas, Applications.

SERIES AND RESIDUES (8 hours)

Sequences and Series, Taylor Series, Laurent Series, Zeros and Poles, Residues and Residue Theorem, Some Consequences of the Residue Theorem, Evaluation of Real Trigonometric Integrals, Evaluation of Real Improper Integrals, Applications.

INTRODUCTION TO PROBABILITY THEORY (8 hours)

Axiomatic construction of the theory of probability, independence, conditional probability, And Baye's Theorem. Bernoulli trials.

RANDOM VARIABLES (9 hours)

Random variables, probability distributions, functions of random variables; Standard Univariate discrete and continuous distributions and their properties, mathematical expectations, Moments,Moment generating function and Characteristic function.

NUMERICAL METHODS (8 hours)

Mathematical modelling and engineering problem solving, Roots of equations, Newton Cote's Formula, Numerical Integration and Differentiation.

Text Books:

1. A First course in complex analysis with applications, Dennis Zill and Patrick Shanahan,Jones and Bartlett publishers.

2. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition
3. Numerical methods for engineers, Chapra and Canale, McGraw Hill Education, 7th edition.

Reference Books:

1. Complex Variables and applications, Brown and Churchill, McGraw Hill Education, Eighth Edition.
2. Probability, Statistics and Statistics with Reliability, Queuing, and Computer Science Applications, Kishore Trivedi, Prentice Hall, 2nd Edition
3. Probability and Random Processes, S. Miller and Childers, Elsevier Inc.,Second Edition
4. A First Course in Numerical Methods, Ascher and Grief, SIAM 2011

SEM/YEAR : IV SEM
COURSE CODE : 16CS205
TITLE OF THE COURSE : FINITE AUTOMATA AND FORMAL LANGUAGES
L: T/A:P: C : 3 : 2 : 0 : 4

Course Objectives

The course begins with the basic mathematical preliminaries and goes on to discuss the general theory of automata, properties of regular sets and regular expressions, and the basics of formal languages. Besides, sufficient attention is devoted to such topics as pushdown automata, context- free languages, Turing machines

Course outcomes

At the end of the course student will be able

1. To understand the concept of Automata
2. To explain the concept of Regular Expression, languages and abstract machines to recognize them
3. To know the generalized computation model and different types Computation

Module – 1

Introduction to Finite Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon – transitions

9Hrs

Module – 2

Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions. applications of regular expressions such as Grep, and Lex etc..

Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata

12Hrs

Module 3

Context – free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages

Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata, **10hrs**

Module 4

Properties of Context – Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc

9hrs

Module 5

Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing Machines and Computers. Chomsky hierarchy

10 hrs

Text Books

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008
2. J.E. Hopcroft , R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education , New Delhi 2008

Reference Books

1. K.L.P. Misra and N. Chandrashekaran. Theory of Computer Science- Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007
2. C. Martin - Introduction to Languages and the Theory of Computation 2ndEdn, TMH, New Delhi, 2000.

SEM/YEAR : IV SEM

COURSE CODE : 16CS206
TITLE OF THE COURSE : MICROPROCESSORS AND APPLICATIONS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. To introduce microprocessors and basics of system design using microprocessors.
2. To introduce h/w architecture, instruction set and programming of 8086 microprocessor
3. To introduce the peripheral interfacing of microprocessors.
4. To introduce the h/w architecture, instruction set, programming and interfacing of 8051 microcontroller

Course outcomes

At the end of the course student will be able

1. To Know the basics of system design using microprocessors.
2. To implement the h/w architecture, instruction set and programming of 8086 microprocessor
3. To implement peripheral interfacing of microprocessors.
4. To know the h/w architecture, instruction set, programming and interfacing of 8051 microcontroller

Module 1

INTRODUCTION TO MICROPROCESSOR

Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, The Microprocessor and its Architecture: Introduction and difference between 8085 and 8086 microprocessor.8086 pin diagram, Minimum mode maximum mode. **9hrs**

Module 2

8086 ARCHITECTURE

Internal Architecture of 8086,Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Memory Paging, Flat Mode Memory Addressing Modes.

8 hrs

Module 3

PROGRAMMING 8086

Data Movement Instructions: MOV Revisited, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Controlling the Flow of the Program, Bit manipulation instruction.

10hrs

Module 4

I/O INTERFACING

Memory Interfacing and I/O interfacing –8255 pin diagram, Parallel communication interface – Serial communication interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller –Applications.

9hrs

Module 5

8051 MICROCONTROLLERS

Architecture of 8051 – Pin Diagram of 8051, Operational features – Memory and I/O addressing – Interrupts – Instruction set – Applications. **9hrs**

Text Books

1. Douglas V Hall, "MICROPROCESSORS AND INTERFACING, PROGRAMMING AND HARDWARE" TMH, 2006.
2. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009

Reference Books

1. Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.
2. Mohammed Rafiquzzaman, Microprocessors and Microprocessor Based Systems, 2nd Edition CRC Press, 2000
3. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.
4. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.

SEM/YEAR : IV SEM
COURSE CODE : 16CS207
TITLE OF THE COURSE : COMPUTER ORGANIZATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. Provide in depth knowledge of designing a processor considering both the data part and control parts of a processor
2. Give students thorough knowledge of memory technology , different types of memory, I/O sub systems, and I/O operations
3. Help students understand the concept of pipeline processing, parallel architectures and multi core architectures

Course outcomes

At the end of the course student will be able

1. To design the data part and control part of a processor
2. To understand memory technology, I/O systems and I/O operation and use them i the design of a computing system
3. To understand and appreciate the pipe line processing and parallel processing

Module 1

Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle.
Machine instructions, Instructions set architectures, Assembly language programming, addressing modes, instruction cycles, registers and storage, addressing modes; discussions about RISC versus CISC architectures

9hrs

Module 2

Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation;
Data Part Design : Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path,
Control Part Design: Control unit design; Hardwired and Microprogrammed Control unit **10hrs**

Module 3

Memory Technology, static and dynamic memory, Random Access and Serial Access Memories, Cache memory and Memory Hierarchy, Address Mapping, Cache updation schemes, Virtual memory and memory management unit **08 hrs**

Module 4

I/O subsystems: Input-Output devices such as Disk, CD-ROM, Printer etc.; Interfacing with IO devices, keyboard and display interfaces; Basic concepts Bus Control, Read Write operations, Programmed IO, Concept of handshaking, Polled and Interrupt-driven I/O, DMA data transfer. **9 hrs**

Module 5

Pipeline Processing, Instruction and Arithmetic Pipeline, Pipeline hazards and their resolution, Parallel Processing Systems, Multi-core Architectures **9 hrs**

Text Books

1. Mano, M.M., Computer System Architecture, Prentice Hall of India, New Delhi, 1992
2. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization , McGraw Hill series 2002

Reference Books

1. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
2. Vincent P. Heuring and Harry F. Jordan , Computer Systems Design and Architecture (2nd Edition), Dec, 2003
3.David Patterson and John Hennessey Computer Organization and Design, Elsevier. 2008

SEM/YEAR : IV SEM
COURSE CODE : 16CS208
TITLE OF THE COURSE : INTRODUCTION TO OPERATING SYSTEMS AND UNIX
L: T/A:P: C : 3 : 0 : 2 : 4

Course Objectives

1. Gives an introduction to Operating systems, different types of them, their functionalities
2. Expose the students to different operating systems UNIX/LINUX, Windows, Android with the help of case studies
3. Introducing the shell programming constructs in UNIX/Linux and awk

Course outcomes

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

1. Know the general structure of an operating systems and it's functionalities
2. Understand the UNIX/Linux, Windows and Android operating systems,
3. Know the different constructs of shell programming in UNIX/Linux and use them in programming

Module 1

Operating System Objectives and Functions,The Evolution of Operating Systems developments Leading to Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore architectures, Microsoft Windows Overview, Modern UNIX Systems, Linux, Android. Booting Process of all the above operating systems.

9hrs

Module 2

The Unix Operating System, The UNIX architecture and Command Usage, General Purpose Utilities, The File System, Basic File Attributes
The Shell,The Process, Process Status, System Processes, Mechanisms of Process Creation,
Process States and Zombies, Running jobs in background, Killing processes with Signals, Customizing the environment, File Systems & Inodes, hard links, The directory, umask, and find.

10 hrs

Module 3

Simple filters, Different commands: pr, head, tail, cut, paste, sort, uniq, tr. Filters using Regular, expressions grep and sed,
Essential Shell Programming: read, exit, the if conditional, case conditional, expr, while loop, for loop, set and shift, trap.
awk – An Advanced Filter and using it in programming, splitting a Line in to fields, variables, expressions, Comparison operators, Number Processing, -f option, arrays, functions, if, for and while. **09 hrs**

Module 4

Program Development tools and Essentials of Systems Administration Program **development Tools:** Handling multi source C applications, make command, Removing redundancies, cleaning up and backups,

ar command: Building a Library(archive), Maintaining an archive with make Essential Systems Administration: Root: The systems administrator's login, The Administrative privileges, maintaining security, User Management, Start ups and shutdown, Managing disk space, Device files, cpio: a back up program, tar : The Tape archive program **09 hrs**

Module 5

UNIX System Administration:

TCP/IP basics, Resolving IP addresses, ping, telnet and ftp, Maintaining Security, Partitions and File Systems, Standard File systems and their types, fdisk : creating partitions, mkfs: creating a file system, Mounting and unmounting file systems, fsck: File system checking, systems start up and init. Shutdown and sync operation, backup **08 hrs**

Text Books

1. Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.
2. Silberschatz, Galvin, and Gagne, "Operating System Principles", Seventh Edition, Wiley India Pvt Ltd, 2007. (Chapters 1 and 2)

Reference Books

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
2. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
3. Harvey M. Detail, "Operating Systems", Third Edition, Pearson Education, 2004.

SEM/YEAR : IV SEM
COURSE CODE : 16CS209
TITLE OF THE COURSE : ANALYSIS AND DESIGN OF ALGORITHMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

The designing of algorithm is an important component of computer science. The objective of this course is to make students aware of various techniques used to evaluate the efficiency of a particular algorithm. Students eventually should learn to design efficient algorithm for a particular program

Course Outcomes

1. An ability to design and analyze algorithms, study time complexity and prove correctness
2. An ability to develop various techniques used to evaluate the efficiency of a particular algorithm and solve engineering problems

Module 1

Introduction:

Algorithm Design paradigms - motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Recurrences- substitution method, recursion tree method, master method, generating functions.

9hrs

Module 2

Divide and Conquer and Greedy Algorithms

Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Merge sort**,** Strassen Multiplication; Analysis of divide and conquer run time recurrence relations.

Greedy Method

Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), Approximate solution (Knapsack problem), Single source shortest paths, travelling salesman **10 hrs**

Module 3

Dynamic programming

Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, chain Matrix multiplication, Travelling salesman Problem, longest Common sequence, knapsack problem **08 hrs**

Module 4

Graph searching and Traversal

Representation of graphs, strongly connected components, graph matching, network flowsBack tracking , Overview, 8-queen problem, and Knapsack problem

Branch and bound,LC Searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

09 hrs

Module 5

Computational Complexity

Complexity measures, Polynomial vs Non-Polynomial time complexity; NP-hard and NP-complete classes, examples. Intractability **09 hrs**

Text Book

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2009

Reference Books

1. E. Horowitz, S. Sahni, and S. Rajsekaran, " Fundamentals of Computer Algorithms," Galgotia Publication, 2008
2. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley
3. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", Pearson Education, 2009
4. D. E. Knuth, " The Art of Computer Programming , Volume 3" 2nd Edition, Addison Wesley, 2014

SEM/YEAR : IV SEM
COURSE CODE : 16CS273
TITLE OF THE COURSE : MICROPROCESSOR AND APPLICATIONS LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course Objectives

1. To introduce microprocessors and basics of system design using microprocessors.
2. To introduce h/w architecture, instruction set and programming of 8086 microprocessor
3. To introduce the peripheral interfacing of microprocessors.
4. To introduce the h/w architecture, instruction set, programming and interfacing of 8051 microcontroller

Course outcomes

At the end of the course student will be able

1. To Know the basics of system design using microprocessors.
2. To implement the h/w architecture, instruction set and programming of 8086 microprocessor
3. To implement peripheral interfacing of microprocessors.
4. To know the h/w architecture, instruction set, programming and interfacing of 8051 microcontroller

Lab experiments based on the following:

a) Programming experiments to implement software programs using stacks, and queues,
b) Programming experiments to implement software programs using linked lists
c) Programming experiments to implement software programs on bit operations
d) Programming experiments to implement software programs using arithmetic operations
e) Programming experiments to implement software programs - searching and sorting
f) Interface ADC to microprocessor kit
g) Interface DAC to microprocessor kit
h) Interface Logic Controller to microprocessor kit
i) Interface Stepper motor to microprocessor kit
i) Interface Additional Keyboard and display units to microprocessor kit
j) Interface 2 compatible devices

SEM/YEAR : IV SEM
COURSE CODE : 16CS274
TITLE OF THE COURSE : DESIGN AND ANALYSIS OF ALGORITHMS LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course Objectives

1. This Lab course is to provide students the art of design and analysis of algorithms using different strategies
2. Course introduces complexity of algorithms
3. Lab experiments provide the design and implementation of algorithms and their time analysis .

Course outcomes

At the end of the Lab course student will be able
To understand and design of different algorithms using Divide-and-Conquer, Dynamic Programming, Branch & bound, and Greedy strategies

Lab assignment will be based on the following:

Mini projects based on

a) Binary search, Quick sort and merge sort using divide and conquer techniques.
b) Algorithms based on greedy method.
c) Dynamic programming.
d) Depth First and Breadth Search traversals of graphs, graph matching and network flows
e) Algorithms based on backtracking.
f) Algorithms based on Branch and Bound.

SEM/YEAR : V SEM
COURSE CODE : 16CS301
TITLE OF THE COURSE : PROBABILITY MODELS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

Give students necessary probability models such as stochastic processes, queuing theory and models so that they can use them in their areas

Course outcomes

At the end of the course students will be able to

1. Understand stochastic processes, queuing models and their application to computer science and communication areas
2. Apply the concepts learnt to systems and devices to study their working and performance.

Module 1 Overview of Probability Theory

Conditional Distribution and expectation: Introduction, Mixture Distributions, Conditional Expectation, Imperfect fault coverage and reliability. Random sums

8hrs

Module 2 Stochastic Processes

Introduction, Classification of Stochastic Processes, The Bernoulli Process, The Poisson Process, Renewal Processes, Availability Analysis, Random Incidence, Renewal Model of Program Behavior

9hrs

Module 3 Discrete-Time Markov Chains

Introduction, Computation of n-step Transition Probabilities, State Classification and Limiting Probabilities, Distribution of Times Between State Changes, Markov Modulated Bernoulli Process, Irreducible Finite Chains with Aperiodic States, Discrete-Time Birth-Death Processes

9hrs

Module 4 Continuous-Time Markov Chains

Introduction, The Birth-Death Process, Other Special Cases of the Birth-Death Model, Non- Birth-Death Processes, Markov Chains with Absorbing States Solution Techniques

9hrs

Module 5 Networks of Queues

Introduction, Open Queuing Networks, Closed Queuing Networks, General Service Distribution and Multiple Job Types, Non-product-form Networks, Computing Response Time Distribution **10hrs**

Text Books

1.Kishor Shridharbhai Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, John Wiley & Sons, 2nd Edition

Reference Books

1.Sheldon M Ross, Introduction to Probability Models, Elsevier, 9th Edition

SEM/YEAR : V SEM
COURSE CODE : 16CS302
TITLE OF THE COURSE : DATABASE MANAGEMENT SYSTEMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. To learn data models, conceptualize and depict a database system using ER diagram
2. To understand the internal storage structures in a physical DB design
3. To know the fundamental concepts of transaction processing techniques

Course outcomes

At the end of the courses students will get the acquire the

1. Ability to Install, configure, and interact with a relational database management system
2. Ability to master the basics of SQL and construct queries using SQL
3. Ability to design and develop a large database with optimal query processing

Module 1

Introduction: Purpose of Database System-–Views of data–data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes, relationships, relationship types, E/R diagram notation, examples.

8hrs

Module 2

Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses.

9hrs

Module 3

Database Design: Dependencies and Normal forms, dependency theory – functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF

10hrs

Module 4

Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

9hrs

Module 5

Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL

9hrs

Text Books

1. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 5thEd, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8thed, Pearson Education, 2006.

Reference Books

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addision Wesley, 2007
2. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003
3. S. K. Singh, "Database Systems Concepts, Design and Applications", First Edition, Pearson Education, 2006

SEM/YEAR : V SEM
COURSE CODE : 16CS303
TITLE OF THE COURSE : OPERATING SYSTEMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. To tell the students the how the operating system is making computer system more convenient.
2. How to efficiently utilize the computer resources.

Course outcomes

At the end of the course student will be able to

1. Understand functions, structures and history of operating systems
2. Master understanding of design issues associated with operating systems
3. Master various process management concepts including scheduling,synchronization , deadlocks, file sharing .

Module 1

Computer System and Operating System Overview: Overview of computer system, Over View of Operating Systems, operating systems functions protection and security distributed systems special purpose systems operating systems structures, Operating System Services and systems calls, Virtual Machines, Operating System Design and Implementation, operating systems generation. **8hrs**

Module 2

Process Management – Process concepts, threads, scheduling-criteria algorithms, their evaluation, thread scheduling. Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors.

9hrs

Module 3

Principles of deadlock – system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock,

Memory Management : Swapping, contiguous memory allocation, paging, structure of the page table , segmentation, virtual memory, demand paging, page-Replacement, algorithms, case studies UNIX

10hrs

Module 4

I/O systems, Hardware, application interface, kernel I/O subsystem, Transforming IO requests, Hardware operation, STREAMS, performance.

File system Interface- the concept of a file, Access Methods, Directory structure, File system mounting, and file sharing, protection.

File System implementation- File system structure, file system implementation, directory implementation, directory implementation, allocation methods, free-space management, efficiency and performance.

9hrs

Module 5

Protection: Protection,GoalsofProtection,PrinciplesofProtection,Domainofprotectio AccessMatrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability- Based systems, Language–Based Protection,

Security- The Security problem, program threats, system and network threats cryptography as a security tool, user authentication, implementing security defenses, firewalling to protect systems and networks, computer –security classifications.

Introduction to Mass-storage structure: NAS and SAN. **9 hrs**

Text Books

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Operating systems- A Concept based Approach-D.M.Dhamdhere, 2nd Edition, TMH.

Reference Books

1. Operating Systems' – Internal and Design Principles Stallings, Fifth Edition–2005, Pearson education/PHI
2. Operating System A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI.

SEM/YEAR : V SEM
COURSE CODE : 16CS304
TITLE OF THE COURSE : SOFTWARE ENGINEERING
L: T/A:P: C : 2 : 0 : 2 : 3

Course Objectives
This course is introduced to give the students necessary knowledge, understanding and Design aspects in Software Engineering

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

1. Understand software development life cycle models, process models, and various design engineering techniques
2. Understand the importance of testing and us different types of testing techniques.

Module 1
Introduction to Software Engineering: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties, The evolving role of software, Changing Nature of Software, Software myths.
A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Organizations, people and computer systems; Legacy systems. Software Cost Estimation: Productivity; Estimation techniques
8hrs

Module 2
Process models: A simple safety- critical system; System dependability; Availability and reliability, the waterfall model, Incremental process models, Evolutionary process models, The Unified process. Comparison of different models with case studies.
9hrs

Module 3
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods. **10hrs**

Module 4
Testing Strategies: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. A strategic approach to software testing, System testing, the art of Debugging; Component testing; Test case design; Test automation - Selenium, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing.
10hrs

Module 5

Agile Tech, SCC, Case Study using Rational Suite

8hrs

Text Books

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition.

Reference Books

1. SoftwareEngineering-K.K.Agarwal&YogeshSingh,NewAgeInternationalPublishers
2. SoftwareEngineering,anEngineeringapproach-JamesF.Peters,WitoldPedrycz,JohnWiely.
3. SystemsAnalysisandDesign-ShelyCashmanRosenblatt,ThomsonPublications.
4. SoftwareEngineeringprinciplesandpractice-WamanSJawadekar,TheMcGraw-HillCompanies.

SEM/YEAR : V SEM
COURSE CODE : 16CS305
TITLE OF THE COURSE : OBJECT ORIENTED PROGRAMMING
L: T/A:P: C : 3 : 0 : 2 : 4

Course Objectives
To learn the basic principles of object-oriented programming paradigm using C++

Course outcomes
Students will be able to:
1. Identify classes with attributes and functions for given problem
2. Analyze the relationship between the classes link them using appropriate concepts
3. Design and implement abstract data types.
4. Devise generic classes capable of manipulating primitive and user defined data types.

Module 1
Programming Paradigms - Introduction to OOP – Overview of C++ - Classes – Structures – Union – Friend Functions – Friend Classes – Inline functions – Constructors – Destructors –Dynamic Initialization of Objects - Static Members – Passing objects to functions – Function returning objects-Arrays of Objects, Object as Function Arguments

8hrs

Module 2
Arrays – Pointers – this pointer – References – Dynamic memory Allocation – functions Overloading – Default arguments – Overloading Constructors – Pointers to Functions – Operator Overloading - Type Conversion.

9hrs

Module 3
Inheritance – Types - Derived Class Constructors- Issues in Inheritance – Virtual base Class – Polymorphism – Virtual functions – Pure virtual functions

10hrs

Module 4
Class templates and generic classes – Function templates and generic functions – Overloading function templates – power of templates – Exception Handling – Derived class Exception – over handling generic functions – Exception handling Functions

9hrs

Module 5
Streams – Formatted I/O with IOS class functions and manipulators –File I/O – Name spaces –Array based I/O – Error handling during file operations - Formatted I/O – STL: Overview-Container Classes Lists-Maps- Algorithms Using Functions and Objects-String Class - Sequence Containers, Iterators-Specialized Iterators - Associative Containers. Storing User- Defined Objects - Function Objects

9 hrs

Text Books

1. Stephen Prata,"C++ Primer Plus", 6th Edition ,Addison-Wesley Professional, 2011
2. BjarneStroustrup, "Programming: Principles and Practice Using C++,1st Edition, Addison-Wesley Professional, 2008

Reference Books

1. Andrew Koenig and Barbara E. Moo, "Accelerated C++: Practical Programming by Example", 1st Edition, Addison-Wesley Professional, 2000
2. Bruce Eckel ,"Thinking in C++: Introduction to Standard C++: Volume One" 2nd Edition,PrenticeHall, 2000
3. Andrei Alexandrescu , "Modern C++ Design: Generic Programming and Design PatternsApplied" , 1st Edition, Addison-Wesley Professional, 2001

SEM/YEAR : V SEM
COURSE CODE : 16CS321
TITLE OF THE COURSE : SIGNALS AND SYSTEMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

This course is introduced to give necessary prerequisites to students so that they understand signals and systems so that they use them later in DSP, Image Processing, Speech processing and uch areas.

Course outcomes

At the end of the course students will be able to

i) Represent signals and various aspects of signals mathematically
ii) Define and analyze linear time invariant systems, continuous and discrete signals
iii) Define the Z-transform and understand it's properties
iv) Understand and Analyze sampling of continuous time signal

Module 1

Continuous-Time and Discrete-Time Signals, Mathematical Representation-Signal energy power-classification of CT and DT signals-CT and DT systems-classification-Classification of the signals-Periodic signals-Transformation of the independent variable. **9hrs**

Module 2

Linear Time Invariant Systems: Discrete LTI-Convolution sum-Representation of Discrete time signals-Continuous Time Invariant signal-convolution integral –Representation of Continuous time signals-Properties of LTI-Singularity functions. **9 hrs**

Module 3

Analysis of Continuous signals & Discrete Signals: Fourier Representation of the continuous time periodic signals-convergence of Fourier series-Properties of continuous Fourier series-Fourier series representation of Discrete-time periodic signals-properties of discrete Fourier series-Filtering-Examples for continuous-times and discrete-time filters. **9hrs**

Module 4

The Z - Transform:Introduction, Properties of the Region Convergence for Z-Transform, The Inverse Z Transform,

Z Transform Properties: Linearity, Time Shifting, Multiplication by exponential sequence, Differentiation, Conjugation of a complex sequence, Time Reversal, Convolution of Sequences, Initial Value Theorem **9hrs**

Module 5

Sampling of Continuous Time Signal:Introduction, Periodic Sampling, Frequency Domain Representation of sampling, Reconstruction of band limited signals from samples, Discrete Time processing of Continuous time signals, Continuous Time processing of discrete time signals, Changing the sampling rate using discrete time processing **9hrs**

Text Books

1.A V Oppenheim and R W Shaffer, Discrete Time Signal Processing, Printice Hall, 2nd Edition

Reference Books

1.SanjitMitra, Digital Signal Processing- Computer Based Approach, 4th Edition , MGH

SEM/YEAR : V SEM
COURSE CODE : 16CS322
TITLE OF THE COURSE : VLSI DESIGN & VERIFICATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. Study VLSI design methodology and need of CAD tools
2. Study of algorithms used in design-automation tools.
3. Study of algorithms used in automation tools for verification and testing

Course outcomes

At the end of the course student will be able to

1. define problems of complexity, productivity, verification and optimization, and learn currently available and emerging solutions
2. define problems of complexity, productivity, verification and optimization, and learn currently available and emerging solutions
3. gain insight into CAD, and develop ability to read the professional CAD literature.

Module 1

Introduction

Introduction to Digital VLSI Design Flow, High Level Design Representation, Transformations for High Level Synthesis

8hrs

Module 2

Scheduling, Allocation and Binding: Introduction to HLS(High Level Synthesis): Scheduling, Allocation and Binding Problem, Scheduling Algorithms, Binding and Allocation Algorithms.

10hrs

Module 3

Logic Optimization and Synthesis: Two level Boolean Logic Synthesis, Heuristic Minimization of Two-Level Circuits, Finite State Machine Synthesis, and Multilevel Implementation.

10hrs

Module 4

Verification: Binary Decision Diagram: Binary Decision Diagram: Introduction and construction, Ordered Binary Decision Diagram, Operations on Ordered Binary Decision Diagram. **08 hrs**

Module 5

Temporal Logic and Introduction to Digital Testing: Introduction and Basic Operations on Temporal Logic, Syntax and Semantics of CLT, Equivalence between CTL Formulas , Introduction to Digital VLSI testing. 0**9 hrs**

Text Books

1. Giovanni De Micheli, “Synthesis and Optimization of Digital Circuits”, Tata McGraw-Hill, 1st edition, 2003.

2. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, “High-Level Synthesis: Introduction to Chip and System Design, Springer”, 1st edition, 1992.
3. Sabih H. Gerez, “Algorithms for VLSI Design Automation”,1st edition,1998

Reference Books

1. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.
2. M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems, Cambridge University Press, 2nd Edition, 2004.
3. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000

SEM/YEAR : V SEM
COURSE CODE : 16CS323
TITLE OF THE COURSE : DATA COMMUNICATIONS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

This course give the students who want to get specialized in computer networks all necessary back ground on Physical layer, Transmission media, switching techniques, and Analog and digital communication.

Course outcomes

At the end of the course the students will

i) understand transmission of data in the analog and digital form, data representation, categories of networks and protocols
ii) understand the transmission media and signal transmission, transmission of digital transmission and derive the data rate limits.
iii) Understand and analyze switching systems, different types of switching systems
iv) Analyze and design different blocks in Analog and Digital Communication Systems, and understand the fundamental of Modems, Spread Spectrum Wireless Systems and Cellular Communication Systems.

Module 1

Data Transmission: Concepts and Terminology- Analog and Digital Data Transmission-Transmission Impairments-Channel Capacity-Components- Data Representation- Data Flow. Network Criteria-Physical Structures - Network Models - Categories of Networks-Interconnection of Networks. Protocols-standards-Internet-Internet standards.

8hrs

Module 2

Transmission Media and Signal Transmission: Guided Transmission Media- Wireless Transmission-Wireless Propagation-Line-of-Sight-Transmission-Data and Signals-Analog and Digital Signals-Periodic and non-periodic signals. Digital signals-transmission. Signal Transmission overheads-Data rate limits-Performance parameters.

9hrs

Module 3

Switching Systems: Telecommunications Transmission: Basic Switching System, Simple Tele-phone Communication, evolution of switching systems -Stronger switching systems Switching Used in telecommunications cross bar switching, Electronic Switching – Space Division Switching, Time Division Switching –Time Division space switching, Time Division Time Switching, Time multiplexed space switching, Time multiplexed Time Switching, Combination Switching Control of Switching Systems: Call processing functions, common control, stored program control (For all type of switching systems)

10hrs

Module 4

Analog and Digital Communication: Basic blocks in a communication system- transmitter, channel and receiver- baseband and passband signals and their representations; concept of modulation and demodulation. Continuous wave (CW) modulation: AM, DSB, DSBSC,

SSBSC, VSB Angle modulation –PM, FM, narrow and wideband FM. Pulse Modulation: sampling process; PAM; PWM, PPM ; PCM; line coding; DPCM, DM,. Geometric representation of signal waveforms: Gram-Schmidt procedure for baseband and bandpass signal representation, constellations. Baseband and Bandpass transmission through AWGN channel: Baseband and Bandpass modulation schemes- MPAM, QAM, MPSK and MFSK. **9hrs**

Module 5

Communication Systems: Fundamentals of Modems-Spread spectrum- Wireless system: Frequency bands for Radio and TV broadcasting, propagation characteristics, point-to-point two-way communication system in HF, VHF and UHF band, transmitter and receiver for Radio and TV; Cellular communication systems-basic concepts; Microwave and line of sight communication.

9hrs

Text Books

1. W. Stallings, Data and Computer Communications, 8th Ed, Pearson India, 2007.
2. B. Forouzan, Data Communications and Networking, 4th Ed, Tata Mcgraw Hill, 2006.

Reference Books

1. Viswanathan T, "Telecommunication switching systems and networks" 17th Indian reprint, PHI, India, (2003).
2. J. G. Proakis and M. Salehi, Communication system engineering, 2/e, Pearson Education Asia, 2002.
3. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 5/e, John Wiley & Sons, 2001.
4. Flood J E, "Telecommunications switching, traffic and networks" first Indian reprint, Pearsoneducation Asia, (2001)

SEM/YEAR : V SEM
COURSE CODE : 16CS331
TITLE OF THE COURSE : RANDOMIZED & APPROXIMATE ALGORITHMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

i. To introduce the concept of randomized algorithms
ii. To apply the concepts of probabilistic analysis of algorithms

Course outcomes

i. Ability to apply basics of probability theory in the analysis of algorithms
ii. Ability to comprehend randomized algorithms and its advantages to traditional algorithm
iii. Ability to design and implement randomized techniques in solving real world problems

Module 1

Elements of probability theory, Verification of polynomial identities, matrix multiplication. Las Vegas and Monte Carlo algorithms, Random Variables and Expectations. **9hrs**

Module 2

Jensen's Inequality, Bernoulli and Binomial RV, Conditional Expectation, Geometric distribution, Coupon collector's problem. **9hrs**

Module 3

Game Tree evaluation, The Minimax Principle, Randomness and Non Uniformity, Markov's Inequality, Variance and Moments of a RV, Chebyshev's inequality. **9hrs**

Module 4

Randomized Quick Sort, Coupon Collector's problem and Randomized Median Finding. **9hrs**

Module 5

Sum of Poisson Trials, Coin flips, Set balancing, Packet Routing in Sparse Networks, Bucket Sort, Hashing, Hamiltonian Cycles in Random Graphs, Finding a large cut, Maximum satisfiability, Graphs with large girth. **9hrs**

Text Books

1. M. Mitzenmacher and E. Upfal, "Probability and computing: Randomized algorithms and Probabilistic analysis", Cambridge, 2005
2. D. Dubhashi and A. Panconesi, "Concentration of measure for the analysis of randomized algorithms", Cambridge, 2009.
3. R. Motwani and P. Raghavan, "Randomized Algorithms", Cambridge Press, 1995.

Reference Books

1. J. Hromkovic, "Design and analysis of randomized algorithms", Springer Verlag, 2005.
2. K. Mulmuley, "Computational Geometry, an introduction through randomized algorithms", Prentice Hall, 1994.

SEM/YEAR : V SEM
COURSE CODE : 16CS332
TITLE OF THE COURSE : NUMERICAL COMPUTING
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. Develop the basic understanding of numerical algorithms
2. Develop skills to implement algorithms to solve mathematical problems on the computer

Course outcomes

At the end of the course student will be able

- solve an algebraic or transcendental equation using an appropriate numerical method
- approximate a function using an appropriate numerical method
- solve a differential equation using an appropriate numerical method
- evaluate a derivative at a value using an appropriate numerical method
- solve a linear system of equations using an appropriate numerical method

Module 1

Curve fitting and numerical solution of equations Method of Least Squares – Fitting a straight line – Fitting a parabola – Fitting an exponential curve – Fitting a curve of the form y = axb – Calculation of the sum of the squares of the residuals.- Newton-Raphson method – Gauss Elimination method – Gauss Jacobi method – Gauss Seidel method.

12 Hrs

Module 2

Finite differences and interpolation First and Higher order differences – Forward differences and backward differences and Central Differences – Differences of a polynomial – Properties of operators – Factorial polynomials – Shifting operator E – Relations between the operators. Interpolation – Newton-Gregory Forward and Backward Interpolation formulae - Divided differences – Newton's Divided difference formula – Lagrange's Interpolation formula – Inverse interpolation.

12 Hrs

Module 3

Numerical Differentiation and Integration: Newton's forward and backward differences formulae to compute first and higher order derivatives – The Trapezoidal rule – Simpson's one third rule and three eighth rule.

12 Hrs

Module 4

Numerical solutions of ordinary differential equations solution by Taylor's series – Euler's method – Improved and modified Euler method – Runge Kutta methods of fourth order (No proof) – Milne's Method - Adam's Bashforth method.

12 Hrs

Module 5

Numerical solutions of partial differential equations classification of Partial differential equations of the second order - Difference quotients – Laplace's equation and its solution

by Liebmann's process – Solution of Poisson's equation – Solutions of Parabolic and Hyperbolic equations.

12 Hrs

Text Books

1. M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 4th edition,2003.
2. Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 2005.

Reference Books

1. B.S. Grewal, Numerical Methods in engineering and science, Khanna Publishers, 42nd edition,2012.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, 4th edition,2005.
3. E. Balagurusamy, Computer Oriented Statistical and Numerical Methods – Tata McGraw Hill., 2000.
4. M.K.Jain, Numerical Solution of Differential Equations, 2nd edition (Reprint),2002. 5. P.Kandasamyetal., Numerical Methods, S.Chand& Co., New Delhi, 2003.

SEMESTER/YEAR : 5TH SEM
COURSE CODE : 16CS334
TITLE OF THE COURSE :CLOUD COMPUTING
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:
1. Understand various basic concepts related to cloud computing technologies
2. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
3. Understand the applications of Cloud Computing
4. Get exposure to Microsoft Azure, Google Cloud Platform, Amazon Web Services

COURSE OUTCOMES:
1. Define Cloud computing and characteristics
2. Describe benefits and drawbacks of Cloud computing
3. Explain various types of virtualization and capacity planning metrics
4. Discuss various types of cloud services
5. Discuss Cloud Security and various challenges

MODULE 1 - INTRODUCTION 8Hrs
Basics of cloud computing, Cloud Computing Models (Paas, Saas, Iaas), Understanding Public Clouds, Private Clouds, Community Cloud and Hybrid Clouds, Cloud Computing Benefits and risks, Cloud Computing Challenges, Cloud Computing Architecture and Virtualization. Introduction to Google App Engine.

MODULE 2- CLOUD Technologies 8Hrs
Overview of Cloud Computing techniques (Grid Computing, Cloud Computing, Utility Computing, Fog Computing, Edge computing). Introduction to Cloud security.

MODULE 3 – CLOUD VIRTUALIZATION TECHNOLOGY 8Hrs
Introduction, why virtualization, virtualization benefits, application virtualization, virtual machine, desktop virtualization, server virtualization, storage virtualization, Network virtualization implementing virtualization, Hypervisor.

MODULE 4 – ACCESSING THE CLOUD AND MIGRATING TO THE CLOUD 8Hrs
Accessing the Cloud: Cloud Web access technologies (SOAP ,REST),Platforms, web applications framework, web hosting service, web APIs, web browsers.
Migrating to the Cloud: Broad approaches to migrating into the cloud, the seven-step model of migration into a cloud.

MODULE 5- CLOUD APPLICATIONS 8Hrs
Cloud Platforms in Industry: Amazon Web Services, Google Cloud Platform, Microsoft Azure. Cloud Applications: Scientific Applications (Healthcare: ECG Analysis in the Cloud) and Business and Consumer Applications (Social Networking, Smart Grids)

Text Books
Module 1 & 5:
▪ Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education
Module 2:
▪ Cloud Computing, Dr. Kumar Saurabh, Wiley Publications, 2012

▪ Guide to Cloud Computing, Richard hill, Springer Publications, 2013

Module 3:

▪ Cloud Computing A Practical Approach, Anthony T Velte et.al, MC Graw Hill publications, 2014
▪ Cloud Computing Principles and Paradigms, Rajkumar Buyya et.al, Wiley Publications, 2015

Module 4:

▪ Cloud Computing Technologies and Strategies of the Ubiquitous data center, Brain J.S et.al, CRC Press, 2014

SEM/YEAR : VI SEM
COURSE CODE : 16CS306
TITLE OF THE COURSE : COMPUTER GRAPHICS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives
The student should be made to:

- Gain knowledge about graphics hardware devices and software used.
- Understand the two dimensional graphics and their transformations.
- Understand the three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understand clipping techniques.

Course outcomes
At the end of the course, the student should be able to:

- To Design two dimensional graphics, Apply two dimensional transformations.
- To Design three dimensional graphics and Apply three dimensional transformations.
- To Apply Illumination and color models and Apply clipping techniques to graphics.
- Designing the animation sequences.

Module 1
Overview of computer graphics: representing pictures, preparing, presenting& interacting with pictures for presentations; Visualization& image processing; RGB color model. Geometry and Generation of Simple Primitives: Line generation algorithms, Circle generation algorithms, Character generation and Ellipse generation. Graphical Devices: Input Devices, Display devices Scan Converting Polygons: Raster displays and Vector displays. **9Hrs**

Module 2
Algorithms to scan convert polygons. Two Dimensional Transformations: Translation, Scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Rotation, Reflection Shear. **9Hrs**

Module 3
Lighting and Shading - light sources, normal computation, reflection models, flat and smooth shading , Introduction to Textures and Mapping - Rendering Techniques - slicing, volume rendering, iso-surface extraction, ray casting, multi resolution representations for large data rendering. Data Structures for efficient implementation.

10 Hrs

Module 4
Hidden Surfaces and Lines: Z –Buffer algorithm, Scan Line algorithm, Painter's algorithm, Sub –division algorithm Light, Colour and Shading: Illumination, Shadows, Transparency and Colour, Shading Algorithm, Ray tracing, Halftones. Properties oflight - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model -YIQ colour model.

7 Hrs

Module 5

Animation: Design of Animation Sequences, Animation Functions, Raster Animations and Animation Languages, Key-Frame Systems, Motion Specification. Curve and Surfaces: Parametric Functions and Properties of Curves. Advanced animation techniques.

10 Hrs

Text Books

1. Donald Hearn & M Pauline Baker, "Computer Graphics", Pearson Education.
2. Newman, W M and Sproull R F, "Principles of Interactive Computer Graphics", McGraw Hill, Tokyo.

Reference Books

1. Alan Watt, "3D Computer Graphics", Addison Wesley.
2. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles, Pearson Education.
3. F S Hill, "Computer Graphics Using Open GL", Pearson Education.

SEM/YEAR : VI SEM
COURSE CODE : 16CS307
TITLE OF THE COURSE : COMPILER DESIGN AND SYSTEMS SOFTWARE
L: T/A:P: C : 3 : 2 : 0 : 4

Course Objectives
The student should be made to:

- To understand the relationship between system software and machine architecture.
- To know the design and implementation of assemblers, linkers and loaders.
- Learn the design principles of a Compiler and various parsing techniques and different levels of translation
- Learn how to optimize and effectively generate machine codes

Course outcomes
At the end of the course, the student should be able to:

- Design and implement assemblers, linkers and loaders.
- Design and implement a prototype compiler.
- Apply the various optimization techniques.
- Use the different compiler construction tools.

Module 1
ASSEMBLERS: Basic assembler functions - A simple assembler – Assembler algorithm and data structures - Machine dependent assembler features - Instruction formats and addressing modes – Program relocation - Machine independent assembler features - Literals –Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Implementation example - MASM assembler.

7Hrs

Module 2
LOADERS AND LINKERS: Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader -Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features – Automatic Library Search – Loader Options - Loader design options - Linkage Editors – Dynamic Linking – Bootstrap Loaders - Implementation example - MSDOS linker. **8Hrs**

Module 3
Lexical and Syntax Analysis
A language for specifying lexical analyzers-Design of a lexical analyzer generator. Need and role of Parser-Context free grammar-Top down parsing–Bottom up parsing-Operator precedence parsing-LR and LALR Parsers,. Parser Generator Error Handling and Recovery in Syntax Analyzer.

11Hrs

Module 4
Syntax-Directed Translation: Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions-Type

Systems-Specification of a simple type checker- Equivalence of Type Expressions-Type Conversions. Semantic Analysis,. Intermediate code Generation

11 Hrs

Module 5

Run-time Environments(2hrs), and Introduction to Code Optimization.
A Simple Code Generator – Compiler project.

8Hrs

Text Books

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rdEdition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

Reference Books

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Second Revised Edition, Tata McGraw-Hill, 2000.
2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 2000.
3. John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan KaufmannPublishers, 2000.

SEM/YEAR : VI SEM
COURSE CODE : 16CS308
TITLE OF THE COURSE : COMPUTER NETWORKS
L: T/A:P: C : 3 : 2 : 0 : 4

Course Objectives

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.

Course outcomes

At the end of the course

- Students should be understand and explore the basics of Computer Networks and Various Protocols. He/she will be in a position to understand the World Wide Web concepts.
- Students will be in a position to administrate a network and flow of information
- Further he/she can understand easily the concepts of network security, mobile, and ad hoc networks.

Module 1

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

Physical Layer: Introduction to Guided transmission media and wireless transmission media. Transmission mode, Classification of networks. Parallel & Serial Transmissions, Analog & Digital Signals, Periodic & Aperiodic Signals, Encoding Schemes. RS-233C Protocol.

Data Link Layer - Design issues, CRC codes, Elementary Data Link Layer Protocols, stop and wait, sliding window, go-back-N protocols.

10 hrs

Module 2

Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways. LLC, WiFi, Bluetooth Protocols.

9 hrs

Module 3

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control, Classful IP addresses(A,B,C,D) ,QoS, Details of IP Packet.

9 hrs

Module 4

The Internet Transport Protocols: Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP. **9hrs**

Module 5

Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH, SNMP. Socket Programming using TCP and UDP.

Introduction to Internet of Things, Introduction to Sensors, Actuator, Transducers, Gateway, IOT Architecture, Introduction to Node MCU and Arduino. Overview of Edge,Fog and Cloud computing and application of IOT in Home Automation. **10 hrs**

Text Books

1. Behrouz A. Forouzan, Data Communications and Networking -, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

Reference Books

1. W. Tomasi, "Advanced Electronic Communication Systems", 2000
2. James Martin, "Telecommunications & the Computer", 3rd Edition, PHI. 2001
3. P. C. Gupta, "Data Communications, PHI, 2001.

Introduce following topics

1. Network Security
2. Introduction to IOT
3. Security Firewalls
4. RIP and OSPF
5. IPV6, NAT and Tunneling

SEM/YEAR : VI SEM
COURSE CODE : 16CS309
TITLE OF THE COURSE : UNIX SYSTEM PROGRAMMING
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives

- To understand the fundamental design of the unix operating system
- To become fluent with the systems calls provided in the unix environment
- To be able to design and build an application/service over the unix operating system

Course outcomes

At the end the course the students will have

i) Ability to understand and reason out the working of Unix Systems
ii) To be able to build an application/service over a Unixsystem.

Module 1

Introduction UNIX and ANSI Standards, X/Open Standards, POSIX APIs, POSIX Development Environment, API Common Characteristics, File types, Attributes, Inodes in UNIX System V, APIs to Files, UNIX Kernel support for files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

5Hrs

Module 2

UNIX File APIs General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO file APIs, Symbolic Kink File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory File, FIFO file Class, Device File Class, Symbolic Link File Class, File Listing Program.

8Hrs

Module 3

UNIX Processes The Environment of a UNIX Process, main function, Process termination, command-line arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp functions, getrlimit, setrlimit functions, UNIX Kernel Support for Processes.

11Hrs

Module 4

Process Control and Signals Process Identifiers, fork, vfork, exit, wait, waitpid, race conditions, exec functions, changing user ids, Interpreter files, systems function, Process Accounting, User Identification, Process Times, Signals : The Unix Kernel Support for Signals, Signal Mask, sigaction, the SIGCHLD signal and waitpid function, the sigsetjmp and siglongjmp functions, Kill, Alarm, Interval Timers.

11Hrs

Module 5

Daemon Processes and Inter Process Communication Daemon Processes, Daemon Characteristics, Daemon Conventions, client-servier Model. Inter Process Communication, Pipes,popen, pclose,FIFOs, Message Queues, Semaphores.

8Hrs

Text Books

1. Maurice J Bach, “The design of the UNIX Operating System”, Pearson Education/PHI, 1987.
2. Terrance Chan, “Unix System Programming Using C++”, Prentice Hall India, 1999.

Reference Books

1. W. Richard Stevens, “Advanced Programming in the UNIX Environment”, 2nd Edition, Pearson Education/PHI, 2005.
2. Marc J Rochkind, “Advanced Unix Programming”, 2nd Edition, Pearson Education, 2005.

SEM/YEAR : VI SEM
COURSE CODE : 16CS336
TITLE OF THE COURSE : DIGITAL IMAGE PROCESSING
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives

- Develop an overview of the field of image processing.
- Understand the fundamental algorithms and how to implement them.
- Prepare to read the current image processing research literature.
- Gain experience in applying image processing algorithms to real problems.

Course outcomes
At the end of the course student will be able

- Understand image formation and Analysis
- Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense.
- Learn the signal processing algorithms and techniques in image enhancement and image restoration.
- Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.

Module 1
Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

8Hrs

Module 2
Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. **9Hrs**

Module 3
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

10Hrs

Module 4
Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters , Homomorphic Filtering.

8Hrs

Module 5

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.

10Hrs

Text Books

1. Rafel C Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2003.
2. A K Jain, Digital Image Processing,

Reference Books

1. Scott.E.Umbaugh, "Computer Vision and Image Processing", Prentice Hall, 1997.
2. A. K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2004.
3. Z. Li and M.S. Drew, "Fundamentals of Multimedia", Pearson, 2004.
4. 4. S.Jayaraman, S.Esakkirajan, T. Veerakumar, "Digital Image Processing", Tata McGraw Hill, 2004.

SEM/YEAR : VI SEM
COURSE CODE : 16CS337
TITLE OF THE COURSE : COMPUTER ARCHITECTURE
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives
To understand the micro-architectural design of processors
- Learn about the various techniques used to obtain performance improvement
- Learn Power savings in current

Course outcomes
At the end of the course student will be able
- To describe the principles of computer design and classify instructions set architecture
- Describe the operations of performance such as pipelines, dynamic scheduling branch predictions, caches
- Describe the modern architecture such as RISC, Scalar, VLIW Multi core and multi CPU systems
- Describes instruction and thread level parallelism
- Develop the applications for high performance computing systems

Module 1
FUNDAMENTALS OF COMPUTER DESIGN: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

9hrs

Module 2
PIPELINING: Introduction; Pipeline hazards; Implementation of pipeline; what makes pipelining hard to implement? ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation.

9hrs

Module 3
INSTRUCTION –LEVEL PARALLELISM – 2: Exploiting ILP using multiple issues and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example. **9hrs**

Module 4
MULTIPROCESSORS AND THREAD –LEVEL PARALLELISM: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency.

9hrs

Module 5

HARDWARE AND SOFTWARE FOR VLIW AND EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

9hrs

Text Books

1. Computer Architecture, A Quantitative Approach – John L. Hennessey and David A. Patterson:, 4 th Edition, Elsevier, 2007.

Reference Books

1. Advanced Computer Architecture Parallelism, Scalability – Kai Hwang: Programmability, Tata Mc Grawhill, 2003.
2. Parallel Computer Architecture, A Hardware / Software Approach – David E. Culler, Jaswinder Pal Singh, Anoop Gupta:, Morgan Kaufman, 1999.
3. Computer Organization and Architecture: Designing for performance, W. Stallings, 4th Ed. PHI, 1996.

SEM/YEAR : VI SEM
COURSE CODE : 16CS338
TITLE OF THE COURSE : MOBILE COMPUTING AND APPS DEVELOPMENT
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives

- The student should be made to:
- Understand the basic concepts of mobile computing
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system
- Be exposed to Ad-Hoc networks
- Gain knowledge about different mobile platforms and application development

Course outcomes
Acquire technical competency and skills in developing applications using Android

Module 1
INTRODUCTION TO MOBILE COMPUTING
Characteristics and advantages of mobile communication, types of mobile applications – development approaches, overview of mobile strategy and designing mobile solutions. Mobile computing project structure, building and testing. Evolution of Modern Mobile Wireless communication system. Mobile computing vs. wireless - MAC Protocols Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

09hrs

Module 2
MOBILE PLATFORMS AND APPLICATIONS
Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone –M-Commerce – Structure – Pros & Cons – Mobile Payment System.

09hrs

Module 3
INTRODUCTION TO ANDROID
Android: Introduction, trends, platforms, Android Development Setup like, Android Studio,Eclipse, Android SDK, tools. Emulator setup. App Behaviour on the Android Runtime (ART).
Platform Architecture. Application framework and basic App Components resources.

09hrs

Module 4
MOBILE APP DEVELOPMENT USING ANDROID
Android App Use Case (Use Case Diagram (UML)) Implement user Interface - layout, values, asset XML representation, generated R.Java file, Android manifest file. Activities, Intent and UI Design - activities life-cycle. Android Components – layouts, fragments, basic views, list views, picker views, adapter views, Menu, Action Bar etc. - Managing data using SQLite database.

09hrs

Module 5

DATA PERSISTENCE AND GOOGLE APIS FOR ANDROID
Managing data using SQLite, user content provider and persisting data into database Google APIs for Android - Maps, Cloud Messaging, Authentication, Storage, Hosting and Google Play services.

09hrs

TEXT BOOKS

1. Learning Android by Marko Gargenta O'reilly Publications
2. Professional Android™ Application Development by Reto Meier ,Wrox Publication
3. Head First Android Development by Jonathan Simon O'reilly Publications

REFERENCES

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

SEM/YEAR : VI SEM
COURSE CODE : 16CS343
TITLE OF THE COURSE : COMPUTATIONAL GEOMETRY
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives
The student should be made to:

- To understand problems in Computational Geometry and solve them using Randomised Algorithms.

Course outcomes
At the end of the course the student will be able to:

- Ability to understand the theory behind computational geometry
- Ability to design and implement randomized techniques in solving real world problems specifically for Computational Geometry

Module 1
Review of Randomized Quick Sort, Introduction to Computational Geometry: Range queries, Arrangements, Trapezoidal decompositions, Convex Polytopes, Voronoi Diagrams, Early deterministic algorithms: planar convex hulls, planar Voronoi diagrams.

9Hrs

Module 2
Deterministic vs. Randomized algorithms, Incremental algorithms: Trapezoidal decompositions, Convex polytopes, Voronoi diagrams.

9Hrs

Module 3
Dynamic algorithms: Trapezoidal decompositions, Voronoi diagrams**,** Dynamic Shuffling**,** Random Sampling: Top down sampling, Bottom up sampling, Dynamic sampling, more dynamic algorithms.

9Hrs

Module 4
Randomized approximation schemes, The DNF counting problem, Approximating the Permanent, Volume Estimation.

9Hrs

Module 5
Delaunay Triangulations Triangulations of Planar Point Sets, The Delaunay Triangulation, Properties of the Delaunay Triangulation, A randomized incremental algorithm for computing the Delaunay Triangulation , Interval Trees, Priority Search Trees, Segment Trees, Interval Trees, Priority Search Trees, Segment Trees

9Hrs

Text Books

1. K. Mulmuley, “Computational Geometry, an introduction through randomized algorithms”, Printice Hall, 1994.

Reference Books

1. R. Motwani and P. Raghavan, “Randomized Algorithms”, Cambridge Press, 1995
2. J. Hromkovic, “Design and analysis of randomized algorithms”, Springer Verlag, 2005.
3. M. Mitzenmacher and E. Upfal, “Probability and computing: Randomized algorithms and Probabilistic analysis”, Cambridge, 2005

SEM/YEAR : VI SEM
COURSE CODE : 16CS344
TITLE OF THE COURSE : SOFT COMPUTING
L: T/A:P: C : 3 : 0: 0 : 3

Course Objectives
The student should be made to:

- Learn the various soft computing frame works.
- Be familiar with design of various neural networks.
- Learn genetic programming.
- Be exposed to hybrid systems.

Course outcomes
At the end of the course the student will be able to:

- Analyze the selected topic, organize the content and communicate to audience in an effective manner.
- Practice the learning by self-study.

Module 1
Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing. Learning problems: Designing a Learning System, Issues in Machine Learning: The Concept Learning Task- General-to-specific ordering of hypotheses. Overview of Neural Networks: Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.

9Hrs

Module 2
NEURAL NETWORKS: Issues in Decision tree learning; - Artificial Neural Networks (ANN), ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm.

9Hrs

Module 3
NEURAL NETWORKS(continued..): Back propagation Algorithm- Convergence, Estimating Hypotheses Accuracy, Basics of sampling Theory. Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory.

9Hrs

Module 4
GENETIC ALGORITHM: Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm. Genetic Programming– multilevel optimization – real life problem- advances in GA for solving optimization problems.

9Hrs

Module 5

SOFT COMPUTING TECHNIQUES & APPLICATIONS: Learning first order rules-sequential covering algorithms. A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

9Hrs

Text Books

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

Reference Books

1. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
2. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
3. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.

SEM/YEAR : VI SEM
COURSE CODE : 16CS345
TITLE OF THE COURSE : DATA SCIENCE
L: T/A:P: C : 2 : 0: 2 : 3
Course Objectives:

- To use statistical and computational techniques to Discover, Analyze, Visualize and Present Data.

Course outcomes: On completion of the course, the students should be able to

- Apply statistical techniques to preprocess data and perform exploratory data analysis
- Understand and be able to use appropriate statistical and machine learning modeling techniques for data analysis and modeling
- Use data visualization techniques for exploratory data analysis and communicating the results
- Evaluate and improve performance of Models
- Use appropriate python libraries for data preprocessing, analysis, modeling and visualization

Module 1: Overview of the Data Science process. Statistical thinking in the age of big data – Population and Samples, Measures of central tendencies, variability, hypothesis testing, correlation, statistical models and inference.
Basic Python constructs and data structures. Jupyter Notebooks **9hrs**

Module 2: Data Preprocessing: Data Cleaning - Missing values, Noisy data, Data cleaning as process, Data Reduction: Principal Components Analysis, Data Transformation: Strategies Overview, Data Transformation by normalization, Discretization by binning. Introduction to Pandas for Data Wrangling. **10hrs**

Module 3: Exploratory Data Analysis and Data Visualization with Python: Introduction, Scatter Plots, Histogram, Box Plots, Violin Plot, Heat Map, waffle charts, word clouds, attractive regression plots. Visualizing geospatial data using Folium. choropleth maps.
Case Study: Let my dataset change your mindset by Dr Hans Gosling. **7hrs**

Module 4: Basic Machine Learning Algorithms – Linear Regression, k-nearest neighbors, k-means, decision trees, naïve Bayes. **10hrs**

Module 5: Model Evaluation: Confusion Matrix, Evaluation Measures. Comparing Classifiers based on cost-benefit and ROC curves. Improving Classifier accuracy: Ensemble Methods, Bagging and Boosting. **9hrs**
Capstone Project

Text Books

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'reilly Publications, 2014
2. Jiawei Han, Micheline Kember and Jian Pei, Data Mining Concepts and Techniques, 3rd edition, Elsevier, 2012
3. Jake VanderPlas, Python Data Science Handbook – Essential tools for working with data, O'Reilly, 2016

Reference Books

1. Data Science and Big Data Analytics, Wiley Publications, 2015
2. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008

SEMESTER/YEAR : VI SEM / III YEAR
COURSE CODE : 16CS373
TITLE OF THE COURSE : COMPILER DESIGN & SYSTEMS SOFTWARE LAB
L: T/A: P: C : 0: 0 : 4 : 2

COURSE OBJECTIVES: The student should be made to:

1. Experiment on the basic techniques of compiler construction and tools that can used to perform syntax directed translation of a high-level programming language into an executable code
2. Know the implementation of assemblers, loaders and various parsing techniques.
3. Learn how to optimize and effectively generate machine codes

COURSE OUTCOMES:
At the end of the course, the student should be able to:

1. Understand the working of lex and yacc compiler for debugging of programs.
2. Understand and define the role of lexical analyzer, absolute loader and symbol table.
3. Learn & use the new tools and technologies used for designing a compiler.
4. Develop program for solving parser problems.
5. Learn how to write programs that execute faster.

LIST OF EXPERIMENTS:

1. Implementation of symbol table
2. Implementation of absolute loader
3. Implementation of token separation using lex tool
4. Implementation of calculator using yacc tool
5. Construction of operator precedence parse table
6. Construction of lr-parsing table
7. Generation of code for a given intermediate code
8. Implementation of simple code optimization techniques
9. Mini project

SEMESTER/YEAR : VI SEM / III YEAR
COURSE CODE : 16CS374
TITLE OF THE COURSE : COMPUTER NETWORKS & UNIX SYSTEM PROGRAMMING LAB
L: T/A: P: C : 0: 0 : 4 : 2

COURSE OBJECTIVES:

1) To understand the basics of Unix internals and systems programming.
2) To get familiar with POSIX standards, interfaces and device driver functionality.
3) To implement inter-process communication mechanisms among the processes.
4) To simulate various network scenarios and protocols using NS2 and Cisco packet router.

COURSE OUTCOMES:

At the end of this practical course, students should be able

1) To design and implement race condition and system functions on Unix platform
2) To design and implement connection oriented and connectionless socket interfaces
3) To experience the Unix environment and device driver functionality.
4) To simulate various networking topologies and protocols using NS2 and Cisco packet router

LIST OF EXPERIMENTS

1. Design and implement a C program to copy a file using command line arguments passed to a user defined function.
2. Write a C/C++ POSIX compliant program to check the following limits on the system: (i) Maximum number of characters allowed in a path name (ii) Maximum number of child processes that may be created (iii) Maximum number of characters allowed in a file name (iv) Number of clock ticks per second (v) Maximum number of files that can be opened simultaneously by a process.
3. Design and implement a C program that demonstrates interprocess communication between two processes using mkfifo, open, read, write and close APIs.
4. a) Write a C program that prints the contents of its environment list.
   b) Design and implement a C program to implement the mv command in Unix using link and unlink APIs.
5. Design and implement a C program to illustrate the race condition using parent and child processes.
6. Design and implement a C program to implement the system function.
7. Design and implement C programs for both server and client to demonstrate inter-process communication using connection oriented (TCP) sockets. Client requests a file from server. The file received from server should be displayed on the client's terminal. Otherwise appropriate error message should be printed.

8. Design and implement C programs for both server and client to demonstrate inter-process communication using connectionless (UDP) sockets. Client requests a file from server. The file received from server should be displayed on the client's terminal. Otherwise appropriate error message should be printed.
9. Design and implement a simple Linux driver.
10. Simulate three nodes point to point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
11. Simulate transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
12. Study of basic network command and Network configuration commands. Configure a network topology using packet tracer software. Configure Cisco router and ping it.

    All commands related to Network configuration which includes how to switch to privilege mode and normal mode and how to configure router interface and how to save this Configuration to flash memory or permanent memory. This commands includes

    a) Configuring the Router commands
    b) General Commands to configure network
    c) Privileged Mode commands of a router
    d) Router Processes & Statistics
    e) IP Commands
    f) Implementation of Authentication of client on server
    g) Uses of ARP and DHCP Protocol

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS401
TITLE OF THE COURSE : MACHINE LEARNING
L: T/A: P: C : 3 : 0: 0 : 3

COURSE OBJECTIVES:

1. To know about basic concepts of Machine Learning
2. To obtain a thorough knowledge of various Machine learning techniques and their representation schemes
3. To study about Evaluating Hypothesis
4. To have an overview of various Machine Learning applications

COURSE OUTCOMES: At the end of the course students will be able to:

1. Technical knowhow of Machine Learning applications, heuristics, Knowledge representation Systems,
2. To Acquire knowledge of various Machine Learning techniques

MODULE 1 - Introduction: Basic definitions **Statistical Learning:** Estimate F, Supervised Versus Unsupervised Learning, Regression Versus Classification Problems
Accessing Model Accuracy: Quality of fit, Bias –Variance trade-off, Classification Setting.

MODULE 2 - Linear Regression: Simple Linear Regression, Multiple Linear Regression
Classification: Logistic Regression, Linear Discriminant Analysis: Baye's Theorem for classification, Quadratic Discriminant Analysis, KNN Method, Comparison of classification methods .

MODULE 3 - Resampling Methods: Cross Validation: Leave-One-Out Cross-Validation, k-fold cross validation, Bootstrap.
Tree based methods: The Basics of Decision Tree: Regression tree method, Classification trees, Trees Versus Linear Models, Advantages and Disadvantages of Trees, Bagging ,Random forest, boosting.

MODULE 4 - Support Vector Machines: Maximal Margin classifier, Support Vector classifier, Classification with non-linear decision boundaries, SVM with more than two classes.
Unsupervised Learning: Challenges, Principal component Analysis Clustering –K-Means clustering, Hierarchical clustering.

MODULE 5 - Deep Learning: Artificial Neural Networks: Universal Approximation Theorem, Feedforward Neural networks. Gradient descent and the Backpropagation Algorithm.
Convolutional Neural Networks : Architectures, convolution / pooling layers
Recurrent Neural Networks : LSTM, GRU, Encoder Decoder architectures A Case Study -Computer Vision

Text Books

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R, Springer Texts in Statistics.

Reference Books

1. 1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
2. Thomas M. Mitchell, Machine Learning, McGraw-Hill, Inc. New York, ISBN:0070428077 9780070428072
3. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS402
TITLE OF THE COURSE : EMBEDDED SYSTEMS
L: T/A: P: C : 2 : 0 : 2 : 3

Course Objectives:

1. To get ability to identify, formulate and design solutions in the areas of embedded computing system
2. To understand the program design and analysis

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

1. Explain the purpose of embedded systems and compare microprocessors with microcontrollers
2. Design and analysis of a processor for specific Purpose
3. ToDesignReal Time Operating System (RTOS) Based

Module I **6Hrs**

Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design Example: Model Train Controller.

Module II **9Hrs**

Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

Module III **10Hrs**

Bus-Based Computer Systems: CPU Bus, Memory Devices, I/O devices, examples of Arduino board and Raspberry pi. Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis Design Example: Alarm Clock,

Module IV

7Hrs

Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

Module V **12Hrs**

Real Time Operating System (RTOS) Based Design : Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization, Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine.

Text Book

1. Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems

Design, 2nd Edition, Elsevier, 2008.
2. J.W. Valvano, Embedded Microcomputer System: Real Time Interfacing, Brooks/Cole, 2000.

References:

1. David Simon, An Embedded Software Primer, Addison Wesley, 2000.
2. H. Kopetz, Real-time Systems, Kluwer, 1997
3. R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.
4. Gomaa, Software Design Methods for Concurrent and Real-time Systems, Addison-Wesley, 1993.
5. Shibu K V:Introduction to Embedded Systems, Tata McGraw Hill, 2009(Chapters10, 13)

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS403
TITLE OF THE COURSE : OPTIMIZATION TECHNIQUES
L: T/A: P: C : 3 : 0: 0 : 3

COURSE OBJECTIVES:

1) To introduce Optimization techniques and their applications
2) To formulate Optimization problems and selecting techniques to solve them
3) To study and understand the Un-constrained and Constrained techniques

COURSE OUTCOMES:

Students will be able to

1) Formulate the optimization problems and use suitable algorithm to solve Linear and Non-Linear Programming
2) Formulate Un-constrained and constrained optimization models and solve them using appropriate techniques

MODULE 1 - Introduction to Optimization 7Hrs

Introduction: Engineering application of optimization, statement of an optimization problem with example for minimum weight and optimum cost consideration, classification of optimization problems and techniques, Single variable optimization, multi-variable optimization with equality and inequality constraints and without constraints.

MODULE 2 - Formulation of optimization problems 7Hrs

Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions. Necessary and sufficient conditions for optimum of unconstrained functions- Numerical methods for unconstrained functions - One-dimensional search - Gradient-free search with fixed step size.

MODULE 3 - Linear & Non-Linear Programming 12Hrs

Linear: Introduction, standard form of the problem, Geometry, basic terminology Techniques of linear programming: Simplex method, Revised simplex method: Duality in linear programming, decomposition principle, post-optimality analysis.

Non-Linear: Introduction, elimination methods: various search methods- Fibonacci method and golden section method Interpolation Method-Quadratic and cubic interpolation methods, Direct root method.

MODULE 4 - Unconstrained Optimization Introduction 10Hrs

Techniques: Introduction; Standard form of the problem and basic terminology; Direct search method- Simplex method, Random search method, Univariate and pattern search method Indirect search method-Steepest Descent (Cauchy)method, Conjugate gradient method, Newtons method, Application to engineering problems.

MODULE 5- Constrained Optimization Introduction 10Hrs

Standard form of the problem and basic terminology; Direct method: Sequential Linear Programming; Generalized Reduced gradient method, Methods of feasible direction

Indirect method: Penalty function method Interiorand exterior penalty function method, Convex programming problem, Check for convergence Application to engineering problems.

Case Study: Genetic Algorithm based Optimization, Neural network based optimization.

Text Books

1. S.S.Rao, Engineering Optimisation- Theory and Practice, New Age International. 4th Edition.
2. G. Zapfel, R. Barune and M. Bogl, Metaheuristic search concepts: A tutorial withapplications to production and logistics, Springer.2010

Reference Books

1. Gass S. I., Introduction to Linear Programming, Tata McGraw Hill.
2. Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman.
3. Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley.
4. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India.
5. Gallagher and O.C Zeinkiewicz, Optimum Structural Design Theory & Applications, John Wiley.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16HU401
TITLE OF THE COURSE : LAW FOR ENGINEERS
L: T/A:P: C : 3 :0 : 0 : 3

COURSE OBJECTIVES: The objective of the course is to acquaint the prospective Engineers with Elementary Knowledge of Law that would be of utility in their profession. The Syllabus covers the following ideas and concepts of importance that are required in the day to day work of Engineers.

1. Indian Legal System
2. To understand Contracts and their importance.
3. Property rights particularly the Intellectual Property Rights
4. The Management of Labour
5. Tax effect on various Manufacturing and Industrial activities.

COURSE OUTCOMES:

1. To understand prevailing legal and judicial aspects.
2. Contracts are the back of all business activities – documentation importance of documentation.
3. Engineering activities should lead to innovations, hence, the right and protection of Intellectual Property.
4. Deployment, utilization and Protection of Labour.
5. To understand prevailing legal and judicial aspects.

Module -1 :-Indian Legal System and Constitution: (10Hrs)

Indian Legal System, Constitutional Law, Fundamental Rights Duties, Directive Principles of State Policy, Judicial Activism, Disputes and Resolutions.

Module –2 : Contracts: (10Hrs)

Formation of Contract, offer and acceptance – Tendering, Consideration, Mode of discharge of Contract. Remedies for branch of Contracts, Damages, Specific Relief, Specific Performance, Power of Court to grant relief.

Module –3 : Property –Intellectual Property – (10Hrs)

Property -Intellectual Property, Different Forms, Patents, Product Patent, Process Patent, Registering of Patents – Infringement, Offences and Penalties, Trade Marks, Deceptive Similarity, Domain name Protection and Registration, Offenses Penalties. Information Technology Act, Cyber Space, Cyber Crime, Software Piracy. Copy Right**,** Infringement, Offences and Penalties. Designs , Registration, Offences and Penalties, WIPO ,TRIPS.

Module 4 :Taxation **(10 Hrs)**

Taxes -Direct and Indirect Taxes, Income Tax, Salaries , House Property, Business , Capital Gains, Offences and Penalties.

GST – SGST- CGST –IGST – UTGST, Incidence and Levy, Customs Duty, Ports and Ware Houses, Levy and Collection, Offences and Penalties. .

Module 5 : Labour Laws **(10 Hrs)**

The Factories Act 1948. Definitions, Health Safety and Welfare of Workers. The Employee State Insurance Act 1948, Definitions, Benefits and Adjudication of Disputes. The Provident Fund Act 1952, Eligibility, Withdrawal and Settlement. The Industrial Dispute Act 1947, Dispute Resolution Machinery, Grievance Settlement. The Trade Union Act 1926 Trade Union, Trade Disputes, Collective bargaining and settlements.

Text Books :-

1.D.D. Basu, Introduction to the Constitution of India, (Lexis Nexis Latest Edition)

2.K.K. Ghai, Constitution of India (Latest Edition)

3.Indian Legal System by Fali. S. Nariman

4.Pollock&Mulla, Indian Contract and Specific Relief Act, - Lexis Nexis – Latest Edition.

5.Anson William, Law of Contract 32nd Edition Oxford University Press.

6.Intellectual Property by GanguliPrabuddha – Intellectual Property Rights – Unleashed the Knowledge Economy (Tata Mc.Graw Hill Publishing Co., Latest Edition)

Reference Books:

1.Ryder Rodney – Intellectual Property and the Internet (Jain Book Agency - Latest Edition)

2.Mittal D.P. – Taxman's Law of Information Technology (Cyber Law) Taxman Allied Services – Latest Edition)

3.Dr.V.K. Singhania – Students Guide to Income Tax – Latest Edition.

4.P.L. Mallik – Commentaries on Customs Act.- Latest Edition. Zeeshan Mehdi – "The Guide to Understanding Goods and Services Tax.- 2017

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS471
TITLE OF THE COURSE :WEB PROGRAMMING LAB
L: T/A: P: C : 0 : 1 : 3 : 2

COURSE OBJECTIVES:

1. Students will select mini projects in teams with the help of the faculty in-charge.
2. JAVA and PYTHON will be used to implement the mini projects

COURSE OUTCOMES: At the end of the course students will be able to:

1. Know how to use effectively JAVA and PYTHON languages to implement projects to solve the real life problems

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS421
TITLE OF THE COURSE : PATTERN RECOGNITION
L: T/A:P: C : 3 :0: 0 : 3

COURSE OBJECTIVES:

1. Numerous examples from machine vision, speech recognition and movement recognition have been discussed as applications.
2. Unsupervised classification or clustering techniques have also been addressed in this course.
3. Analytical aspects have been adequately stressed so that on completion of the course the students can apply the concepts learnt in real life problems.

COURSE OUTCOMES: At the end of the course students will be able to:

2. Know feature extraction techniques and representation of patterns in feature space.
3. Measure of similarity between two patterns. Statistical, nonparametric and neural network techniques for pattern recognition.
4. Understand Techniques for recognition of time varying patterns.

MODULE 1-INTRODUCTION AND STATISTICAL PATTERN RECOGNITION 9hrs

Introduction: Feature extraction and Pattern Representation, Concept of Supervised and Unsupervised Classification, Introduction to Application Areas.
Statistical Pattern Recognition: Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary, Normal Density, Discriminant Function for Discrete Features, Parameter Estimation.

MODULE 2-DIMENSIONALITY PROBLEM AND NONPARAMETRIC PATTERN CLASSIFICATION 10hrs

Dimensionality Problem: Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis.
Nonparametric Pattern Classification: Density Estimation, Nearest Neighbour Rule, Fuzzy Classification.

MODULE 3- LINEAR DISCRIMINANT FUNCTIONS 10Hrs

Linear Discriminant Functions: Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure Kesler's Construction

MODULE4-NEURAL NETWORK CLASSIFIER AND TIME VARYING PATTERN RECOGNITION 10Hrs

Neural Network Classifier: Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network
Time Varying Pattern Recognition: First Order Hidden Markov Model, Evaluation, Decoding, Learning

MODULE 5 - UNSUPERVISED CLASSIFICATION 7hrs

Unsupervised Classification: Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique, Iterative Optimization

Text Books

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley & Sons, 2001.

2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

Reference Books

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.

2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

SEMESTER/YEAR : 8TH SEM / 4TH YEAR
COURSE CODE : 16CS422
TITLE OF THE COURSE : WIRELESS NETWORKS
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives:

1. Understand the architecture and applications of current and next generation wireless networks
2. Get a basic introduction to the key concepts and techniques underlying modern
   physical layer wireless and mobile communications
3. Learn how to design and analyze various medium access and resource allocation
   techniques
4. Learn how to design and analyze network layer routing protocols, along with keycomponent mechanisms
5. Learn to design and analyze transport layer protocols

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

1. Get an idea about the entire wireless network and the functionalities.
2. Get an idea about 5 G technologies.

Module I **8Hrs**

Introduction, Fundamentals of cellular systems, mobile ad-hoc and sensor networks, wireless PAN/LAN/MAN. Overview of probability theory, traffic theory, queuing theory, and discrete event driven simulations.

Module II **9 Hrs**

Mobile radio propagation, multi-path propagation, path loss, slow fading, fast fading. Channel coding and Error Control Techniques. Cellular concept, frequency reuse, cell splitting, cell sectoring. Multiple radio access protocols, CSMA, CSMA/CD, CSMA/CA and standards.

Module III **9Hrs**

Multiple division techniques: FDMA, TDMA, CDMA, OFDM, SDMA. Static and dynamic channel allocation techniques. Mobile Communication Systems: Registration, Roaming, Multicasting, Security and Privacy.

Module IV **9Hrs**

Ad-hoc networks, routing in MANETs. Wireless sensor networks, MAC protocols for wireless sensor networks, routing in sensor networks. Wireless PAN (Bluetooth), Wireless LAN (Wi-Fi), Wireless MAN (WiMAX)

Module V **10Hrs**

Introduction – 5G vision – 5G features and challenges – Applications of 5G – 5G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

Text Books

1. Dharma PrakashAgrawal and Qing-An Zeng, Introduction to Wireless and Mobile Systems, Tomson, 2010, 3rd edition
2. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
3. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008.

Reference Books

1. Vijay K. Grag and Joseph E. Wilkes, Wireless and Personal Communications Systems, 1996.
2. Christian Huitema, Routing in the Internet, Prentice Hall, 1995.
3. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Pearson Education, 2007

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS424
TITLE OF THE COURSE : MULTICORE ARCHITECTURE
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. To understand the recent trends in the field of Computer Architecture and identify performance related parameters
2.To expose the students to the problems related to multiprocessing

Course Outcomes

1. To understand the multi-core architectures and issues involved in writing code for the multi-core architectures
2. To develop software for these architectures and What are the program optimization techniques
3. To build some of these techniques in compilers &OpenMP and parallel programming libraries

Module I **9Hrs**

Introduction to parallel computers: Instruction Level Parallelism (ILP) vs. Thread Level Parallelism (TLP); performance issues: brief introduction to cache hierarchy and communication latency. Shared memory multiprocessors: general architecture and the problem of cache coherence; synchronization primitives: atomic primitives; locks: TTS, tickets, array; barriers: central and tree; performance implications in shared memory programs.

Module II **9Hrs**

Chip multiprocessors: why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI;memory consistency models: SC; chip multiprocessor case studies: Intel Montecito and dual core Pentium 4, IBM power4, Sun Niagara.

Module III **9Hrs**

Introduction to program optimization: overview of parallelism, shared memory programming; introduction to OpenMP; data flow analysis, pointer analysis, alias analysis, data dependence analysis, solving data dependence equations (integer linear programming problem); loop optimizations; memory hierarchy issues in code optimization.

Module IV **9Hrs**

Operating system issues for multiprocessing: need for pre-emptive OS, scheduling techniques in multi core architectures, interprocess communication in multi core architecture, shared memory: sharing issues and synchronization, sharing memory and other structures.

Module V **9Hrs**

Sharing I/O devices, distributed semaphores, monitors spin locks, implementation techniques for multi-cores; case studies from applications: digital signal processing, image processing, speech processing.

Text Book

1. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan Kaufmann publishers.
2. D. E. Culler, J. P. Singh, with A. Gupta. Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann publishers.

References

1. Allen and Kennedy. Optimizing Compilers for Modern Architectures.Morgan Kaufmann publishers.
2. A. S. Tanenbaum. Distributed Operating Systems.Prentice Hall.
3. Coulouris, Dollimore, and Kindberg. Distributed Systems Concept and Design. Addison- Wesley publishers.

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS425
TITLE OF THE COURSE : INTERNET OF THINGS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To learn the building blocks of Internet of Things (IoTs) and their characteristics.
2. To introduces the students to the programming aspects of Internet of Things with a view towards rapid prototyping of IoT applications.
3. To learn Reference architectures for different levels of IoT applications.
4. To learn IoT data analytics and Tools for IoT.

COURSE OUTCOMES: At the end of the course students will be able to

1. Will be able to identify a suitable IOT data analytics and a tool for IOT
2. Will know in a manner how the general Internet as well as Internet of Things work

MODULE 1 - Introduction 8Hrs

Introduction: Concepts behind the Internet of Things. - The IoT paradigm - Smart objects - Bits and atoms - Goal orientation - Convergence of technologies. Introduction to Internet of Things Introduction, Definition & Characteristics of IoT ,Physical Design of IoT , Things in IoT , IoT Protocols . IoT Levels & Deployment Templates.

MODULE 2 - Domain Specific IOTs: 9Hrs

Introduction , Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry. IoT and M2M- Introduction , M2M , Difference between IoT and M2M , SDN and NFV for IoT, Software Defined Networking , Network Function Virtualization .

MODULE 3 - IOT SYSTEM MANAGEMENT WITH NETCONF: 10Hrs

Need for IoT Systems Management, Simple Network Management Protocol(SNMP), Limitations of SNMP, Network Operator Requirements, NETCONF 83 4.5 YANG , IoT Systems Management with NETCONF-YANG , NETOPEER

MODULE 4 - DEVELOPING INTERNET OF THINGS: 9Hrs

IoT Platforms Design Methodology , Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, DATA ANALYTICS FOR IOT -Introduction , Apache Hadoop ,MapReduce Programming Model , Using Apache Storm for Real-time Data Analysis ,REST-based approach ,WebSocket-based approach , Structural Health Monitoring Case Study

MODULE 5 - Tools for IoT Introduction: 9Hrs

Chef, Setting up Chef , Chef Case Studies, Multi-tier Application Deployment ,Hadoop Cluster , Storm Cluster, Puppet, Puppet Case Study - Multi-tier Deployment, NETCONF-YANG Case Studies ,Steps for IoT device Management with NETCONF-YANG , Managing Smart Irrigation IoT System with NETCONF-YANG , Managing Home Intrusion Detection IoT System with NETCONF-YANG ,IoT Code Generator

Text books:

1. Arshdeep Bahga and Vijay Madisetti , Internet of Things - A Hands-On Approach, VPT; 1 edition (August 9, 2014)

Reference Books:

1. Ian G Smith, The Internet of Things 2012 New Horizons, IERC - Internet of Things European Research Cluster, 2012.
2. IEEE 802.3 Working Group, http://www.ieee802.org/3, Retrieved 2014. Paul Deitel, C How to Program, 7th Edition, Deitel How to Series.
3. M. Wang, G. Zhang, C. Zhang, J. Zhang, C. Li, An IoT-based Appliance Control System for Smart Homes, ICICIP 2013.
4.] H. Zhang, J. Guo, X. Xie, R. Bie, Y, Sun, Environmental Effect Removal Based Structural Health Monitoring in the Internet of Things, International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013

SEMESTER/YEAR : 7TH SEM/ 4TH YEAR
COURSE CODE : 16CS428
TITLE OF THE COURSE : DATA WAREHOUSING AND DATA MINING

L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. Be familiar with the concepts of data warehouse and data mining
2. Apply preprocessing statistical methods for any given raw data.
3. Be acquainted with the tools and techniques used for knowledge Discovery in Databases

COURSE OUTCOMES: At the end of the course students will be able to

1. Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications
2. Explore DWH and OLAP , and devise efficient & cost effective methods for maintaining DWHs
3. Develop practical work of DM techniques and design hypotheses based on the analysis to conceptualize a DM solution to a practical problem.

MODULE 1 - DATA WAREHOUSING: 8Hrs

Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

MODULE 2 - BUSINESS ANALYSIS: 9Hrs

Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

MODULE 3 - DATA MINING: 9Hrs

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Types of Data-attributes and measurements, types of data sets, Data Quality, Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

MODULE 4 - CLUSTERING AND TRENDS IN DATA MINING: 9Hrs

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications

MODULE 5 - ASSOCIATION RULE MINING AND CLASSIFICATION: 10Hrs

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

TEXTBOOKS:

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition,Tenth Reprint,2007.
2.Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Second Edition,Elsevier,2007.

REFERENCES:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining", PersonEducation,2007.
2.K.P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory and Practice", Easter Economy, Edition, PrenticeHallofIndia, 2006.
3. G. K. Gupta, " Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4.DanielT.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.

SEMESTER/YEAR : 7TH SEM / 4TH YEAR
COURSE CODE : 16CS429
TITLE OF THE COURSE : CRYPTOGRAPHY
L: T/A: P: C : 3 : 0: 0 : 3

COURSE OBJECTIVES:

1. Understand OSI security architecture and classical encryption techniques. Acquire fundamental knowledge on the concepts of finite fields and number theory
2. To understand the various cryptographic concepts and algorithms
3. To understand the underlying mathematical structures of cryptographic algorithm
4. To get an overview of the various applications of the cryptographic algorithms and implement them in mini project.

COURSE OUTCOMES: At the end of the course students will be able to

1. Understand the theories and concepts of Cryptographic
2. Understand the Cryptographic Techniques
3. Design the Cryptographic Algorithms
4. Apply Cryptographic Algorithms in real world problems

MODULE 1 - Introduction & Number Theory 8Hrs

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).

Finite fields and number theory: Overview of Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm. Finite fields- Polynomial Arithmetic –Prime numbers, Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms.

MODULE 2 - Cryptographic Protocols 9Hrs

Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols – Advanced Protocols – Zero Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography -Oblivious Transfer - Oblivious Signatures – Esoteric Protocols.

MODULE 3 - Cryptographic Techniques 9Hrs

Key Length - Key Management - Electronic Codebook Mode - Block Replay - Cipher Block Chaining Mode – Stream Ciphers - Self-Synchronizing Stream Ciphers - Cipher-Feedback Mode - Synchronous Stream Ciphers – Output Feedback Mode - Counter Mode - Choosing a Cipher Mode - Interleaving - Block Ciphers versus Stream Ciphers -Choosing an Algorithm - Public-Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels -Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding,and Encryption - Detecting Encryption – Hiding and Destroying Information.

MODULE 4 - Cryptographic Algorithms 9Hrs

Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation – Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab– RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

MODULE 5 - Cryptographic Algorithms Design and Applications 10Hrs

Symmetric Algorithms (Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Cipher Design - N-Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - One-Way Hash Functions Using Symmetric Block Algorithms)

Asymmetric Algorithms Using Public-Key Algorithms -Message Authentication Codes. RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes – Ongchnorr - Shamir - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol – IBM Secret-Key Management Protocol – Kerberos
Case study: IBM Common Cryptographic Architecture.

Text Books

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, John Wiley &Sons,Inc, 2nd Edition, 2007.
2. William Stallings, Cryptography and Network Security, 6rd Edition, Pearson Education, 2013

Reference Books

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in PublicWorld", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.
8. AtulKahate, Cryptography and Network Security, Tata McGrew Hill, 2003.

Wenbo Mao, Modern Cryptography Theory and Practice, Pearson Education, 2004.

SEMESTER/YEAR : 7TH SEM/ 4TH YEAR
COURSE CODE : 16CS431
TITLE OF THE COURSE : DISTRIBUTED COMPUTING
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the phases of distributed computing
2. To be aware of the transaction models and deadlocks.
3. To build concepts regarding the fundamental principles of distributed systems
4. To learn the design issues and distributed system concepts

COURSE OUTCOMES: At the end of the course students will be able to

1. Apply the design and development principles of distributed operating systems in the construction of distributed middleware components.
2. Create a distributed system through the integration of heterogeneous applications and web services using appropriate tools and technologies.
3. Demonstrate the understanding of need for distributed systems and their applications.

MODULE 1 - Introduction 9Hrs

Distributed Computing systems- Evolution of DCS-Characterization of distributed systems - Examples - Resource sharing and the web - Challenges – System models - Architectural and fundamental models –Distributed Operating System – Issues in designing a DOS –Introduction to distributed computing Environment -Networking and internetworking.

MODULE 2- Message Passing and Synchronization 9Hrs

Interprocess communication - The API for the internet protocols - External data representation and marshalling - Client-Server communication - Group communication - Desirable features message passing system- Issues in message passing- Synchronization- Clock synchronization- Event ordering- Mutual exclusion- Deadlock- Election Algorithm - Buffering.

MODULE 3 - Remote Procedure Call 9Hrs

RPC model - Transparency of RPC- Implementing RPC mechanism- Stub generation- Marshaling arguments and results- Server management- Parameter passing semantics - Call semantics- Communication protocols for RPCs- Complicated RPC client server binding- Exception handling- Security- Special types of RPCs- RPCs in heterogeneous environments- Lightweight RPC.

MODULE 4- Distributed Shared Memory 9Hrs

General architecture of DSM systems- Design and implementation of DSM- Granularity- Structure of shared memory space- Consistency models- Replacement strategy- Thrashing- Other approaches to DSM- Heterogeneous DSM and advantages of DSM.

MODULE 5 - Distributed Naming **9Hrs**

Introduction- Desirable features of naming system- Fundamental concepts- System oriented names-Object locating mechanisms-Human oriented names- Name caches - Naming and security.

Case Studies: Google- overall architecture and design philosophy, underlying communication paradigm, data storage and coordination services. Hadoop – HDFS, Map-Reduce Framework.

Text Books

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 2009.
2. Pradeep K Sinha . Distributed Operating Systems : Concepts and design,. IEEE computer society press,2007.

Reference Books

1. M.L.Liu, Distributed Computing Principles and Applications, Pearson Education, 2004.
2. Andrew S Tanenbaum, Maartenvan Steen, Distibuted Systems –Principles and Pardigms, Pearson Education, 2002.
3. Hadoop: The Definitive Guide, 3rd Edition - O'Reilly Media

SEMESTER/YEAR : 8TH SEM / 4TH YEAR
COURSE CODE : 16CS336
TITLE OF THE COURSE : COMPUTER VISION
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To introduce various topics of computer vision with their applications.
2. Combining the analytics with CV which helps in various Video Analytics processing.

COURSE OUTCOMES: At the end of the course students will be able to

1. Computer Vision along with video analysis helps the students to do the video analytics in a much easier way using Stereo Vision and Structure from motion features.
2. Students will be able to do analysis on various real-time application of video analytics

MODULE 1 - Image Formation Models 8Hrs

Introduction to Computer Vision, Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Image representations (continuous and discrete), Edge detection, Image Enhancement, Restoration, Histogram Processing.

MODULE 2- Depth estimation, views & Object Recognition 10Hrs

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, RANSAC, 3-D reconstruction framework; Auto-calibration. Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition

MODULE 3 - Motion Estimation& Analysis 8Hrs

Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion, Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

MODULE 4- Shape Representation and Segmentation 10Hrs

Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object detection.

MODULE 5 - Dynamic Vision **08Hrs**

Multiview Identification: View based model, view correspondence, in identification, Generalization from multiple view.

Identifying moving faces, Biological perspectives, Computational Theories of temporal identification, identification using holistic temporal trajectories, Identification by Continuous view transformation.

Text Books

1. Computer Vision - A modern approach, by David A. Forsyth and Jean Ponce, Pearson, 2nd Edition, 2015
2. Computer Vision: Algorithms and Applications, by Richard Szeliski, Springer-Verlag London Limited 2011.
3. Dynamic Vision: From Images to Face Recognition, Imperial College Press, World Scientific Publication Co Ltd, 2000

Reference Books

1. Introductory Techniques for 3D Computer Vision, by EmanueleTrucco and Aalessandro Verri, Publisher: Prentice Hall. 1998
2. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
3. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
4. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992

SEMESTER/YEAR : 8TH SEM / 4TH YEAR
COURSE CODE : 16CS337
TITLE OF THE COURSE : PARALLEL COMPUTING
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. To understand the architectural, hardware, OS and programming aspects in High Performance Computing
2. To understand the distributed memory programming, shared memory programming, and a few parallel applications

Course Outcomes

1. Knowledge and understanding of high performancecomputing at variouslevels/layers
2. Design and implement parallel solutions to the givenproblems

Module 1: 8 Hrs

Introduction to Computer Systems: Processors, Memory, I/O Devices; Cost, timing, and scale (size) models. Program Execution: Process, Virtual Memory, System Calls, Dynamic Memory Allocation.

Module 2: 9 Hrs

Machine-Level View of a Program: typical RISC instruction set and execution, Pipelining. Performance issues and Techniques, Cost and Frequency Models for I/O, paging, and caching. Temporal and spatial locality.

Module 3: 10 Hrs

Typical Compiler Optimizations: Identifying program bottlenecks – profiling, tracing. Simple high-level language optimizations – locality enhancement, memory disambiguation.Choosing Appropriate Computing Platforms: benchmarking, cost-performance issues.

Module 4: 10Hrs

Parallel Computing: Introduction to parallel Architectures and Interconnection Networks, communication latencies. Program parallelization: task partitioning and mapping, data distribution, Message passing, synchronization and deadlocks.

Module 5: 9Hrs

Distributed memory programming using MPI/PVM.Shared memory parallel programming. Multithreading.

Text Books:

1. Dowd, K., High performance Computing, O'Reilly Series,1993.
2. Culler, D., and Singh, J.P., Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann Pub.,1999.

References

1. Gropp, W., Lusk, E., and Skjellum, A., Using MPI: Portable Parallel Programming with the Message-passing Interface, MIT Press,1997.
2. Grama, Gupta, A., Karypis, G., Kumar, V., Introduction to Parallel Computing, Addison Wesley, 2003. ISBN:0-201-64865-2

SEMESTER/YEAR : 8TH SEM / 4TH YEAR
COURSE CODE : 16CS338
TITLE OF THE COURSE : SOCIAL NETWORKS AND ANALYTICS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the Social network concepts and its issues/challenges, various tools of Social network analysis.
2. To know about Social network APIs.
3. To know about mining and classification techniques of Social networks.

COURSE OUTCOMES: At the end of the course students will be able to

1. Understand the Social network concepts and its issues/challenges, various tools of Social network analysis.
2. Understand about Social network APIs.
3. Understand about mining and classification techniques of Social networks.

MODULE 1 - Introduction ` 8Hrs

Social network concepts – Development of social network and analysis - Online social networks – Social Network Data - Issues and challenges

MODULE 2 - Social Network Analysis 9Hrs

Linked-based and structural analysis - Content-based analysis - Static and dynamic analysis Mathematical Representation of social networks

MODULE 3 - Social networking systems and API 9Hrs

Social networking systems and API - Statistical Analysis of Social Networks- Community Detection in Social Networks - Node Classification in Social Networks -Evolution in Dynamic Social Networks

MODULE 4 - Social Influence Analysis 9Hrs

Social Influence Analysis -Link Prediction in Social Networks -Data Mining in Social Media Text Mining in Social Networks - Social Tagging -Building social services

MODULE 5 - Tools for Social network analysis 9Hrs

UCINET – PAJEK– NETDRAW – StOCNET - SPlus - R – NodeXL- SIENA and RSIENA - Real-world networks (Facebook graph, Twitter networks,)**Case Studies**

Text Books

1. Christina Prell, Social Network Analysis: History, Theory and Methodology, SAGE Publications Ltd, Publication Year 2011
2. Stanley Wasserman and Katherine Faust, " Social Network Analysis: Methods and Applications", Cambridge University Press, 1994

Reference Books

1. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", 2010
2. Carrington and Scott (eds). The SAGE Handbook on Social Network Analysis SAGE, First Edition 2011

SEMESTER/YEAR : 8TH SEM/ 4TH YEAR
COURSE CODE : 16CS339
TITLE OF THE COURSE : HUMAN COMPUTER INTERFACE
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

- Learn the foundations of Human Computer Interface
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile HCI
- Learn the guidelines for user interface.

COURSE OUTCOMES: At the end the course the students will be able to design the Human `Computer Interface.

MODULE 1 - FOUNDATIONS OF HCI 6Hrs

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Historical evolution of HCI; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

MODULE 2- DESIGN & SOFTWARE PROCESS 9Hrs

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

MODULE 3 - MODELS AND THEORIES 12Hrs

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models.
Keystroke level model (KLM), GOMS, CASE STUDIES.
Shneiderman's eight golden rules; Norman's seven principles; Norman's model of interaction; Neilsen's ten heuristics with example of use

MODULE 4- Responsive GUI Design 11 Hrs

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.Case Studies.

MODULE 5 7 Hrs

Conversational Interfaces, IVR, Chatbot, ALEXIA, MONTANA and similar tools.
Case Studies.

Text Books

1. Alan Dix, , Inc, Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (MODULE I , II & III)

2. Brian Fling, “Mobile Design and Development”, First Edition ,O‟Reilly Media Inc., 2009 (MODULE –IV).

3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O‟Reilly, 2009.(MODULE -V)

Reference Book:

1.Interaction Design, beyond Human Computer Interaction”, by I Jennifer Preece, Yvonne Rogers, Helen Sharp, John Wiley & Sons

INSTITUTION ELECTIVES

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE401
TITLE OF THE COURSE : ARTIFICIAL INTELLIGENCE
L: T/A: P: C : 3 :0 : 0 : 3

COURSE OBJECTIVES:
To search and discover intelligent characteristics of existing AI projects, map a new problem – as search and create an animation – showing different search strategies for a problem, program a new game/ problem in Prolog, evaluate different Knowledge Representation schemes for typical AI problems, design and implement a typical AI problem to be solved Using Machine Learning Techniques, design and implement a futuristic AI application

COURSE OUTCOMES: At the end of the course students will be able to

1) Understand the concepts of AI and problem solving techniques
2) Get to know the representation of knowledge
3) Understand Machine Learning and different techniques of learning
4) Use of ANN and it's applications in real life situation

Module I **9hrs**

INTRODUCTION

Introduction – Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents –Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

PROBLEM SOLVING METHODS

Problem solving Methods - Search Strategies- Uninformed - Informed – Heuristics-Local Search Algorithms and Optimization Problems - Searching with Partial Observations Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search-Game Playing -Optimal Decisions in Games -Alpha--Beta Pruning -Stochastic Games

Module 2 **9hrs**

KNOWLEDGE REPRESENTATION

First Order Predicate Logic – Prolog Programming - Unification
Forward Chaining -Backward Chaining - Resolution –Knowledge Representation

Ontological Engineering - Categories and Objects-Events - Mental Events and Mental Objects

Module 3 **9hrs**

Reasoning Systems for Categories - Reasoning with Default Information

Machine Learning

Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks

Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees - Regression and Classification with Linear Models

Module 4 **9hrs**

Artificial Neural Networks - Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data

Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

APPLICATIONS

AI applications – Language Models - Information Retrieval - Information Extraction

Module 5 **9hrs**

Natural Language Processing - Machine Translation – Speech recognition

Robot – Hardware – Perception – Planning – Moving

TEXT BOOKS:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2009

2. Bratko, I., Prolog Programming for Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th edition, 2011.

3. David L. Poole, Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

REFERENCES:

1. M. Tim Jones, Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc; 1 edition, 2008

2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009

3. Nils J. Nilsson, the Quest for Artificial Intelligence, Cambridge University Press, 2009.

4. William F. Clocksin, and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE402
TITLE OF THE COURSE : DATA STRUCTURES & ALGORITHMS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1) To study Data Structures, and their implementation
2) To learn Graphs and Trees
3) To study algorithms using the Divide and Conquer and Greedy strategies

COURSE OUTCOMES: At the end of the course students will be able to

1. Understand different data structures such as arrays, stack, queues, dynamic data structures and implement them
2. Understand the fundamental concepts of graphs and trees and their implementation
3. Will be understand divide and conquer principle and Greedy Strategy and apply them in solving problems

Module I **9hrs**

Introduction to Data structures:

Data structures: Definition, Types. Algorithm design, Complexity, Time-Space Tradeoffs. Use of pointers in data structures. Array Definition and Analysis
Representation of Linear Arrays in Memory, Traversing of Linear Arrays, Insertion And Deletion, Single Dimensional Arrays, Two Dimensional Arrays, Multidimensional Arrays Function Associated with Arrays, Character String in C, Character String Operations, Arrays as parameters, Implementing One Dimensional Array, Sparse matrix.

Module 2 **9hrs**

Introduction to Stacks and queue

Stack: Definition, Array representation of stacks, Operations Associated with Stacks- Push & Pop, Polish expressions, Conversion of infix to postfix, infix to prefix (and vice versa) Tower of Hanoi problem.
Queue: Definition, Representation of Queues, Operations of queues- QInsert, QDelete, Priority Queues, Circular Queue, Deque.
Dynamic Data Structure: Linked list, Introduction to Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list.

Module 3 **9hrs**
Dynamic Data Structure(continued)

Linked list: doubly linked list, circular linked list, generalized list. Applications of Linked List polynomial representation using linked list and basic operation. Stack and queue implementation using linked list.

Trees & Graphs: Basic Terminology, Binary Trees and their representation, expression

evaluation, Complete Binary trees, extended binary trees,
Traversing binary trees, Searching, Insertion and Deletion in binary search trees.

Module 4 **9hrs**

Trees and Graphs (continued)

Trees General trees, AVL trees,

Graphs: Terminology and Representations, Graphs &Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Graph Transversal, Connected Components and Spanning trees.

Sorting: Insertion sort, Quick sort, merge sort, and heap sort. Hashing techniques

Module 5 **9hrs**

Divide and Conquer and Greedy Algorithms

Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Merge sort**,** Strassen Multiplication; Analysis of divide and conquer run time recurrence relations.

Greedy Method

Overview of the greedy paradigm examples of exact optimization solution, (minimum cost spanning tree), Approximate solution (Knapsack problem), Single source shortest paths, travelling salesman

Text Books

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).

REFERENCES:

1. A M Tannenbaum, Y Langsam, M J Augentien "Data Structures using C ", Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C" PHI
3. File Structures An object-Oriented Approach with C++ by Michael J. Folk, Bill Zoellick, BregRiccardi, Published by Addison Wesley (1st ISE Reprint,1999).
4. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE403
TITLE OF THE COURSE :WEB TECHNOLOGIES
L: T/A: P: C : 3 :0 : 0 : 3

COURSE OBJECTIVES:

1) To study XHTML, Dynamic HTML
2) To introduce Java Script and XML,
3) To get exposed to Web Services and Multimedia

COURSE OUTCOMES: At the end of the course students will be able to

1) Understand, analyze and build dynamic and interactive web sites
2) Install and manage server software and server side tools.
3) Understand current and evolving Web languages for integrating media and user interaction in both front end and back end elements of a Web site
4) Analysis and reporting of web data using web analytics
5) Applying different testing and debugging techniques and analyzing the web site effectiveness.

MODULE 1: 8hrs

Creating home pages, Introduction to XHTML- Editing XHTML, First XHTML Example, W3C XHTML Validation Service, Headers, Linking, Images, Special Characters and More Line Breaks, Unordered Lists, Nested and Ordered Lists, Internet and World Wide Web Resources.

MODULE 2: 9hrs

Dynamic HTML: Object Model and Collections- Introduction, Object Referencing, Collections all and children, Dynamic Styles, Dynamic Positioning, Using the frames Collection, navigator Object, Summary of the DHTML Object Model, Dynamic HTML: Event Model- IntroductionEvent onclick, Event onload, Error Handling with onerror, Tracking the Mouse with Event onmousemove, Rollovers with onmouse over and onmouse out, Form Processing with onfocus and onblur, More Form Processing with onsubmit and onreset, Event Bubbling, More DHTML Events. Dynamic HTML Filters and transitions, Dynamic HTML Data binding with tabular data control, Structured graphics and active X control.

MODULE 3 9hrs

JavaScript: Functions- Introduction, Program Modules in JavaScript, Programmer-Defined Functions, Function Definitions, Random-Number Generation, Example: Game of Chance, Duration of Identifiers, Scope Rules, JavaScript Global Functions, Recursion, Example Using Recursion: Fibonacci Series, Recursion vs. Iteration, JavaScript Internet and World Wide Web Resources. JavaScript arrays, JavaScript objects.

Module 4 **9hrs**

Extensible Markup Language (XML)- Introduction, Structuring Data, XML Namespaces, Document Type Definitions (DTDs) and Schemas, Document Type Definitions, W3C XML Schema Documents, XML Vocabularies, Chemical Markup Language (CML), Other Markup CO1 Understand, analyze and build dynamic and interactive web sites CO2 Install and manage server software and server side tools. CO3 Understand current and evolving Web languages for integrating media and user interaction in both front end and back end elements of a Web site CO4 Analysis and reporting of web data using web analytics CO5 Applying different testing and debugging techniques and analyzing the web site effectiveness. Languages, Document Object Model (DOM), DOM Methods, Simple API for XML (SAX), Extensible Style sheet Language (XSL), Simple Object Access Protocol (SOAP), Internet and World Wide

Module 5 **8hrs**

Web Resources, Web Servers (IIS, PWS and Apache)- Introduction, HTTP Request Types, System Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers, Microsoft Internet Information Services (IIS), Microsoft Personal Web.
Multimedia, PHP, String Processing and Regular Expressions, Form processing and Business logic, Dynamic content, Database connectivity, Applets and Servlets, JDBC connectivity, JSP and Web development Frameworks.

Text Books:

1. Deitel, Deitel and Nieto, Internet and Worldwide Web - How to Program, 5th Edition, PHI, 2011.
2. Bai and Ekedhi, The Web Warrior Guide to Web Programming, 3rd Edition, Thomson, 2008

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE404
TITLE OF THE COURSE : MANAGEMENT INFORMATION SYSTEMS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1) To learn Computer Systems, fundamentals of Information Systems, Telecommunications and Networks,
2) To study and understand the Data Source Management and DSS and Business Applications

COURSE OUTCOMES: At the end of the course students will be able to

1. Understand Computer Systems, Networks and fundamentals of Information Systems
2. Know the Data Resource Management and Decision Support System and apply them to Business Applications

Module 1: Computer System 7hrs

Introduction to computer technology, Computer System Concepts, Types of Computer Systems, Computer System Concepts, Memory (Primary Storage, Secondary Storage, Cache), CPU-Central Processing Unit, Hardware (input Devices, output Devices, Software and its Classification, Types of Computer System.

Module 2: Foundation of Information System 9hrs

Data, Data processing, Information, Information System, Characteristics of Information System, Need of Information Systems in Business, Fundamental Resources of Information System, Potential Risks for Information System, Types of Information System(TPS,MIS,DSS,ESS),Definition, objectives of MIS, Characteristics, Applications of MIS, Benefits and Limitations of MIS, Approaches of MIS Development, Implementations of MIS, System Development Life Cycle (SDLC) and its Stages, Success and Failure of MIS.

Module 3: Telecommunication and Network 7hrs

Networking the Enterprise, The Concept of a Network, The Business value of Telecommunications Networks, Types of Telecommunications Networks, Telecommunications Media, Network Topologies , Trends in Telecommunications.

Module 4: Data Resource Management and DSS 12hrs

Fundamental Data Concepts, Database structures, Database Development, Types of Databases, Technical Foundation of Database Management, Data warehouses and Data Mining, Decision Support in Business, Decision Structures, Decision Support Trends Decision Support Systems, online Analytical Processing. Using Decision support systems. Practical: Microsoft Access, Database Creating New Database, Setting up Tables, Form and Report Design.

Module 5: Business Applications **11 hours**

E-business systems, Customer Relationship Management Customer Relationship Management CRM, Three Phases of CRM. Benefits and Challenges of CRM, Trends in CRM, Enterprise Resource Planning Enterprise Resource Planning ERP Benefits and Challenges of ERP, Trends in ERP supply Chain Management SCM, Roles of SCM, Benefits and Challenges of SCM, Trends in SCM, Ecommerce Systems E-Commerce and its scope, Essential e-Commerce Processes, Electronic Payment Processes

Applications and Case Studies : Introduction to Hospitality Information System, Characteristics of Hospitality Information System, Computer Reservation System (CRS), Global Distribution System (GDS), Property Management Systems (PMS), Point of sales Systems(POS)

Text Book :

1. O'Brien, J. A, Marakas, G. M. Management Information systems (10th Edition) McGraw Hill,New Work: 2011

Reference Book:

1. Kenneth, C. L. Jane P. L Management Information Systems (12th Edition) Pearson Education, New Jersey 2010
2. Tesone, D. F. Hospitality Information System & E-commerce John Wiley & Sons, New Jersey, 2006

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE421
TITLE OF THE COURSE : SENSORS, NETWORKS & PROTOCOLS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:
1. Understand the basic principles and performance issues in sensor operation.
2. Detailed discussion of communication in wired and wireless embedded system
3. Understand the wireless network communication stack, protocols and sensor network applications

COURSE OUTCOMES:
1. Grasp of the principles and practical implementation of interfacing the microcontroller with real world signals
2. Gain insight into various concepts of wireless and embedded Networks
3. Challenges with deploying sensors
4. Gain insight into Ethernet
5 Gain insight into Ethernet GSM Architecture, Protocols,

UNIT- I:

INTRODUCTION TO SENSORS 10hrs
Explanation and examples of sensors, Theory on how sensors work Sensor arrays, grids and WSNs, Challenges with deploying sensors - Calibrating sensors, signal conditioning, replacement, etc. Choosing sensors -Parameters to keep in mind, survey of sensor input mechanisms & signal conditioning

UNIT- II:
EMBEDDED COMMUNICATION PROTOCOLS: 10hrs
Embedded Networking: Introduction, Serial/Parallel Communication, Serial communication protocols, RS232 standard, RS485, Synchronous Serial Protocols-Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

UNIT- III:
ETHERNET BASICS: 10hrs
Elements of a network, Inside Ethernet, Building a Network: Hardware options: Cables, Connections and network speed, Design choices: Selecting components, Ethernet Controllers. Using the internet in local and internet communications, Internet protocol, UDP and TCP concepts, Serving web pages with Dynamic Data, Serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Network secure.

UNIT- IV:
WIRELESS EMBEDDED NETWORKING: 10hrs
Wireless sensor networks: Introduction, Applications, Network Topology, Localization ,Time Synchronization , Energy efficient MAC protocols , SMAC, Energy efficient and robust routing , Data Centric routing, Wireless LAN – IEEE 802.11 Standard-Architecture,

Services – AdHoc Network , Hiper LAN, Blue Tooth.

UNIT- V:

MOBILE NETWORKS: (10 Hours)

Cellular Wireless Networks, GSM Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security GPRA

TEXT BOOKS:

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications, 2002
2. Robert B. Northrop: "Introduction to Instrumentation and Measurements", 2nd edition, CRC press

REFERENCES:

1. Jan Axelson, 'Parallel Port Complete' , Penram publications, 2006
2. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
3. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
4. KavehPahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE422
TITLE OF THE COURSE : IMAGE PROCESSING AND COMPUTER VISION
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To make students understand image fundamentals and how digital images can be processed
2. To understand Image enhancement techniques and its application, Image compression and its applicability, fundamentals of computer vision, geometrical features of images, object recognition
3. Application of real time image processing.

COURSE OUTCOMES:

1. Fundamentals of image processing.
2. Basic skills to enhancing images.
3. Fundamental and state of the art image compression standards.
4. Real time image processing with computer vision.
5. Image Recognition using Tensor flow

UNIT - Introduction: 10hrs
Digital image representation, fundamental steps in image processing, elements of digital image processing systems digitization.

UNIT -2 Digital Image fundamentals: 10hrs
A Simple Image Model, Sampling and Quantization, Relationship between Pixel, Image Formats, Image Transforms

UNIT -3 Image Enhancement: 10hrs
Histogram processing, image subtraction, image averaging, smoothing filters, sharpening filters, enhancement in frequency and spatial domain, low pass filtering, high pass filtering.

UNIT -4 Image Compression: 10hrs
Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Recent Image Compression Standards. Image recognition Case Study using Tensor flow

UNIT -5 Computer Vision: **10hrs**
Imaging Geometry; Coordinate transformation and geometric warping for image registration, Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component Analysis, Shape priors for recognition.

Text Books

1. Gonzalez, R.C., and Woods, R.E., Digital Image Processing, Dorling Kingsley (2009) 3rd ed.
2. Jain A.K., Fundamentals of Digital Image Processing, Prentice Hall (2007).
3. Sonka M., Image Processing and Machine Vision, Prentice Hall (2007) 3rd ed.
4. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall.
5. B. K. P. Horn, Robot Vision, McGraw-Hill.
6. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.
7. Richard Szeliski, Computer Vision: Algos and Applications, Springer.

Reference Books

1. Tekalp A.M., Digital Video Processing, Prentice Hall (1995).
2. Ghanbari M., Standard Codecs: Image Compression to Advanced Video Coding, IET Press (2003).

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE423
TITLE OF THE COURSE : AUTOMOTIVE EMBEDDED SYSTEMS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To provide the students the requisite skill to design and implement automotive embedded applications using micro-controllers.
2. To develop automotive applications using microcontrollers
3. To understand typical embedded microcontroller used in automotive industries, hardware interfacing and microcontroller programming in C and assembly languages are taught in detail.

COURSE OUTCOMES:

1. Explain real-time system principles, issues involved in the development of real-time
2. Analyse different features, architecture, peripheral interfacing and programming of embedded microcontrollers for automotive applications
3. Design, develop and implement automotive embedded systems by interfacing required peripherals with embedded microcontroller
4. Gain Insight in to Embedded Software development cycle
5. Gain Insight in to Architecture of Embedded Microcontroller

INTRODUCTION TO AUTOMOTIVE ECU SOFTWARE DEVELOPMENT USING ADVANCE MICROCONTROLLER
(10Hours)

Basics of ECU HW -Microcontroller/microprocessor -Signal conditioning circuits (input/output circuits) - Memory Layouts (RAM/ROM/Flash) -Understanding schematics of an ECU

ARCHITECTURE OF 16-BIT EMBEDDED MICRO-CONTROLLERS (10 Hours)
Introduction to 68HC12 Family of Micro controllers -68HC12 in automotive applications –Architecture – Registers - 68HC12/68HCS12 - assembly language programming - 16-bit HCS12 CPU -SIM (System Integration module) -Clocks and Reset Generator (CRG) - Memory, Peripheral -On-chip Voltage Regulator

PERIPHERAL INTERFACING WITH 16-BIT MICRO-CONTROLLER (10 Hours)
Timer -parallel port programming -Stepper motors – LCD – Keyboard - Serial Port – ADC – DAC - Sensor Interfacing - Interrupt handling - PWM generation - DC motor control - automotive embedded system Application development using IO and related programming –UART – SPI - I2C - Various ways to use the CAN module in HCS12 - Micro-controller based system development using IO related programming

TIMERS, ALARMS, COUNTERS, EVENTS, INTERRUPTS, EXCEPTIONS (10 Hours)
Implementation of Timer – Alarms – Counters – Events - Interrupts and Exceptions in a Microcontroller

EMBEDDED SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC) (10 Hours)

V Model Water fall - Requirement Engineering - Requirement gathering - Requirement analysis - Software Architecture - Software Prototyping - Software design - High level - Low level -Software Implementation - Software verification and validation -Software Development Practices - Basics of Project/Product Management -Software estimation - Resource planning and management - Risk Management - Software Quality processes - Requirement change management - Software Configuration management.

TEXT BOOK:

1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified hardware/Software Introduction, John Wiley &Sons. (2002)
2. Muhammad Ali Mazidi, Danny Causey and Janice Mazidi. HCS12 Microcontrollers and Embedded Systems, Prentice Hall. (2008)

REFERENCES:

1. International Journal for Automotive Technology
2. IEEE Transactions on Vehicular Technologies
3. David E. Simon, (1999), an Embedded Software Primer, Pearson Education
4. The HCS12 - 9S12 - An Introduction to Software and Hardware Interfacing 2nd Edition - Huang

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE424
TITLE OF THE COURSE : EVOLUTION OF TELECOMMUNICATIONS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To study the concept of Mobile radio propagation, cellular system design.
2. To understand mobile technologies like GSM and CDMA.
3. To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
4. To have overview of immerging technologies for 4 G standards.

COURSE OUTCOMES:

1. Understand GSM concepts and architecture, frame structure, system capacity, services provided.
2. Evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.
3. Understand CDMA concepts and architecture
4. Understand emerging technologies required for fourth generation mobile systems such as SDR, MIMO etc.
5. Long Term Evolution Technologies (LTE):

UNIT- I: (8 hours)

Introduction: Evolution of Telecommunications, Simple Telephone Communication, Manual switching system, major telecommunication Networks, Strowger Switching System, Crossbar Switching

UNIT – II: (10 hours)

Introduction to wire1ess communication

Fundamentals of Mobile Communication

Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM

UNIT- III: (10 hours)

2G Technologies

GSM Network architecture, signaling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP.

GSM evolution in GPRS and EDGE: Architecture and services offered.

IS-95 A& B(CDMA-1): Frequency and channel specifications of forward and reverse CDMA channel

UNIT –IV: (10 hours)

3G Technology

Network architecture, air Interface specification, forward and reverse channels in W-CDMA and CDMA 2000

Cell search and synchronization, establishing a connection, hand off and power control in 3G system, 3GPP LTE Introduction and system overview

UNIT – V: **(10 hours)**

4G Technology

4G Introduction and vision, Overview of 4G research initiatives and developments.
Long Term Evolution Technologies (LTE):
OFDM, MIMO channels, Space Time Codes, LTE Advanced

Text Books:

1. Theodore S. Rappaport, —Wireless Communications, Prentice Hall of India, PTR publication
2. Andreas Molisch, Wireless Communications, Wiley, Student second Edition.
3. Vijay Garg, Wireless Network Evolution 2G-3G, Pearson Education.
4. Young Kyun Kim and Ramjee Prasad, 4 G Roadmap and Emerging Communication Technologies, Artech house.

Reference Books:

1. Raj Pandya, —Mobile And Personal Communications Systems and Services, Prentice hall.
2. Singhal, —Wireless Communication, TMH
3. C.Y Lee, —Mobile Communication, Wiley
4 The evolution to 4G cellular systems: LTE-Advanced. Ian F. Akyildiz, David M. GutierrezEstevez, Elias Chavarria Reyes. Broadband Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology.
5. Vijay K. Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers,
2007, ISBN 978-0-12-373580-5

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE441
TITLE OF THE COURSE : ENTREPRENEURSHIP MANAGEMENT
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. This course is designed to provide a comprehensive introduction to Entrepreneurship, entrepreneurship mind set, entrepreneurial strategy
2. Course introduces students to idea to Introduction to business opportunity to business plan to funding the venture to Funding the Venture to Launching, Growing, and Ending the New Venture

Course outcomes

At the end of the course student will be able to

1. Understand the terminologies entrepreneurship, entrepreneurship mind set, and Entrepreneurial strategy.
2. Identifying opportunities from the idea.
3. Preparing the business plan, marketing, organizational and financial plans.
4. Various means of funding the venture.

Module 1 The Entrepreneurial perspective (9 Hours)

a) Entrepreneurship and The Entrepreneurial mind-set
b) Corporate Entrepreneurship
c) Entrepreneurial Strategy: Generating and Exploiting New Entry Opportunities

Module 2 From Idea to the Opportunity (8 Hours)

a) Creativity and the Business Idea
b) Identifying and Analyzing Domestic and International Opportunities
c) Protecting the Idea and Other Legal Issues for the Entrepreneur

Module 3 From the Opportunity to the Business (10 Hours)

a) The Business Plan Creating and Starting the venture
b) The Marketing Plan
c) The Organizational Plan
d) The Financial Plan

Module 4 From Business Plan to Funding the Venture (8 Hours)

a) Sources of Capital
b) Informal Risk Capital, Venture Capital, and Going Public

Module 5 **(10 Hours)**

From Funding the Venture to Launching, Growing, and Ending the New Venture

a) Strategies for Growth and Managing the Implications of Growth
b) Accessing Resources for Growth from External Sources
c) Succession Planning and Strategies for harvesting and Ending the Venture

Text Book:

1. Robert D. Hesrich, Mathew J. Manimala, Michael P Peters, Dean A. Shepherd,
2. Entrepreneurship, 7th Edition, MGH Education, 2014

Reference Books

1. Joe Abraham, Entrepreneurial DNA, MGH, 2011

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE442
TITLE OF THE COURSE : INNOVATION & ENTREPRENEURSHIP
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. This course introduces student's innovation.
2. Types of innovation, seven sources of innovation opportunity, the practice of innovation, the practice of Entrepreneurship and
3. Entrepreneurial strategies.

Course outcomes

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

1. Know about innovation, different types of innovation.
2. Understand different sources where innovation can happen,
3. Know about the strategies to convert the innovation into a business.

Module 1: Introduction: (10 Hours)
What is innovation, What are the skills of innovators? Can innovation skills be learnt? How is the Innovation generation different? How do we develop young people to become innovators, Portrait of the young Innovator as a Young man, STEM Innovators

Module 2 Practice of Innovation: (10 Hours)
Systematic Entrepreneurship; Purposeful Innovation and the seven sources for Innovation Opportunity; source: The Unexpected; source: Incongruities, source: Process Need;

Module 3 (9 Hours)

The Practice of Innovation (Continued): Source: Industry and Market Structures; source: Demographics; source: The Changes in Perception; source: New Knowledge; The Bright Idea; Principles Of Innovation;

Module 4 (9 Hours)

The Practice of Entrepreneurship Entrepreneurial Management; the entrepreneurial Business; Entrepreneurship in theServices Institution; the New Venture.

Module 5 Entrepreneurial Strategies: (8 Hours)
'Fustest with the Mostest' ; 'Hit Them Where They Ain't' ;
Ecological Niches; Changing Values and Characteristics

Text Books

1. Peter F Drucker, Innovation and Entrepreneurship, Routledge Taylor & Fransis Group, 2007.
2. Creating Innovators, Tony Wagner , Scribner Publications, 2015

Reference Books

1. Heike Mayer, Entrepreneurship and Innovation in Second Tier Regions, Edward Elgar, 2011.
2. Clayton M. Chrestensen, The Innovator's Dilemma, Harvard Business School Press, 1997.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE443
TITLE OF THE COURSE : LOGISTICS & SUPPLY CHAIN MANAGEMENT
L: T/A: P: C : 3 : 0 : 0 : 3

Course objectives

1. To introduce various concepts related to the supply chain management.
2. To educate the importance of supply chain decision such as design, planning, and operations of a firm.
3. To give the students an understanding of the analytical tools necessary to solve supply chain problems.
4. To showcase the ways by which the companies use different supply chain drivers to improve their performance.

Course outcomes

1. The students would have learned about various concepts related to the supply chain management.
2. The students would have got educated about the strategic importance of supply chain design, planning and operational decisions.
3. Understanding and applications of the analytical tools to solve supply chain problems would have taken place.
4. Various case studies and illustrations would have inculcated the importance of supply chain drivers in improving the performance of an organization.

Module 1 INTRODUCTION TO SUPPLY CHAIN MANAGEMENT (8 Hours)

Supply chain – historical perspective - objectives – importance – decision phases – process view – impellers of supply chain – financial measures of performance – drivers of supply chain performance – framework for structuring drivers – facilities – inventory – transportation – information – sourcing – pricing.

Module 2 DESIGNING DISTRIBUTION NETWORKS AND NETWORK DESIGN (10 Hours)

Role of distribution – factors influencing distribution network design – design options for a distribution network – online sales and the distribution network – Distribution channels in Indian agricultural, FMCG and commodity sectors – Role of network design – factors influencing network design decisions – framework for network design decisions.

Module 3 DEMAND FORECASTING AND MANAGING UNCERTAINTY (8 Hours)

Demand Forecasting: Role – characteristics – components – approach – time series methods – measures of forecast error – role of IT.

Managing uncertainty: Safety inventory and its appropriate level – impact of supply uncertainty, aggregation and replenishment policies.

Module 4 COORDINATION IN A SUPPLY CHAIN (10 Hours)

Lack of supply chain coordination and the Bullwhip effect – Effect on performance – obstacles to coordination – managerial levers – continuous replenishment and vendor-managed inventories – collaborative planning, forecasting and replenishment – Indian experience.

Module 5 TRANSPORTATION AND SOURCING (10 Hours)

Role of transportation – modes and their performance – design options and their trade-offs – Tailored transportation. Sourcing – In-house or Outsource – 3rd and 4th PLs – Scoring and assessing suppliers.

Case studies in SCM

Text books:

1. Sunil Chopra, Peter Meindl and Kalra D V, Supply Chain Management–Strategy, Planning and Operation, Pearson, 5th Edition, 2013.

2. Janat Shah, Supply Chain Management : Text and Cases, Pearson, 1st Edition, 2009.

Reference Books:

1. Donald J Bowersox, David J Closs, Bixby Cooper M, Supply Chain Logistics Management, Tata McGraw Hill, 2nd Edition, 2008.
2. Sople V V, Supply Chain Management – Text and Cases, Pearson Education, 2012.
3. Jeremy F Shapiro, Modeling the Supply Chain, Cengage Learning, 2nd Edition, 2007.
4. Coyle, Bardi, Longley, The management of Business Logistics–A supply Chain Perspective, Thomson Press, 7th Edition, 2006.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE444
TITLE OF THE COURSE : DIGITAL MARKETING
L: T/A: P: C : 3 : 0 : 0 : 3

Course objectives

To learn how to do marketing online- Boost website traffic, generate potential leads & increase sales revenue with better brand awareness using internet platforms like Social Media, Email Marketing, Mobile Marketing, Ecommerce Marketing and Affiliate Marketing.

Course outcomes

1. Appreciate the challenges required for effective Marketing Management
2. Understand and apply the tools and techniques used in Marketing management
3. Anticipate Marketing and Sales problems and issues common in the modern workplace
4. implement Digital Marketing strategy for client requirements

UNIT-1
Digital Marketing Overview (7 Hours)
Introduction, Key terms and concepts, What is marketing? What is digital marketing? Why Digital Marketing wins over traditional Marketing, Understanding marketing strategy, The building blocks of marketing ,
Understanding Digital Marketing Process: Increasing Visibility, Visitors engagement

UNIT-2
Search Engine Optimization and Search Markets (10 Hours)
Stakeholders in Search, Customer Insights, On & off-page Optimization, Meta Tags, Layout, Content Updates, Inbound Links & Link Building, Goal Configuration &Funnels, Intelligence Reporting, Conversions, Bounce Rate, Traffic Sources, Scheduling etc.

UNIT-3
Social Media (10 Hours)
What is Social Media Marketing? Overview of Facebook, Twitter, LinkedIn, Blogging, Youtube and Flickr, building Brand Awareness Using Social Media, Social Media Management, Insights and Analytics, Best Practice Examples & case Studies

UNIT-4 Website Analytics (9 Hours)
Goal Configuration &Funnels, Intelligence Reporting, Conversions, Bounce Rate, Traffic Sources, Scheduling etc

UNIT-5 Email and Mobile Marketing (8 Hours)
User Behaviour, Segmentation, Key Metrics, Best Practice Case Studies, Split Testing, Campaign Process Optimization, SMS Strategy, Mobile Advertising, Mobile Optimized Websites, 7 Step Process for Mobile Apps, Proximity Marketing, Strategic Steps, Review & Testing

Text Books:

1. Digital Marketing, Vandana Ahuja, Oxford University Press
2. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns, Ian Dodson, Wiley 2016

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE461
TITLE OF THE COURSE : INDUSTRIAL ROBOTICS AND AUTOMATION
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

- To understand the various components of robotics and automation.
- To study the various sensors and controls.
- To study the robot actuation and feedback components.
- To know the future scenario of robots technology and artificial intelligence.

Course Outcomes

- Have comprehensive knowledge of robotics and automation from application point of view in industries.
- Understand automation with focus on the industrial end processes.
- Understand future of robotics technology & Artificial Intelligence.

Module I: Introduction to Industrial Robotics 10L Hrs

Robotics - Definition of Robot, Robot Anatomy, Robot configurations: Polar, Cartesian, cylindrical and Jointed-arm configuration. Robot motions, Joints, Work volume, Robot drive systems, Precision of movement – Spatial resolution, Accuracy, Repeatability, End effectors – Tools and grippers.

Module II : Introduction to Industrial Automation 8L Hrs

Automation -History of Automation, Reasons for automation, Disadvantages of automation, Automation systems, Types of automation – Fixed, Programmable and Flexible automation, Automation strategies

Industrial Automation Systems: Components, classification and overview of manufacturing Systems, Flexible Manufacturing Systems (FMS), Types of FMS, Applications and benefits of FMS.

Module III: Controllers , Actuators and feedback components 8L Hrs

Controllers and Actuators

Basic Control System concepts and Models, Transfer functions, Block diagrams, characteristic equation, Types of Controllers: on-off, Proportional, Integral, Differential, P-I, P-D, P-I-D controllers. Control system and analysis.

Robot actuation and feedback components

Position sensors – Potentiometers, resolvers, encoders, velocity sensors. Actuators - Pneumatic and Hydraulic Actuators, Electric Motors, Stepper motors, Servomotors, Power Transmission systems.

Module IV: Robot Sensors and Machine vision system 10L Hrs

Sensors in Robotics - Tactile sensors, Proximity and Range sensors, use of sensors in robotics.

Machine Vision System: Introduction to Machine vision, the sensing and digitizing function in Machine vision, Image processing and analysis, Training and Vision systems.

Module V: Robots Technology & Artificial Intelligence 08L Hrs

Robots Technology of the future: Robot Intelligence, Advanced Sensor capabilities, Telepresence and related technologies, Mechanical design features, Mobility, locomotion and navigation, the universal hand, system integration and networking.

Artificial Intelligence: Goals of AI research, AI techniques – Knowledge representation, Problem representation and problem solving, LISP programming, AI and Robotics, LISP in the factory.

Text books

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

Reference books

1. Ghosal A, Fundamental Concepts and Analysis, Robotics, Oxford, 2006.
2. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
3. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
4. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach,Prentice Hall of India, New Delhi, 1994.
5. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
6. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., Robotics control, sensing, vision and intelligence, McGraw Hill Book co, 1987.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE462
TITLE OF THE COURSE : TOTAL QUALITY MANAGEMENT
L: T/A: P: C : 3: 0 : 0 : 3

Course Objectives

1. To provide the foundation concepts on total quality management.
2. To train on problem solving techniques for continuous improvement.

Course Outcomes

- Students will have the knowledge on quality tools.
- Students will be able to know the philosophies of quality management
- Students able to use the concepts of stastical process and quality control systems

Module I: Introduction to Quality Management 8L Hrs

Definitions – TOM framework, benefits, awareness and obstacles. Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

Module II : Principles and Philosophies of Quality Management 8L Hrs

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.

Module III: Statistical Process Control and Process Capability 10L Hrs

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed.

Process capability – meaning, significance and measurement – Six sigma concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TMP) – relevance to TQM, Terotechnology. Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

Module IV: Tools And Techniques For Quality Management 10L Hrs

Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven old (statistical) tools. Seven new management tools. Bench marking and Poka Yoke.

Module V: Quality Systems Organizing and Implementation 8L Hrs

Quality Management Systems: ISO 9000 series of standard; ISO 14000 series of standards, guidelines for performance improvements. Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward- Introduction to software quality.

Text books

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia,Third Edition, Indian Reprint (2006).
2. ShridharaBhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

Reference books

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, (2003).
3. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd. (2006)

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE463
TITLE OF THE COURSE : AUTOMOBILE ENGINEERING
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

The course will enable the students to:

- Understand basics of Automobile Engineering & various Automotive system.
- Understand vehicle layout, vehicle specifications & important of automobile.
- Make the student conversant with drive train & transmission.
- Make the student conversant with Suspension, Steering, Brakes systems & Tyre Wheel assembly.
- Make the student conversant with Vehicle Maintenance & Garage Practice.
- Understand the various Automobile Electrical System, Vehicle performance & their safety.

Course Outcomes

After completion of the course student would be able to

- Handle technical & management problems in automotive industries.
- Diagnosis the faults of automobile vehicles.
- Understand various transmission systems, Suspension, brakes, Vehicle Performance, Vehicle Safety.

Module I: Introduction to Automobile Engineering 7L Hrs

Automobile history and development, current scenario in Indian auto/ ancillary industries, Role of the automobile industry in national growth, Classification, types of chassis layout with reference to power plant locations and drive, Vehicle frames, Various types of frames. Constructional details, Unitised frame body construction, Loads acting on vehicle frame, details of chassis material.

Module II : Drive Train & Transmission 9L Hrs

Classification of clutches, Single plate & with dual flywheel effect, Multi plate, Cone, diaphragm spring, Centrifugal, Clutch materials, Clutch plate, Electromagnetic, vacuum operated, Necessity of gear box, Manual gear box-Constant mesh, Sliding mesh, Synchromesh, Epicyclic, fluid flywheel, Torque convertor, Continuous variable transmission, Electronic transmission control, overdrive, Propeller Shaft, Universal Joint, Differential and final drive, hotchkiss drive, torque tube drive.

Module III: Front & Rear Axle, Steering System, Suspension & Brakes System 12L Hrs

Axle: Purpose and requirement of front & rear axle, live and dead axles types & arrangement, types of loads acting on rear axles, full floating, three quarter floating and semi floating rear axles.

Steering System: Steering mechanism, steering geometry, cornering force, slip angle, scrub radius, steering characteristic, steering linkages & gearbox, power steering, collapsible steering, reversibility of steering, four wheel steering.
Suspension: Sprung and unsprung mass, types of suspension linkages, types of suspension springs- leaf, coil, air springs, hydro gas, rubber suspension, interconnected suspension, self-levelling suspension (active suspension), damping and shock absorbers
Brakes: Types of brake systems - drum, disc, operation-mechanical, hydraulic, air brakes, servo and power braking, hand brake, ABS.

Module IV: Vehicle Performance, Safety & Modern Trends 8L Hrs
Vehicle performance parameters, road resistance, traction and tractive effort, power requirement for propulsion, road performance curves(Numerical treatment expected), Stability of vehicles, roll over safety regulations, Vehicle safety- active, passive safety, air bags, seat belt, Vehicle interior and ergonomics, comfort, NVH in automobiles, electrical car layout, hybrid vehicles, Solar operated vehicle, measuring instruments for wear, speed, acceleration, vibration, noise.

Module V: Electrical System & Vehicle maintenance 8L Hrs
Batteries: Principles and construction of lead-acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on battery condition, charging methods.
Lighting System & Accessories: Insulated & earth return systems, positive & negative earth systems, electrical fuel pump, speedometer, fuel, oil & temperature gauges, horn, wiper system, trafficator, sensors and actuators, electronic control unit, traction control devices.
Vehicle maintenance Schedule maintenance chart of a vehicle, maintenance, overhauling & servicing of chassis, clutch, gear box, propeller shaft, differential, axles, steering system, wheels, tyres, suspension, brakes system, electrical system.

Text books

1. William H. Crouse., "Automotive Mechanics", Tata McGraw Hill Publishing House.
2. Automobile Electrical Equipment -P. S. Kohali, Tata McGraw Hill Publishing House.

Reference books

1. K. Newton and W. Seeds, T.K. Garrett, "Motor Vehicle", 13thEdition, Elsevier publications.
2. Hans Hermann Braess, Ulrich Seiffen, "Handbook of Automotive Engineering ", SAE Publications
3. Narang G. B. S , " Automobile Engineering", S. Chand and Company Ltd.
4. Dr.Kirpal Singh, "Automobile Engineering", Volume 1, Standard Publishers distributors.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE464
TITLE OF THE COURSE : RENEWABLE ENERGY SOURCES
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. To educate the students scientifically the new developments in renewable energy studies
2. To make an understand the new developments in non-conventional and renewable energy studies.
3. To emphasize the significance of Green Energy Technologies

Course Outcomes

1. To understand importance of solar energy applications
2. To know the principles of power generation by wind energy
3. To know ocean energy technologies to harness power
4. To appreciate the use of hydrogen as renewable energy source

Module I: Solar Energy 8Hrs

Solar Energy- Solar radiation its measurements and prediction - solar thermal collectors - flat plate collectors, concentrating collectors – applications - heating, cooling, desalination, drying, cooking, etc. Principle of photovoltaic conversion of solar energy - types of solar cells and fabrication -photovoltaic applications - battery charging, domestic lighting, street lighting.

Module II :Wind Energy 9Hrs

Wind Energy- Wind energy - energy chains - application - historical background, merits and limitations - nature of wind - planetary and local day / night winds - wind energy quantum - power in wind- turbine efficiency - torque thrust calculations - velocity at different heights - site selection - components of wind energy conversion system (WECS).

Module III: Energy from Biomass 9Hrs

Energy from biomass - biomass as renewable energy source - types of bio mass fuels - solid, liquid and gas - biomass conversion techniques- wet process, dry process-photosynthesis - biogas generation - factors affecting bio- digestion - classification of bio gas plant - continuous, batch and fixed dome types - advantages and disadvantages.

Module IV: Tidal, Ocean Thermal Energy, Hydel and Geothermal Energy Conversion 9Hrs

Tidal Energy: tide – spring tide, neap tide – tidal range – tidal power – types of tidal power plant – single and dual basin schemes – requirements in tidal power plant - ocean thermal energy conversion (OTEC): principle - open and closed OTEC cycles - hydel energy: micro hydro - geothermal energy: geothermal energy sources - power plant and environmental issues.

Module V: New Energy Sources **9Hrs**

Hydrogen as a renewable energy source - sources of hydrogen - fuel for vehicles - hydrogen production - direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - storage of hydrogen - gaseous, cryogenic and metal hydride - fuel cell – principle of working, construction and applications.

Text books

1. Rai.G.D, Non- conventional resources of energy, Khanna publishers, Fourth edition, 2010.
2. Khan. B.H, Non-Conventional Energy Resources, McGraw Hill, Second edition, 2009.

Reference books

1. Rao.S &Parulekar, Energy Technology, Khanna publishers, Fourth edition, 2005.
2. Pai.B.R and Ram Prasad.M.S, Power Generation through Renewable Sources of Energy, Tata McGraw Hill, New Delhi, 1991.
3. Godfrey Boyl, Renewable Energy: Power Sustainable Future, Oxford University Press, Second edition, 2006.

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE465
TITLE OF THE COURSE : PRODUCT AND INDUSTRIAL DESIGN
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives

1. Identify the customer needs, formulate the specifications and carry out need analysis.
2. To generate, screen and test the concepts.
3. To understand the overview of all the product development processes & knowledge of concept generation.

Course Outcomes

1. Solve problems independently and identification of customer needs for the product growth
2. Have a basic knowledge of concept generation and prototyping for small product business
3. Understanding the process of product planning and specifications
4. understand product development with focus on the front end processes

Module I: Introduction 8L Hrs

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research.

Module II: Identifying Customer Needs 9L Hrs

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs-need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies.

Module III: Creative Thinking 9L Hrs

Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition –functional representation –morphological methods-TRIZ- axiomatic design.

Module IV: Decision Making and Theory 9L Hrs

Decision making –decision theory –utility theory –decision trees –concept evaluation methods –Pugh concept selection method- weighted decision matrix –analytic hierarchy process – introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture.

Module V: Industrial Design **9L Hrs**

Industrial design – human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – cost evaluation –categories of cost – overhead costs – activity based costing –methods of developing cost estimates – manufacturing cost –value analysis in costing.

Text books

1. Karl T Ulrich, Steven D Eppinger and Anita Goyal, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education.
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2004, Pearson Education.
3. George E.Dieter and Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009.

Reference books

1. Chitale, A. C. and Gupta, R. C., Product Design and Manufacturing, PH1, 3rd Edition, 2003.
2. YousefHaik and T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010.
3. Clive L.Dym and Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009.
4. GeofferyBoothroyd, Peter Dewhurst and Winston Knight, Product Design for Manufacture and Assembly – 2002.

SEMESTER/YEAR : VI SEM
COURSE CODE : 16CS339
TITLE OF THE COURSE : DEEP LEARNING
L: T/A: P: C : 2: 0: 2: 3

COURSE OBJECTIVES

- To understand the basic building blocks and general principles that allows one to design Deep learning algorithms
- To become familiar with specific, widely used Deep learning networks
- To introduce building blocks of Convolution neural network architecture
- To learn to use deep learning tools and framework for solving real-life problems

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Build various deep learning models
- Identify and Apply the deep learning algorithms which are more appropriate for various types of learning tasks in various domains
- Implement deep learning algorithms and solve real-world problems deep learning tools and framework

Module-1 Mathematical background for Deep learning- Data Manipulation and Data Preprocessing, Linear Algebra, Calculus, Probability **5 Hrs**

Module-2 Introduction to Machine learning - Types of Machine Learning problems, Linear Regression-Basic elements of linear regression, Vectorization for Speed, From Linear Regression to Deep Networks, Softmax Regression **7 Hrs**

Module-3 Multilayer Perceptrons-hidden layers, activation functions, Model Selection, underfitting, overfitting, weight decay, dropout **5 Hrs**

Module 4: Forward Propagation, Backward Propagation, and Computational Graphs Layers and Blocks, shallow neural network, deep neural network, Optimization for training Deep Models. **6 Hrs**

Module 5: Foundations of Convolutional Neural Networks- Convolution operation, Convolutional Layers, Object Edge Detection in Images, Padding and Stride, Multiple Input and Multiple Output Channels, 1 × 1 Convolutional Layer, Pooling, Convolutional Neural Networks (LeNet) **5 Hrs**

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, “Dive into Deep Learning”, Amazon Science, 2020
2. François Chollet, “Deep Learning Python”, Manning Publications, 2018
3. Ethem Alpaydin, “Introduction to Machine Learning”, PHI, 2005
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016.

Reference Books

5. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
6. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, O'Reilly Media; 1 edition (April 9, 2017)
7. Josh Patterson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media; 1 edition (August 19, 2017)

Elective Courses: UG Research Project/Product Development

1. 16CS340 **UG Research Project/Product Development Foundation**
2. *16CS432* **UG Research Project/Product Development**

Course credit: 03 for each of the above course

Introduction

16CS340 is a prerequisite for 16CS432. Apart from that, students can take this in any semester from 6th Sem onwards.
Students can register only for the foundation course or both the courses.

Course Introduction

These courses are intended to give highly motivated students the opportunity to learn how to do research and develop products by participating in an ongoing research/Product development project leading to a publication or a PoC implementation that can be pitched for funding opportunity.

Course Objectives

1. To identify key research questions within a field to carry out research in a team
2. To identify and summarize the literature review of the relevant field
3. To demonstrate relevant referencing and inculcate new skills in various aspects of academic writing
4. To demonstrate the knowledge and understanding of writing the publication/report
7. To showcase the strong evidence on the clarity of the argument, understanding of the selected domain area and presentation of its technical information
8. To detail description of the process of carrying out the independe
nt research in written document along with results and conclusions with reference to the existing literature
9. To analyze and synthesize the new research findings

Course Outcomes

1. Draft of the Publication or Demonstration of the Proof-of-concept product, Draft of patent application

The research topic proposed by both the guide and the student team should be approved by the department chairman to proceed further. A degree of industrial input and involvement will be encouraged, and can be facilitated through existing academic-industrial collaborations or by addressing specific topics that are of interest to industrial partners.
All projects will be closely supervised by the Project Guide with ongoing feedback and guidance at all stages of the project from the conception to completion.
The following criteria will be checked by the department chairman to approve for the research proposal:
a. Department staff as course guide

1. Ability to provide research direction to the student in the chosen field of interest
2. Ability to design an appropriate research strategy and methodology to carry out the research by student
3. Ability to provide and evaluate the strong literature review document for the chosen research topic

5. Ability to train students on research paper / technical writing skills
6. Conduct reviews in regular time period and submit the evaluation to department chairman

b. Student Team

1. To be dedicated and committed to work on a new research topic by learning new technical skills
2. To have fair knowledge on what is product development or research topic
3. To have constant interaction with allocated guide by providing weekly updates
4. To be committed to complete the project and submitting the technical paper within the stipulated time framed by the university

Evaluation:

There will be CIA evaluation as well as the Semester end evaluation of the work done
It will be done by a committee of senior researchers of the Department.
The rubrics for this will be worked out shortly.

SEMESTER/YEAR : VIII SEM
COURSE CODE : 16IE471
TITLE OF THE COURSE : BUSINESS INTELLIGENCE
L: T/A: P: C : 3: 0:0 :3

Course Objective:

- To understand the fundamentals of Business Intelligence
- To identify the appropriateness and need Analysis the data
- To learn the preprocessing, mining and post processing of the data
- To understand various methods, techniques and algorithms in Business Intelligence

Course Outcomes:

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

- Apply basic, intermediate and advanced techniques to analysis the data
- Analyze the output generated by the process of Business Intelligence
- Explore the hidden patterns in the data
- Optimize the mining process by choosing best Business Intelligence technique

Course Contents:

Module 1: Business Intelligence **9 Hrs**

Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

Module 2: Knowledge Delivery **9 Hrs**

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis. Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization

Module 3: Decision Making Concepts **9 Hrs**

Concepts of Decision Making, Techniques of Decision Support System (DSS), Types of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS

Module 4: Classification & Unsupervised Learning **9 Hrs**

Classification: Classification Problem, Classification Models, Classification Trees, Bayesian Method; Association Rule: Structure of Association Rule, Apriori Algorithm, General Association; Clustering: Clustering Methods, Partition Methods, Hierarchical Methods

Module 5: Business Intelligence Applications **9 Hrs**

Data analytics, business analytics, ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications

Text Books:

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015.ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2. Business Process Automation, Sanjay Mohapatra, PHI.

References

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager‟s Guide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw-Hill, 2007.

Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.

SEM/YEAR: VI SEM/3rd YEAR
COURSE CODE: 16CS338
TITLE OF THE COURSE: MOBILE COMPUTING AND MOBILE APPS DEVELOPMENT
L: T/A:P: C: 2: 0: 2: 3

Course Objectives:

- To understand the basic concepts of mobile computing
- To learn the setup of Android development environment
- To illustrate the interaction of app with the user interface and handling various activities
- To identify the options for saving the persistent application data
- To gain knowledge about different mobile platforms and application development

Course Outcome:

- To create, test and debug Android application by setting up the Android development environment
- To implement adaptive and responsive user interfaces that work across various devices
- To demonstrate the techniques involved to store, share and retrieve data in Android applications
- To acquire technical competency and skills in developing applications using Android and cross-platform

Module 1: INTRODUCTION TO MOBILE COMPUTING: Introduction to mobile computing, Architecture of mobile network, Generations of mobile communication, mobile operating systems, Application of mobile communication, Challenges of mobile communication **08 hrs**

Module 2: INTRODUCTION TO ANDROID: Introduction, trends, platforms, Android Development Setup like, Android Studio, Eclipse, Android SDK, tools. Emulator setup. App behaviour on the Android Runtime (ART). Platform Architecture. Application framework and basic App Components resources. Hello World program in Android Studio **12 hrs**

Module 3: MOBILE APP DEVELOPMENT USING ANDROID: Android user Interface – Layouts (Linear, Absolute, Table, Relative, Frame and Scroll), values, asset XML representation, generate R.Java file, Android manifest file. Activities, Intent and UI Design - activities life-cycle. Android Components – layouts, fragments, basic views (Button, Edit Text, Check box, Toggle Button, Radio Button), list views, picker views, adapter views, Spinner views, Menu, Action Bar and Managing data using SQLite database (Database create, Read, Update and delete). **10 hrs**

Module 4: MESSAGING AND LOCATION BASED SERVICES: Sending SMS and mail, Google Maps – Displaying Google Maps in Andriod application, Networking – How to connect to Web using HTTP, Publishing Android Applications – how to prepare application for deployment, exporting application as an APK file and signing it with new certificate, how to distribute new android application and publish android application on market place **10 hrs**

Module 5: DATA PERSISTENCE AND GOOGLE APIS FOR ANDROID: Introduction of Google APIs for Android. SQLite Databases. CROSS-PLATFORM APP DEVELOPMENT - Introduction to Cross platform App Development - Difference to native apps, Pros and cons, Development tools **10 hrs**

TEXT BOOKS

1. Mobile Cloud Computing by Debashis De, CRC Press, Taylor & Francis Group.
2. Learning Android by Marko Gargenta O'reilly Publications
3. Professional Android™ Application Development by Reto Meier, Wrox Publication
4. Head First Android Development by Jonathan Simon O'reilly Publications
5. Beginning Hybrid Mobile Application Development by Mahesh Panhale published by APress

REFERENCES

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
2. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014
4. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580