



KERALA TECHNOLOGICAL UNIVERSITY

B. Tech. Syllabus



KERALA TECHNOLOGICAL UNIVERSITY

**Syllabus
for
I & II Semester
B. Tech. Degree
2015**

as on 01.07.2015

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Course No.	Course Name	L-T-P-Credits	Year of Introduction
MA101	CALCULUS	3-1-0-4	2015

Course Objectives

In this course the students are introduced to some basic tools in Mathematics which are useful in modelling and analysing physical phenomena involving continuous changes of variables or parameters. The differential and integral calculus of functions of one or more variables and of vector functions taught in this course have applications across all branches of engineering. This course will also provide basic training in plotting and visualising graphs of functions and intuitively understanding their properties using appropriate software packages.

Syllabus

Single Variable Calculus and Infinite series, Three dimensional space and functions of more than one variable, Partial derivatives and its applications, Calculus of vector valued functions, Multiple Integrals, Vector Integration.

Expected outcome

At the end of the course the student will be able to model physical phenomena involving continuous changes of variables and parameters and will also have acquired basic training in visualising graphs and surfaces using software or otherwise.

Text Book:

- Anton, Bivens and Davis, Calculus, John Wiley and Sons.
- Pal, S. and Bhunia, S. C., Engineering Mathematics, Oxford University Press, 2015.
- Thomas Jr., G. B., Weir, M. D. and Hass, J. R., Thomas' Calculus, Pearson.

References:

- Bali, N. P. and Goyal, M., Engineering Mathematics, Lakshmy Publications.
- Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
- Jordan, D. W. and Smith, P., Mathematical Techniques, Oxford University Press.
- Kreyszig, E., Advanced Engineering Mathematics, Wiley India edition.
- Sengar and Singh, Advanced Calculus, Cengage Learning.
- Srivastava, A. C. and Srivastava, P. K., Engineering Mathematics Vol. 1, PHI Learning Pvt. Ltd.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Single Variable Calculus and Infinite series (Book I –sec.6.1, 6.4, 6.8, 9.3, 9.5, 9.6, 9.8)		15 %
	Introduction: Hyperbolic functions and inverses-derivatives and integrals.	3	
	Basic ideas of infinite series and convergence. Convergence tests-comparison, ratio, root tests (without proof). Absolute convergence. Maclaurins series-Taylor series - radius of convergence.	3	

	(For practice and submission as assignment only: Sketching, plotting and interpretation of exponential, logarithmic and hyperbolic functions using suitable software. Demonstration of convergence of series by software packages)	3	
II	Three dimensional space and functions of more than one variable (Book I – 11.7, 11.8, 13.1, 13.2)		15 %
	Three dimensional space; Quadric surfaces, Rectangular, Cylindrical and spherical coordinates, Relation between coordinate systems. Equation of surfaces in cylindrical and spherical coordinate systems.	4	
	Functions of two or more variables – graphs of functions of two variables- level curves and surfaces –Limits and continuity.	2	
	(For practice and submission as assignment only: Tracing of surfaces- graphing quadric surfaces- graphing functions of two variables using software packages)	2	
FIRST INTERNAL EXAM			
III	Partial derivatives and its applications(Book I –sec. 13.3 to 13.5 and 13.8)		15 %
	Partial derivatives - Partial derivatives of functions of more than two variables - higher order partial derivatives - differentiability, differentials and local linearity.	4	
	The chain rule - Maxima and Minima of functions of two variables - extreme value theorem (without proof)-relative extrema.	5	
IV	Calculus of vector valued functions(Book I-12.1-12.6, 13.6,13.7)		15 %
	Introduction to vector valued functions - parametric curves in 3-space. Limits and continuity - derivatives - tangent lines - derivative of dot and cross product-definite integrals of vector valued functions.	2	
	Change of parameter - arc length - unit tangent - normal - velocity - acceleration and speed - Normal and tangential components of acceleration.	2	
	Directional derivatives and gradients-tangent planes and normal vectors.	2	
	(For practice and submission as assignment only: Graphing parametric curves and surfaces using software packages)	4	

SECOND INTERNAL EXAM			
V	Multiple integrals (Book I-sec. 14.1, 14.2, 14.3, 14.5, 14.6, 14.7)		20 %
	Double integrals - Evaluation of double integrals - Double integrals in non-rectangular coordinates - reversing the order of integration.	3	
	Area calculated as double integral - Double integrals in polar coordinates.	2	
	Triple integrals - volume calculated as a triple integral - triple integrals in cylindrical and spherical coordinates.	2	
	Converting triple integrals from rectangular to cylindrical coordinates - converting triple integrals from rectangular to spherical coordinates - change of variables in multiple integrals - Jacobians (applications of results only)	3	
VI	Vector integration(Book I sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7, 15.8)		20 %
	Vector and scalar fields- Gradient fields – conservative fields and potential functions – divergence and curl - the ∇ operator - the Laplacian ∇^2	3	
	Line integrals - work as a line integral- independence of path-conservative vector field.	3	
	Green’s Theorem (without proof- only for simply connected region in plane), surface integrals – Divergence Theorem (without proof) , Stokes’ Theorem (without proof) (For practice and submission as assignment only: graphical representation of vector fields using software packages) Green’s Theorem (without proof- only for simply connected region in plane), surface integrals – flux integral - Divergence Theorem (without proof) , Stokes’ Theorem (without proof) (For practice and submission as assignment only: graphical representation of vector fields using software packages)	4	
END SEMESTER EXAM			

Open source software packages such as gnuplot, maxima, scilab, geogebra or R may be used as appropriate for practice and assignment problems.

TUTORIALS: Tutorials can be ideally conducted by dividing each class in to two groups. Prepare necessary materials from each module that are to be taught using computer. Use it uniformly to every class.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
PH100	ENGINEERING PHYSICS	3-1-0-4	2015
Course Objectives Most of the engineering disciplines are rooted in Physics. In fact a good engineer is more or less an applied physicist. This course is designed to provide a bridge to the world of technology from the basics of science and to equip the students with skills in scientific inquiry, problem solving, and laboratory techniques.			
Syllabus Harmonic Oscillations: Damped and Forced Harmonic Oscillations. Waves: One Dimensional and Three Dimensional waves, Interference: Interference in thin films (Reflected system) Diffraction: Fraunhofer and Fresnel Diffraction, Grating, Polarization of Light: Double refraction, production and detection of polarized light, Superconductivity: Properties and Applications. Quantum Mechanics: Schrodinger Equations- Formulation and Solution, Operators, Applications. Statistical Mechanics: Microstates and macro states Maxwell - Boltzmann, Bose-Einstein and Fermi Dirac statistics. Fermi level and its significance. Acoustics: Intensity of sound, Reverberation and design concepts, Ultrasonics: Production, Detection and Applications, NDT methods, Lasers: Properties, Working Principles, Practical Lasers. Photonics: Basics of Solid State lighting, Photo detectors, Solar Cells, Fiber Optics.			
Expected outcome Familiarity with the principles of Physics and its significance in engineering systems and technological advances.			
References: • Aruldas, G., Engineering Physics, PHI Ltd. • Beiser, A., Concepts of Modern Physics, McGraw Hill India Ltd. • Bhattacharya and Tandon, Engineering Physics , Oxford India • Brijlal and Subramanyam, A Text Book of Optics, S. Chand & Co. • Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers • Hecht, E., Optics, Pearson Education • Mehta, N., Applied Physics for Engineers, PHI Ltd • Palais, J. C., Fiber Optic Communications, Pearson Education • Pandey, B. K. and Chaturvedi, S., Engineering Physics, Cengage Learning • Philip, J., A Text Book of Engineering Physics, Educational Publishers • Premlet, B., Engineering Physics, Mc GrawHill India Ltd • Sarin, A. and Rewal, A., Engineering Physics, Wiley India Pvt Ltd • Sears and Zemansky, University Physics , Pearson • Vasudeva, A. S., A Text Book of Engineering Physics, S. Chand & Co			

Web:www.physics.orgwww.howstuffworks.comwww.physics.about.com**Course Plan**

Module	Contents	Hours	Sem. Exam Marks
I	Harmonic Oscillations: Differential equation of damped harmonic oscillation, forced harmonic oscillation and their solutions- Resonance, Q factor, Sharpness of resonance- LCR circuit as an electrical analogue of Mechanical Oscillator (Qualitative)	5	15%
	Waves: One dimensional wave - differential equation and solution. Three dimensional waves - Differential equation & its solution. (No derivation) Transverse vibrations of a stretched string.	4	
II	Interference: Coherence. Interference in thin films and wedge shaped films (Reflected system) Newton's rings-measurement of wavelength and refractive index of liquid Interference filters. Antireflection coating.	5	15%
	Diffraction Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at a single slit. Plane transmission grating. Grating equation - measurment of wavelength. Rayleigh's criterion for resolution of grating- Resolving power and dispersive power of grating.	4	
FIRST INTERNAL EXAM			
III	Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Quarter wave plate and half wave plate. Production and detection of circularly and elliptically polarized light. Induced birefringence- Kerr Cell - Polaroid & applications.	4	15%
	Superconductivity: Superconducting phenomena. Meissner effect. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors - Josephson Junction - SQUID- Applications of superconductors.	5	
IV	Quantum Mechanics: Uncertainty principle and its applications- formulation of Time dependent and Time independent Schrödinger equations- physical meaning of wave function- Energy and momentum Operators-Eigen values and functions- One dimensional infinite square well potential .Quantum mechanical Tunnelling (Qualitative)	6	15%
	Statistical Mechanics: Macrostates and Microstates. Phase space. Basic postulates of Maxwell- Boltzmann, Bose-Einstein and Fermi Dirac	3	

	statistics. Distribution equations in the three cases (no derivation). Fermi Level and its significance.		
SECOND INTERNAL EXAM			
V	Acoustics: Intensity of sound- Loudness-Absorption coefficient - Reverberation and reverberation time- Significance of reverberation time- Sabine's formula (No derivation) -Factors affecting acoustics of a building.	4	20%
	Ultrasonics: Production of ultrasonic waves - Magnetostriction effect and Piezoelectric effect - Magnetostriction oscillator and Piezoelectric oscillator - Detection of ultrasonics - Thermal and piezoelectric methods- Applications of ultrasonics - NDT and medical.		
VI	Laser: Properties of Lasers, absorption, spontaneous and stimulated emissions, Population inversion, Einstein's coefficients, Working principle of laser,Optial resonant cavity. Ruby Laser, Helium-Neon Laser, Semiconductor Laser (qualitative). Applications of laser, holography (Recording and reconstruction)	5	20%
	Photonics: Basics of solid state lighting - LED – Photodetectors - photo voltaic cell, junction & avalanche photo diodes, photo transistors, thermal detectors, Solar cells- I-V characteristics - Optic fibre-Principle of propagation-numerical aperture-optic communication system (block diagram) - Industrial, medical and technological applications of optical fibre. Fibre optic sensors - Basics of Intensity modulated and phase modulated sensors.	5	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CY100	ENGINEERING CHEMISTRY	3-1-0-4	2015
Course Objectives To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like new generation engineering materials, storage devices, different instrumental methods etc. And to develop abilities and skills that are relevant to the study and practice of chemistry.			
Syllabus Spectroscopy - Principles and Applications, Electrochemistry - Electrodes, Electrochemical series and applications, Nernst Equation, Potentiometric titration and application, Cells, Instrumental Methods- Thermal Analysis, Chromatography; Conductivity, Chemistry of Engineering Materials, Copolymers, Conducting Polymers, Advanced Polymers, Nano materials, Fuels and Calorific value; Lubricants and their properties, Water Technology - Hardness, Water softening methods, Sewage water Treatment.			
Expected outcome The student will be able to apply the knowledge of chemistry and will be equipped to take up chemistry related topics as part of their project works during higher semester of the course.			
References Books: - Ahad, J., Engineering Chemistry, Jai Publications - Dara, S. S., Engineering Chemistry, S Chand Publishers - Fernandez, A., Engineering Chemistry, Owl Book Publishers, ISBN 9788192863382 - Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers - Kaurav, Engineering Chemistry with Laboratory Experiments. PHI, ISBN 9788120341746 - Manjooran K. S., Modern Engineering Chemistry, Kannatheri Publication - Seymour, R. B., Introduction to Polymer Chemistry, McGraw Hill - Rath, P., Engineering Chemistry, Cengage Learning, ISBN 9788131526699 - Wiley India, Engineering Chemistry, ISBN 9788126543205			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Spectroscopy: Introduction, Beer Lamberts Law (worked out examples)	1	15%
	UV-visible spectroscopy - Principle, Instrumentation and applications	2	
	IR spectroscopy - Principle and applications	2	
	¹ H NMR spectroscopy - Principle, chemical shift - spin - spin splitting and applications including MRI	4	
II	Electrochemistry: Different types of electrodes (general) – SHE, Calomel electrode, Glass electrode and determination of E ⁰ using SHE & Calomel	2	15%

	electrode		
	Electrochemical series and its applications.	1	
	Nernst equation for an electrode- Derivation, application & numericals	2	
	Potentiometric titration - Acid-base and redox titration	2	
	Lithium ion cell and Fuel cell.	1	
FIRST INTERNAL EXAM			
III	Instrumental Methods: Thermal analysis - Principle, instrumentation and applications of TGA and DTA.	3	15%
	Chromatographic methods - Basic principles, column, TLC. Instrumentation and principles of GC and HPLC.	4	
	Conductivity - Measurement of conductivity	1	
IV	Chemistry of Engineering Materials: Copolymers - BS, ABS - Structure and Properties.	1	15%
	Conducting Polymers - Polyaniline, Polypyrrole - Preparation, Structure and Properties.	2	
	OLED – An introduction	1	
	Advanced Polymers – Kevlar, Polybutadiene rubber and silicone rubber: Preparation, Structure and Properties.	2	
	Nanomaterials – Definition, Classification, chemical methods of preparation - hydrolysis and reduction	2	
	Properties and Applications – Carbon Nano Tubes and fullerenes.	1	
SECOND INTERNAL EXAM			
V	Fuels and Lubricants: Fuels - Calorific Value, HCV and LCV - Determination of calorific value of a solid and liquid fuel by Bomb calorimeter - Dulong's formula and Numericals.	3	20%
	Liquid fuel - Petrol and Diesel - Octane number & Cetane number	1	
	Biodiesel - Natural gas.	2	
	Lubricant - Introduction, solid, semisolid and liquid lubricants.	1	
	Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud point, Pour point and Aniline point.	2	
VI	Water Technology: Types of hardness, Units of hardness, Estimation of Hardness – EDTA method. Numericals based on the above	3	20%
	Water softening methods - Ion exchange process - Principle. Polymer ion exchange.	2	
	Reverse Osmosis - Disinfection method by chlorination and UV	1	
	Dissolved oxygen, BOD and COD.	2	
	Sewage water Treatment - Trickling Filter and UASB process.	1	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE100	ENGINEERING MECHANICS	3-1-0-4	2015
Course Objectives 1. To apply the principles of mechanics to practical engineering problems. 2. To identify appropriate structural system for studying a given problem and isolate it from its environment. 3. To develop simple mathematical model for engineering problems and carry out static analysis. 4. To carry out kinematic and kinetic analyses for particles and systems of particles.			
Syllabus Statics: Fundamental concepts and laws of mechanics; Force systems; Principle of moments; Resultant of force and couple systems; Equilibrium of rigid body; Free body diagram; Equilibrium of a rigid body in three dimension; Support reactions; Properties of surfaces and solids - Centroid, Moment of inertia, Polar moment of inertia, Mass moment of inertia, Product of inertia and Principal moment of inertia; Theorems of Pappus – Guldinus; Friction; Principle of virtual work. Dynamics: Rectangular and cylindrical coordinate system; Combined motion of rotation and translation; Newton’s second law in rectilinear translation; D’ Alembert’s principle; Mechanical vibration; Simple harmonic motion; Spring-mass model.			
Expected outcome 1. Students will be able to apply and demonstrate the concepts of mechanics to practical engineering problems. 2. Students will be able to determine the properties of planes and solids. 3. Students will be able to apply fundamental concepts of dynamics to practical problems.			
Text Books: • Shames, I. H., Engineering Mechanics - Statics and Dynamics, Pearson Prentice • Timoshenko, S. & Young D. H., Engineering Mechanics, McGraw Hill			
References Books: • Babu, J., Engineering Mechanics, Pearson Prentice Hall • Beer and Johnson, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw Hill Publishing Company Limited • Benjamin J., Engineering Mechanics, Pentex Book Publishers and Distributors • Bhavikkatti, S. S., Engineering Mechanics, New Age International Publishers • Hibbeler, R. C., Engineering Mechanics: Statics and Dynamics. Pearson Prentice Hall • Kumar, K. L., Engineering Mechanics, Tata McGraw Hill Publishing Company Limited • Merriam J. L. and Kraige L. G., Engineering Mechanics – Vol. I and II, John Wiley • Rajasekaran S. and Sankarasubramanian, G., Engineering Mechanics, Vikas Publishing House Private Limited • Tayal, A. K., Engineering Mechanics- Statics and Dynamics, Umesh Publications			

Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Statics: Fundamental concepts and laws of mechanics – Rigid body – Principle of transmissibility of forces	2	15%
	Coplanar force systems - Moment of a force – Principle of moments	2	
	Resultant of force and couple system	4	
	Equilibrium of rigid body – Free body diagram – Conditions of equilibrium in two dimensions – Two force and three force members.	3	
II	Types of supports – Problems involving point loads and uniformly distributed loads only.	5	15%
	Force systems in space – Degrees of freedom – Free body diagram – Equations of equilibrium – Simple resultant and Equilibrium problems.	4	
FIRST INTERNAL EXAM			
III	Properties of planar surfaces – Centroid and second moment of area (Derivations not required) - Parallel and perpendicular axis theorem – Centroid and Moment of Inertia of composite area.	3	15%
	Polar Moment of Inertia – Radius of gyration – Mass moment of inertia of cylinder and thin disc (No derivations required).	2	
	Product of inertia – Principal Moment of Inertia (conceptual level).	3	
	Theorems of Pappus and Guldinus.	1	
IV	Friction – Characteristics of dry friction – Problems involving friction of ladder, wedges and connected bodies.	6	15%
	Definition of work and virtual work – Principle of virtual work for a system of connection bodies – Problems on determinate beams only.	4	
SECOND INTERNAL EXAM			
V	Dynamics: Rectangular and Cylindrical co-ordinate system	1	20%
	Combined motion of rotation and translation – Concept of instantaneous centre – Motion of connecting rod of piston and crank of a reciprocating pump.	4	
	Rectilinear translation – Newton’s second law – D’Alembert’s Principle – Application to connected bodies (Problems on motion of lift only).	4	
VI	Mechanical vibrations – Free and forced vibration - Degree of freedom.	1	20%
	Simple harmonic motion – Spring-mass model – Period – Stiffness – Frequency – Simple numerical problems of single degree of freedom.	7	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE110	*ENGINEERING GRAPHICS	1-1-2-3	2015
* As this course is practical oriented, the evaluation is different from other lecture based courses. Points to note: (1) End semester examination will be for 50 marks and of 2 hour duration. (2) End semester exam will include all modules except Module IV. (3) 100 marks are allotted for internal evaluation: first internal exam 40 marks, second internal exam 40 marks and class exercises 20 marks. (4) The first internal exam will be based on modules I and II and the second internal exam will be a practical exam based on Module IV alone.			
Course Objectives To enable the student to be able to effectively communicate basic designs through graphical representations as per standards.			
Syllabus Introduction to Engineering Graphics; Orthographic projections of lines and solids, Isometric projection, Freehand sketching, Introduction to CAD, Sections of solids, Development of surfaces, Perspective projection.			
Expected outcome Upon successful completion of this course, the student would have accomplished the following abilities and skills: 1. Fundamental Engineering Drawing Standards. 2. Dimensioning and preparation of neat drawings and drawing sheets. 3. Interpretation of engineering drawings 4. The features of CADD software			
References Books: • Agrawal, B. and Agrawal, C. M., Engineering Drawing, Tata McGraw Hill Publishers • Anilkumar, K. N., Engineering Graphics, Adhyuth Narayan Publishers • Benjamin, J., Engineering Graphics, Pentex Publishers • Bhatt, N., D., Engineering Drawing, Charotar Publishing House Pvt Ltd. • Duff, J. M. and Ross, W. A., Engineering Design and Visualization, Cengage Learning, 2009 • John, K. C., Engineering Graphics, Prentice Hall India Publishers • Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K., Engineering Graphics with AutoCAD, PHI 2009 • Luzadder, W. J. and Duff, J. M., Fundamentals of Engineering Drawing, PHI 1993 • Parthasarathy, N. S., and Murali, V., Engineering Drawing, Oxford University Press			

• Varghese, P. I., Engineering Graphics, V I P Publishers • Venugopal, K., Engineering Drawing & Graphics, New Age International Publishers			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	6 exercises Introduction to Engineering Graphics: Need for engineering drawing. Drawing instruments; BIS code of practice for general engineering drawing. Orthographic projections of points and lines:-Projections of points in different quadrants; Projections of straight lines inclined to one of the reference planes, straight lines inclined to both the planes; True length and inclination of lines with reference planes; Traces of lines.	10	20%
II	12 exercises Orthographic projections of solids:-Projections of simple solids* in simple positions, projections of solids with axis inclined to one of the reference planes and axis inclined to both the reference planes.	09	20%
FIRST INTERNAL EXAM			
III	12 exercises Isometric Projections:-Isometric projections and views of plane figures simple* and truncated simple* solids in simple position including sphere and hemisphere and their combinations. Freehand sketching: Freehand sketching of real objects, conversion of pictorial views into orthographic views and vice versa.	07	20%
IV	6 exercises Introduction to Computer Aided Drafting - familiarizing various coordinate systems and commands used in any standard drafting software - drawing of lines, circle, polygon, arc, ellipse, etc. Creating 2D drawings. Transformations: move, copy, rotate, scale, mirror, offset and array; trim, extend, fillet, chamfer. Dimensioning and text editing. Exercises on basic drafting principles, to create technical drawings. Create orthographic views of simple solids from pictorial views. Create isometric views of simple solids from orthographic views. Solid modelling and sectioning of solids, extraction of 2D drawings from solid models. (For internal examination only, not for University Examination).	14	Internal
SECOND INTERNAL EXAM			
V	9 exercises	10	20%

	Sections and developments of solids: - Sections of simple* solids in simple vertical positions with section plane inclined to one of the reference planes - True shapes of sections. Developments of surfaces of these solids.		
VI	6 exercises Intersection of surfaces: - Intersection of prism in prism and cylinder in cylinder - axis bisecting at right angles only. Perspective projections: - perspective projections of simple* solids.	06	20%
*Triangular, square, pentagonal and hexagonal prisms, pyramids, cones and cylinders. Note: First angle projection to be followed.			
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-01	INTRODUCTION TO CIVIL ENGINEERING	2-1-0-3	2015
Course Objectives - To provide the students an overview of the profession of Civil Engineering. - To give the students an illustration of the use and properties of various building materials and explain the building construction aspects.			
Syllabus Civil Engineering as a profession; General introduction to history of Civil Engineering; types and classification of buildings; setting out of a building; Building materials - Stones, Bricks, Tiles, Cement, Aggregate, Cement mortar, Timber, Steel; Building Construction - Stone Masonry, Brick Masonry, Floors and flooring, Roofs and roof coverings.			
Expected outcome - Students will be able to explain the importance of Civil Engineering in the infrastructural development of the society. - They will be able to illustrate the types, uses and properties of various building materials. - Students will be able to explain the method of construction of different components of a building.			
References Books: - Chen, W. F. and Liew, J. Y. R., (Eds.), The Civil Engineering Handbook, Second Edition, CRC Press (Taylor and Francis) - Dalal, K. R., Essentials of Civil Engineering, Charotar Publishing House - Gopi, S., Basic Civil Engineering, Pearson Publishers - Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house - Mamlouk, M. S. and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers. - McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services - Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house - Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	General introduction to Civil Engineering - History of Civil Engineering - Relevance of Civil Engineering in the overall infrastructural development of the country.	2	15%
	Types and classification of structures - buildings, towers, chimneys, bridges, dams, retaining walls, water tanks, silos, roads, railways,	3	

	runways and pipelines (Brief description only)		
	Definition and types of buildings as per National Building Code of India (brief description only).	1	
	Selection of site - Components of a building and their functions - Setting out of a building.	2	
II	Stones: Classification of stones - Qualities of good building stones - Quarrying - Dressing - Tests - Specifications - Uses of common building stones.	2	15%
	Bricks: Composition of good brick earth - Classification - Qualities of good bricks - Field and laboratory tests - Specifications.	2	
	Tiles: Classification - Manufacture - Properties - Tests - Specifications	3	
FIRST INTERNAL EXAM			
III	Cement: Basic Ingredients – Manufacturing process - Grades - Properties - Tests - Specifications.	4	15%
	Aggregates: Fine and coarse aggregate - Properties - Uses - Tests.	3	
	Cement Mortar: Types and preparation.	1	
IV	Stone Masonry: Types - Details of Ashlar, Random Rubble, Coarse Rubble and Dry Rubble Masonry.	3	15%
	Brick Masonry: Types - Bond - Introduction to all types of bonds - English bond in detail (1, 1½ and 2 brick walls) - Comparison of stone and brick masonry.	4	
SECOND INTERNAL EXAM			
V	Timber: Properties - Uses - Classification - Seasoning - Defects - Preservation - Tests; Hard board and Particle board - Manufacture and use.	3	20%
	Steel: Structural steel and steel as reinforcement - Types - Properties - Uses - Market forms.	3	
VI	Floors and Flooring materials: Different types and selection of floors and floor coverings.	3	20%
	Roofs and roof coverings: Different types of roofs - Suitability - Types and selection of roofing materials.	3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-02	INTRODUCTION TO MECHANICAL ENGINEERING SCIENCES	2-1-0-3	2015
Course Objectives 1. To introduce different disciplines of Mechanical Engineering 2. To kindle interest in Mechanical Engineering 3. To impart basic mechanical engineering principles			
Syllabus Thermodynamics & Power sources, Thermal Engineering, Refrigeration and Air Conditioning, Automobile & Aeronautical Engineering, Mechanisms & Machines, Materials and manufacturing.			
Expected outcome At the end of the course, the students will have exposed to the different areas of Mechanical Engineering; gained idea about nature, scope and applications of Mechanical Engineering principles.			
References Books: • Dossat, R. J., Principles of Refrigeration, PHI • Heywood, J., Internal Combustion Engine Fundamentals, McGraw Hill Publishers • Holman, J. P., Thermodynamics, McGraw Hill Co. • Jain, K. K. and Asthana, R. B., Automobile Engineering, TTTI Bhopal • Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Pearson education • Maines, R., Landmarks in Mechanical Engineering, ASME • Menon, R. V. G., The Development of Science & Technology. • Peng, W. W., Principles of Turbomachinery, John Wiley & Sons • Pita, E. G., Air Conditioning Principles & Systems, PHI • Shigley, J. E. and Uicker, J. J., Theory of Machines & Mechanisms, Oxford University Press • Shigley, J. E., Mechanical Engineering Design, McGraw Hill Publishers • Spalding, D. B. and Cole, E. H., Engineering Thermodynamics, ELBS & Edward Arnold (Pub) Ltd. • Stone, R. and Ball, T. K., Automotive Engineering Fundamentals, SAE International • Sutton, G. P. and Ross, D. M., Rocket Propulsion Elements, John Wiley & Sons • Von Karman, T., Aerodynamics: Selected Topics in the Light of Their Historical Development, Courier Corporation • Online course on Refrigeration & Air conditioning, IIT Kharagpur www.nptel.ac.in			

Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Thermodynamics: Nature and scope of thermodynamics; Basic concepts ; Laws of thermodynamics- Discovery, Significance & Applications; Qualitative ideas on Entropy, Available energy, Irreversibility, Clausius Inequality, Principle of increase of entropy & Carnot engine; Limitations of Thermodynamics; Sources of power; history of power production; power production in the future.	7	15%
II	Thermal Engineering: Historical development of steam engine, steam turbines, gas turbines and hydraulic turbines; Principle of turbomachinery; History of IC engines; two stroke and four stroke engines-working, applications; Air compressors- types and uses; Principles of Rocket propulsion, chemical rockets, Indian space programme	7	15%
FIRST INTERNAL EXAM			
III	Refrigeration & Air Conditioning: History & scope of refrigeration; applications of refrigeration; Food preservation, refrigerated storage; applications in chemical and process industries; special applications; Air conditioning- Principles & systems; scope of air conditioning; Components of A/c systems, all-air and all-water A/c systems,, Psychrometric properties of air; Human comfort; comfort standards.	7	15%
IV	Automobile & Aeronautical Engineering: Introduction to an Automobile; history of the automobile; Indian Automobiles; Types of automobiles; Layout of an automobile; Major components and their functions; Manufacturers of motor vehicles in India; Fundamentals of aerodynamics; theory of lift and drag; aircraft engines-types and applications.	7	15%
SECOND INTERNAL EXAM			
V	Mechanisms & Machines: Introduction; Analysis and synthesis; terminology; definitions & assumptions; planar, spherical and spatial mechanisms, examples of mechanisms; mobility; classification of mechanisms; Grashof's law; mechanical advantage; Mechanical Engineering design; types of design; design considerations; types of loads; factor of safety; codes & standards; economics of design; reliability; safety.	7	20%
VI	Manufacturing Engineering & Materials: Introduction and history of	7	20%

	materials and manufacturing; engineering materials; metals, alloys, composites, microstructures, heat treatment, physical properties of materials and material testing; methods of manufacturing; examples of manufactured products; Computer Integrated manufacturing; lean production & agile manufacturing; environmentally conscious design & manufacturing; organization for manufacture.		
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-03	INTRODUCTION TO ELECTRICAL ENGINEERING	2-1-0-3	2015
Course Objectives The objective of this course is to set a firm and solid foundation in Electrical Engineering with strong analytical skills and conceptual understanding of basic laws and analysis methods in electrical and magnetic circuits.			
Syllabus Fundamental Concepts of Circuit Elements and Circuit variables, Real and Ideal independent voltage and current sources, V-I relations; Basic Circuit Laws, Analysis of resistive circuits, Magnetic Circuits, Electromagnetic Induction; Alternating current fundamentals, Phasor Concepts, Complex representation, Phasor analysis of RL, RC, RLC circuit, admittances; Complex Power, Resonance in series and parallel circuits; Three-phase systems, analysis of balanced and unbalanced star and delta connected loads; Wiring systems, Earthing, Protective devices.			
Expected outcome The course will enable students to learn advanced topics in Electrical Engineering.			
References Books: • Bhattacharya, S. K., Basic Electrical & Electronics Engineering, Pearson • Bird, J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group • Edminister, J., Electric Circuits, Schaum's Outline Series, Tata McGraw Hill • Hayt, W. H., Kemmerly, J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill • Hughes, Electrical and Electronic Technology, Pearson Education • Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors • Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill • Suresh Kumar, K. S, Electric Circuits and Networks, Pearson Education			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Fundamental Concepts of Circuit Elements and Circuit variables: Electromotive force, potential and voltage. Resistors, Capacitors, Inductors- terminal V-I relations. Basic Circuit Laws: Kirchhoff's current and voltage laws, analysis of resistive circuits - mesh, node analysis, super mesh and super node analysis. Star delta transformation. Numerical problems.	6	15%
II	Magnetic Circuits: Magneto motive force, flux, reluctance, permeability-	9	15%

	comparison of electric and magnetic circuits analysis of series and parallel magnetic circuits, magnetic circuits with air-gaps. Electromagnetic Induction: Faraday's laws, Lenz's law, statically and dynamically induced emf, self and mutual inductance, coupling coefficient. Real and Ideal independent voltage and current sources, V-I relations. Passive sign convention. Numerical problems.		
FIRST INTERNAL EXAM			
III	Alternating current fundamentals: Frequency, Period, RMS and average values, peak factor and form factor of periodic waveforms (pure sinusoidal and composite waveforms). Phasor Concepts, Complex representation (exponential, polar and rectangular forms) of sinusoidal voltages and currents, phasor diagrams, Complex impedance - series and parallel impedances and admittances. Phasor analysis of RL, RC, RLC circuits. Numerical problems.	9	15%
IV	Complex Power: Concept of power factor - active, reactive power and apparent power. Resonance in series and parallel circuits: Energy, bandwidth and quality factor, variation of impedance and admittance in series and parallel resonant circuits. Numerical problems.	5	15%
SECOND INTERNAL EXAM			
V	Three-phase systems: Star and delta connections, three-phase three wire and three-phase four-wire systems, analysis of balanced and unbalanced star and delta connected loads, power in three-phase circuits. Active and Reactive power measurement by one, two, and three wattmeter methods. Numerical problems.	8	20%
VI	Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing: Earthing of installations - necessity of earthing, plate & pipe earthing. Protective devices: protective fuses, MCB, ELCB.	5	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-04	INTRODUCTION TO ELECTRONICS ENGINEERING	2-1-0-3	2015
Course Objectives 1. To get basic idea about types, specification and common values of passive components 2. To familiarize the working and characteristics of diodes, transistors and MOSFETS 3. To understand working of diodes in circuits and in rectifiers 4. To familiarize some measuring instruments			
Syllabus Evolution and Impact of Electronics, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components, Semiconductors, PN junction diode, Zener diode, LED, photo diode, Bipolar Junction Transistors: Structure, principle of operation, different configurations, load line and operating point, biasing and stabilization, Transistor as amplifier, switch, Junction Field Effect Transistors: Structure, principle of operation, characteristics MOSFET: Structure, principle of operation, characteristics, Principle of operation of Photo transistor, UJT, SCR, Diode circuits and power supplies: Series and parallel diode circuits, Half-wave & full wave rectifiers, capacitor filter, zener voltage regulator, Electronic Measurements and measuring Instruments: Performance parameters, Analog and digital multimeter, CRO, DSO, function generator, Testing of Electronic components.			
Expected outcome Student can identify the active and passive electronic components and can design and setup simple circuits using diodes and transistors. Voltage and currents can be measured and monitored using electronic measuring instruments			
References Books: • Bell, D. A., Electronic Devices and Circuits, Oxford University Press • Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education • Kal, S., Basic Electronics: Devices, Circuits and its Fundamentals, PHI Learning • Millman, J., Halkias, C. and Parikh, C. D., Integrated Electronics, Tata Mc Graw Hill • Neaman, D. A., Electronic Circuits Analysis and Design, McGraw Hill • Sedra, A. S. and Smith, K. C., Microelectronic Circuits, Oxford University Press			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Evolution of Electronics, Impact of Electronics in industry and in society.	1	15%
	Resistors, Capacitors: types, specifications. Standard values, marking, colour coding.	3	
	Inductors and Transformers: types, specifications, Principle of working.	2	

	Electro mechanical components: relays and contactors.	1	
II	Diodes: Intrinsic and extrinsic semiconductors, PN junction diode, barrier potential, V-I characteristics, Effect of temperature. Equivalent circuit of a diode. Piece wise linear model.	3	15%
	Specification parameters of diodes and numbering.	1	
	Zener diode, Varactor diodes, characteristics, working principle of LED, photo diode, solar cell.	3	
FIRST INTERNAL EXAM			
III	Bipolar Junction Transistors: Structure, typical doping, Principle of operation, concept of different configurations. Detailed study of input and output characteristics of common base and common emitter configuration, current gain, comparison of three configurations.	3	15%
	Concept of load line and operating point. Need for biasing and stabilization, voltage divider biasing, Transistor as amplifier, switch, RC coupled amplifier and frequency response	3	
	Specification parameters of transistors and type numbering	1	
IV	Junction Field Effect Transistors: Structure, principle of operation, characteristics, comparison with BJT.	2	15%
	MOSFET: Structure, principle of operation of Enhancement type MOSFET, Current voltage characteristics, Depletion-type MOSFET.	2	
	Principle of operation of Photo transistor, UJT, SCR.	3	
SECOND INTERNAL EXAM			
V	Diode circuits and power supplies: Series and parallel diode circuits, Clippers, Clampers, Voltage multipliers	3	20%
	Half-wave and full wave (including bridge) rectifiers, Derivation of V_{rms} , V_{dc} , ripple factor, peak inverse voltage, rectification efficiency in each case, capacitor filter, working and design of a simple zener voltage regulator.	4	
	Block diagram description of a DC Power supply, Principle of SMPS		
VI	Electronic Measurements and measuring Instruments.	2	20%
	Generalized performance parameters of instruments: error, accuracy, sensitivity, precision and resolution.		
	Principle and block diagram of analog and digital multimeter, Block diagram of CRO, Measurements using CRO, Lissajous patterns, Principle and block diagram of DSO, function generator.	4	
	Testing of Electronic components.	1	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-05	INTRODUCTION TO COMPUTING AND PROBLEM SOLVING	2-1-0-3	2015
Course Objectives 1. To learn basics of digital computers 2. To develop problem solving skills 3. To learn programming and to solve problems using computers			
Syllabus Introduction to digital computer, Introduction to programming languages, Operating systems, Problem Solving strategies, Examples for algorithms and flow charts, Introduction to Python language, functions, parameters and arguments, Boolean Expressions, logical operators and control statements Strings, lists, tuples and dictionaries, operations, Files, introduction to objects, attributes and instances			
Expected outcome 1. Ability to design algorithmic solution to problems. 2. Ability to convert algorithms to Python programs. 3. Ability to design modular Python programs using functions 4. Ability to design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays. 5. Ability to design programs using file Input and Output. 6. Ability to develop recursive solutions.			
Text Books: • Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015 • Goel, A., Computer Fundamentals, Pearson Education • Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015 • Rajaraman, V., Computer Basics and C Programming, Prentice-Hall India			
References Books: • Barry, P., Head First Python, , O' Reilly Publishers • Dromy, R. G., How to solve it by Computer, Pearson India • Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India • Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015 • Sprankle, M., Problem Solving & Programming Concepts, Pearson India • Venit, S. and Drake, E., Prelude to Programming: Concepts & Design, Pearson India • Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.			

Web links: • https://archive.org/details/MIT6.00SCS11 • https://www.coursera.org/course/pythonlearn			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Introduction to digital computer – Von Neumann concept – A simple model of computer, acquisition of data, storage of data, processing of data, output of processed data. Details of functional units of a computer. Storage – primary storage and secondary storage. <i>(The discussion should focus more on the functionalities of the units and their interaction than on specific hardware details. However, concepts like memory cells and their addressability (need not be binary), registers, inter-connections (buses) have to be introduced at an abstract level. For storage devices – primary and secondary –, various categories have to be introduced along with their distinguishing features. For I-O devices also, various categories are to be introduced. The Von Neumann concept should be effectively introduced. History computers need not be taught. However, students have to be encouraged to read the relevant sections of the text book. Chapters 1 – 4 of ‘Goel’ may be used to support teaching-learning.)</i> Introduction to programming languages:- types of programming languages - high level language , assembly language and machine language, System software - Operating systems – objectives of operating systems, compiler, assembler and interpreter. <i>(For all the above topics, focus should be more on the concepts, significance and objectives. Chapter 6 and 7 (up to 7.4) of ‘Goel’ may be used to support the teaching-learning process.)</i>	8	15%
II	Problem Solving strategies – Problem analysis – formal definition of problem – Solution – top- down design – breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - representation of procedure by flowchart - Implementation of algorithms – use of procedures to achieve modularity. <i>(For this part the instructor has to initially use suitable analogies of real world problems to explain the concepts, before delving into computer-solvable problems.)</i> Examples for algorithms and flow charts - at least 10 problems (starting	8	15%

	with non-numerical examples, and numeric problems like factorial, largest among three numbers, largest among N, Fibonacci <i>etc.</i> ; <i>to be introduced with progressive levels of difficulty</i>) must be discussed in detail. (<i>Class assignments and/or tutorials may be used to strengthen understanding of this part. Chapters 4 and 5 of the ‘Rajaraman’ may be used for the teaching-learning process.</i>)		
FIRST INTERNAL EXAM			
III	Introduction to Python – variables, expressions and statements, evaluation of expressions, precedence, string operations <i>(Note:- the instructor can demonstrate simple programs to the students and encourage them to develop similar ones. In particular, before attempting programs containing functions, the students should be given enough support and time to develop python code containing long sequence of statements for the simple flowcharts developed earlier. This will strengthen the students’ understanding of instruction sequencing. Chapters 1 and 2 of ‘Downey’ have to be covered. Chapter 1 & 2 of ‘Lambert’ can also be used.)</i> Control statements, Boolean expressions and logical operators, conditional and alternative executions (<i>Note: - Chapter 4 of ‘Downey’ up to Section 4.9 has to be covered. The instructor should demonstrate each of these concepts with real examples and encourage students to develop as many as possible. Chapter 3 of ‘Lambert’ can be used for detailed discussion and self-study</i>) Iteration - while statement and tables. (<i>Note: - Chapter 6 of ‘Downey’ has to be covered. Chapter 3 of ‘Lambert’ can be used for detailed discussion and self-study.</i>)	8	15%
IV	Functions, calling functions, type conversion and coercion, composition of functions, mathematical functions, user-defined functions, parameters and arguments. <i>(Note: - Chapter 3 of ‘Downey’ has to be covered. The instructor should demonstrate each aspect of the function with real examples and encourage students to develop their own. Chapter 6 (up to 6.3) of ‘Lambert’ can be used for detailed discussion and self-study.)</i>	6	15%
SECOND INTERNAL EXAM			
V	Strings and lists – string traversal and comparison with examples. <i>(Note: - Chapter 7 of ‘Downey’ has to be covered. Section 4.1 of ‘Lambert’ can be used for detailed discussion and self-study.)</i> List operations with examples (<i>Note: - Chapter 8 of ‘Downey’ up to Section 8.6 has to be covered. Section 5.1 of ‘Lambert’ can be used for detailed discussion and self-study.</i>); tuples and dictionaries – operations and examples (<i>Note: -</i>	6	20%

	<i>Chapters 9 & 10 of the third text have to be covered. Section 5.4 of 'Lambert' can be used for detailed discussion and self-study.)</i>		
VI	Files and exceptions - text files, directories <i>(Note: - Chapter 11 of 'Downey' has to be covered)</i> Introduction to classes and objects - attributes, instances <i>(Note: - Chapter 12 of 'Downey' up to Section 12.6 has to be covered)</i>	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-06	INTRODUCTION TO CHEMICAL ENGINEERING	2-1-0-3	2015
Course Objectives 1. To instil in students the interest, excitement, and urge to learn the subject of Chemical Engineering 2. To introduce the profession of Chemical Engineering 3. To introduce the purpose of learning important subjects in Chemical Engineering for meeting the requirement of various professional fields in Chemical Engineering.			
Syllabus Introduction to Chemical Engineering, profession, plant operation, Basic concepts of units and equations of state, Overview of unit operations and processes, Modes of heat transfer, chemical reactions, DCDA process, basic concepts of P&I diagram. Introduction to process instrumentation and control, Introduction to safety in chemical process industries, introduction to Environmental Engineering, Challenges of Chemical Engineer, Introduction to novel materials and their development.			
Expected outcome The student will demonstrate the ability to understand the basic concepts of Chemical Engineering			
References Books: • Badger and Banchero, Introduction to Chemical Engineering, McGraw Hill • McCabe, W. L., Smith, J.C. and Harriott, P., Unit Operations in Chemical Engineering, McGraw Hill • Pushpavanam, S., Introduction to Chemical Engineering, PHI Learning Pvt. Ltd. • Smith, R., Chemical Process Design and Integration, Wiley			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Chemical Engineering: history of Chemical Engineering, role of Chemical Engineering– a broad overview; chemical industries in India; introduction to Chemical Engineering profession; introduction to chemical plant operation; process development and process design.	6	15%
II	Basic concepts: units and dimensions, systems of units, conversion and conversion factors of units, concept of mole, weight percent, mole percent, normality, molarity, molality, vapor pressure, partial pressure, concept of ideal gas and equations of state.	7	15%
FIRST INTERNAL EXAM			
III	Overview of unit operations such as distillation, evaporation, absorption,	8	15%

	adsorption, extraction, crystallization, drying, leaching, size separation and size reduction. Overview of unit processes like saponification, polymerization, biodiesel formation and hydrogenation.		
IV	Modes of heat transfer-principles of conduction, convection and radiation, heat exchangers. Fluid flow- laminar and turbulent flow. Introduction to transportation of fluids. Classification of chemical reactions, order of reaction, rate equation, Arrhenius equation, conversion and yield, batch reactor, mixed reactor and plug flow reactor.	8	15%
SECOND INTERNAL EXAM			
V	Block diagram, process flow diagram for DCDA process for Sulphuric acid manufacture, basic concepts of P&I diagram. Introduction to process instrumentation and control: common methodologies of measurements, measuring instruments: thermocouple, venturimeter, U-tube manometer, elements of feedback control loop, introduction to control of a distillation column.	7	20%
VI	Introduction to safety in chemical process industries – basic concepts, Case study: Bhopal gas tragedy. Introduction to Environmental Engineering - basic concepts, Typical wastewater, air and solid waste management system. Case study: Effect of Aerial Spraying of Endosulfan on Residents of Kasargod, Kerala. Challenges of Chemical Engineer –need for sustainable alternatives for processes; products with environment friendly life-cycle. Introduction to novel materials and their development.	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE103	INTRODUCTION TO SUSTAINABLE ENGINEERING	2-0-1-3	2015
Course Objectives - To have an increased awareness among students on issues in areas of sustainability - To understand the role of engineering and technology within sustainable development; - To know the methods, tools, and incentives for sustainable product-service system development - To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.			
Syllabus Sustainability- need and concept, challenges, Environment acts and protocols, Global, Regional and Local environmental issues, Natural resources and their pollution, Carbon credits, Zero waste concept ISO 14000, Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Technology and sustainable development, Sustainable urbanization, Industrial Ecology.			
Expected outcome The student will be - Able to understand the different types of environmental pollution problems and their sustainable solutions - Able to work in the area of sustainability for research and education - Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course			
Reference Books: - Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall. - Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning - Environment Impact Assessment Guidelines, Notification of Government of India, 2006 - Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998 - ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System - Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional. - Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).			

● Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios publication			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.	L4	15%
	Students may be assigned to do at least one project eg: a) Identifying/assessment of sustainability in your neighbourhood in education, housing, water resources, energy resources, food supplies, land use, environmental protection etc. b) Identify the threats for sustainability in any selected area and explore solutions for the same	P1	
II	Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.	L6	15%
	Students may be assigned to do at least one project for eg: a) Assessing the pollution status of a small area b) Programmes for enhancing public environmental awareness c) Observe a pond nearby and think about the different measures that can be adopted for its conservation	P3	
FIRST INTERNAL EXAM			
III	Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) - Procedures of EIA in India.	L4	15%
	Students may be assigned to do at least one project eg: a) Conducting LCA of products (eg. Aluminium cans, PVC bottles, cars etc. or activities (Comparison of land filling and open burning) b) Conducting an EIA study of a small project (eg. Construction of a building)	P2	

IV	Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.	L5	15%
	Students may be assigned to do at least one project eg: a) Consider the design aspects of a sustainable building for your campus b) Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.	P2	
SECOND INTERNAL EXAM			
V	Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy.	L5	20%
	Students may be assigned to do at least one project eg: a) Find out the energy savings that can be achieved by the installation of a solar water heater b) Conduct a feasibility study for the installation of wind mills in Kerala	P2	
VI	Green Engineering, Sustainable Urbanisation, industrialisation and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.	L5	20%
	Students may be assigned to do a group project eg: a) Collect details for instances of climate change in your locality b) Find out the carbon credits you can gain by using a sustainable transport system (travelling in a cycle or car pooling from college to home) c) Have a debate on the topics like: Industrial Ecology is a Boon or Bane for Industries?/Are we scaring the people on Climate Change unnecessarily?/Technology enables Development sustainable or the root cause of unsustainability?	P3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CE100	BASICS OF CIVIL ENGINEERING	2-1-0-3	2015
Course Objectives 1. To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering. 2. To provide the students an illustration of the significance of the Civil Engineering Profession in satisfying societal needs.			
Syllabus General introduction to Civil Engineering - Introduction to types of buildings, Components of a residential building, Introduction to industrial buildings; Introduction to planning of residential buildings - Simple building plans; Introduction to the various building area terms; Setting out of a building; Surveying – Principles, Objectives, Horizontal measurements with tapes, Ranging; Levelling – Instruments, Reduction of levels; Modern surveying instruments; Building materials – Bricks, cement blocks, Cement, Cement mortar, Steel; Building construction – Foundations, Brick masonry, Roofs, Floors, Decorative finishes, Plastering, Paints and Painting; Basic infrastructure and services – Elevators, Escalators, Ramps, Air conditioning, Sound proofing, Towers, Chimneys, Water Tanks; Intelligent buildings.			
Expected outcome 1. The students will be able to illustrate the fundamental aspects of Civil Engineering. 2. The students will be able to plan and set out a building. 3. Students will be able to explain the concepts of surveying for making horizontal and vertical measurements. 4. They will able to illustrate the uses of various building materials and explain the method of construction of different components of a building. 5. Students will be able to discuss about various services in a building.			
References Books: • Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England • Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England • Gopi, S., Basic Civil Engineering, Pearson Publishers • Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house • Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers			

- McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
- Minu, S., Basic Civil Engineering, Karunya Publications
- Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
- Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
- Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	General Introduction to Civil Engineering - Various disciplines of Civil engineering, Relevance of Civil engineering in the overall infrastructural development of the country.	2	15%
	Introduction to types of buildings as per NBC; Selection of site for buildings.	2	
	Components of a residential building and their functions. Introduction to industrial buildings – office / factory / software development office / power house /electronic equipment service centre (any one related to the branch of study)	2	
	Students have to visit one such building and submit an assignment about the features of any one of the listed building related to their branch (Not included for exam).	1	
II	Building planning - Introduction to planning of residential buildings- Site plan, Orientation of a building, Open space requirements, Position of doors and windows, Size of rooms; Preparation of a scaled sketch of the plan of a single storeyed residential building in a given site plan.	4	15%
	Introduction to the various building area terms - Computation of plinth area / built up area, Floor area / carpet area - for a simple single storeyed building; Setting out of a building.	3	
FIRST INTERNAL EXAM			
III	Surveying - Principles and objectives of surveying;	1	15%
	Horizontal measurements – instruments used – tape, types of tapes; Ranging (direct ranging only) – instruments used for ranging.	3	
	Levelling - Definitions, principles, Instruments (brief discussion only) - Level field book - Reduction of levels - problems on levelling (height of collimation only).	3	
	Modern surveying instruments – Electronic distance meter, digital level, total station, GPS (Brief discussion only).	1	
IV	Building materials - Bricks, cement blocks - Properties and specifications.	2	15%

	Cement – OPC, properties, grades; other types of cement and its uses (in brief).	1	
	Cement mortar – constituents, preparation.	1	
	Concrete – PCC and RCC – grades.	1	
	Steel - Use of steel in building construction, types and market forms.	1	
SECOND INTERNAL EXAM			
V	Building construction – Foundations; Bearing capacity of soil (definition only); Functions of foundations, Types - shallow and deep (sketches only).	2	20%
	Brick masonry – header and stretcher bond, English bonds – Elevation and plan (one brick thick walls only).	2	
	Roofs – functions, types, roofing materials (brief discussion only).	1	
	Floors – functions, types; flooring materials (brief discussion only).	1	
	Decorative finishes – Plastering – Purpose, procedure.	1	
	Paints and Painting – Purpose, types, preparation of surfaces for painting (brief discussion only).	2	
VI	Basic infrastructure and services - Elevators, escalators, ramps, air conditioning, sound proofing (Civil engineering aspects only)	2	20%
	Towers, Chimneys, Water tanks (brief discussion only).	1	
	Concept of intelligent buildings.	2	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
ME100	BASICS OF MECHANICAL ENGINEERING	2-1-0-3	2015
Course Objectives To expose the students to the thrust areas in Mechanical Engineering and their relevance by covering the fundamental concepts.			
Syllabus Thermodynamics, laws of thermodynamics, implications, cycles, energy conversion devices, steam and water machines, engines, turbo machines, refrigeration and air conditioning, power transmission devices in automobiles, latest trends, engineering materials and manufacturing processes, types of materials, alloys, shape forming methods, machine tools.			
Expected outcome The student will be able to understand the inter dependence of the thrust areas in Mechanical Engineering and their significance leading to the development of products, processes and systems.			
References Books: - Balachandran, Basic Mechanical Engineering, Owl Books - Benjamin, J., Basic Mechanical Engineering, Pentex Books - Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press - Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi - Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi. - Nag, P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill - Pravin Kumar, Basic Mechanical Engineering - Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai. - Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Thermodynamics: Laws of Thermodynamics, significance and applications of laws of thermodynamics; entropy, available energy; Clausius inequality; principle of increase of entropy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle, Diesel cycle and Brayton cycle; Efficiency of these cycles.	7	15%
II	Energy conversion devices: Boilers, Steam turbines, Gas turbines and Hydraulic turbines; Working principle of two stroke and four stroke I.C.	7	15%

	Engines (Diesel and Petrol), Reciprocating and centrifugal pumps, rotary pumps, reciprocating and centrifugal compressors, fans, blowers, rotary compressors; Air motor.		
FIRST INTERNAL EXAM			
III	Refrigeration and Air Conditioning: Vapour compression and absorption refrigeration systems, COP, Study of household refrigerator, Energy Efficiency Rating, Psychrometry, Psychrometric processes, window air conditioner, split air conditioner. Ratings and selection criteria of above devices. Refrigerants and their impact on environment.	7	15%
IV	Engines and Power Transmission Devices in Automobiles, Different types of engines used in automobiles, types of automobiles; major components and their functions (Description only); Fuels; Recent developments: CRDI, MPFI, Hybrid engines. Belts and belt drives; Chain drive; Rope drive; Gears and gear trains; friction clutch (cone and single plate), brakes (types and applications only); Applications of these devices.	7	15%
SECOND INTERNAL EXAM			
V	Materials and manufacturing processes: Engineering materials, Classification, properties, Alloys and their Applications; Casting, Sheet metal forming, Sheet metal cutting, Forging, Rolling, Extrusion, Metal joining processes - Powder metallurgy.	7	20%
VI	Machine Tools (Basic elements, Working principle and types of operations) Lathe – Centre Lathe, Drilling Machine – Study of Pillar drilling machine, Shaper, planer, slotter, Milling Machine, Grinding machine, Power saw; Introduction to NC and CNC machines.	7	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE100	BASICS OF ELECTRICAL ENGINEERING	2-1-0-3	2015
Course Objectives To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.			
Syllabus Elementary concepts of electric circuits, Kirchhoff's laws, constant voltage and current sources, Matrix representation; Magnetic circuits, energy stored in magnetic circuits, Electromagnetic induction, Alternating current fundamentals; AC Circuits, Phasor representation of alternating quantities- rectangular, polar and exponential forms; Three phase systems, star and delta connection; Generation of power, Power transmission and distribution; Transformers, Electric Machines- D.C. Machines, AC Motors; Tariff, Wiring systems, Lamps.			
Expected outcome The course will enable the students to gain preliminary knowledge in basic concepts of Electrical Engineering.			
References Books: • Bhattacharya, S. K., Basic Electrical & Electronics Engineering, Pearson • Bird, J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group • Del Toro, V., Electrical Engineering Fundamentals, Prentice Hall of India. • Hayt, W. H., Kemmerly, J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill • Hughes, Electrical and Electronic Technology, Pearson Education • Mehta, V. K. and Mehta, R., Basic Electrical Engineering, S. Chand Publishing • Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors • Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill • Suresh Kumar, K. S, Electric Circuits and Networks, Pearson Education			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources, formation of network equations by node voltage and mesh current methods. Matrix representation - solution of network equations by matrix methods, star-delta conversion (Analysis of resistive networks only). Numerical problems.	6	15%

II	Magnetic circuits: MMF, field strength, flux density, reluctance, energy stored in magnetic circuits. Electromagnetic induction: Faraday's laws, Lenz's law-statically induced and dynamically Induced emfs- self-inductance and mutual inductance, coefficient of coupling. Alternating current fundamentals: Generation of alternating voltages, waveforms frequency, period, average and RMS values and form factor. Numerical problems.	9	15%
FIRST INTERNAL EXAM			
III	AC Circuits: Phasor representation of alternating quantities- rectangular, polar and exponential forms. Analysis of simple ac circuits - concept of impedance. Power and power factor in ac circuits- active, reactive and apparent power. Solution of RL, RC and RLC circuits. Three phase systems: Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire systems, relation between line and phase voltages, line and phase currents. Three phase power measurement by two wattmeter method. Numerical problems.	9	15%
IV	Generation of power: Block schematic representation of generating stations- hydroelectric, thermal and nuclear power plants. Renewable energy sources. Power transmission and distribution: Typical electrical power transmission scheme, need for high voltage transmission, substation equipments, primary and secondary transmission and distribution systems.	5	15%
SECOND INTERNAL EXAM			
V	Transformers: construction of single phase and three phase transformers (core type only) – EMF equation, losses and efficiency. Electric Machines: D.C. Machines - Construction, types, principles of operation of dc motor, applications. AC Motors - Construction, principles of operation of single phase and three phase induction motor. Principle of operation of Universal motor.	7	20%
VI	Tariff: Different types of LT and HT consumers, tariff schemes - uniform tariff and differential tariff. Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing of installations - necessity of earthing, plate & pipe earthing, protective fuses, MCB, ELCB. Lamps: Different types of lamps - Incandescent lamps, fluorescent, mercury vapour, sodium vapour, metal halide and LED lamps.	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EC100	BASICS OF ELECTRONICS ENGINEERING	2-1-0-3	2015
Course Objectives 1. To get basic idea about types, specification and common values of passive components. 2. To familiarize the working and characteristics of diodes, transistors, MOSFETS and some measuring instruments. 3. To understand working of diodes in circuits and in rectifiers.			
Syllabus Evolution and Impact of Electronics in industries and in society, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components, PN Junction diode: Structure, Principle of operation, Photo diode, LED, Solar cell, Bipolar Junction Transistors: Structure, Principle of operation, characteristics, Rectifiers and power supplies: Half wave and full wave rectifier, capacitor filter, zener voltage regulator, Amplifiers and Oscillators: common emitter amplifier, feedback, oscillators, RC phase shift oscillator, Analogue Integrated circuits: operational amplifier, inverting and non-inverting amplifier, comparator, Electronic Instrumentation: digital multimeter, digital storage oscilloscope, function generator, Radio communication: principle of AM & FM, super heterodyne receiver, Radar system: Principle, block diagram of pulsed radar, Satellite communication: geo-stationary satellite, transponder, Global Positioning System, Mobile communication: cellular communications, cells, GSM, Optical communication: system, principle of light transmission through fiber, Entertainment Electronics: Color television, cable TV, CCTV system, HDTV, LCD & LED displays.			
Expected outcome Student can identify the active and passive electronic components. Student can setup simple circuits using diodes and transistors. Student will get fundamental idea about basic communication systems and entertainment electronics.			
References Books: • Bell, D. A., Electronic Devices and Circuits, Oxford University Press • Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education • Frenzel, L. E., Principles of Electronic Communication Systems, Mc Graw Hill • Kennedy, G. and Davis, B., Electronic Communication Systems, Mc Graw Hill • Tomasy, W., Advanced Electronic Communication system, PHI Publishers			
Course Plan			
Module	Contents	Hours	Sem. Marks
I	Evolution of Electronics, Impact of Electronics in industry and in society.	1	10%
	Resistors, Capacitors: types, specifications. Standard values, marking,	3	

	colour coding.		
	Inductors and Transformers: types, specifications, Principle of working.	2	
	Electro mechanical components: relays and contactors.	1	
II	PN Junction diode: Intrinsic and extrinsic semiconductors, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell.	3	20%
	Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration, Typical specifications of low, medium and high power and frequency diodes and transistors, packaging.	4	
FIRST INTERNAL EXAM			
III	Rectifiers and power supplies: Block diagram description of a dc power supply ,Half wave and full wave (including bridge) rectifier, capacitor filter, working of simple zener voltage regulator, Principle of SMPS	4	15%
	Amplifiers and Oscillators: Circuit diagram and working of common emitter amplifier, Block diagram of Public Address system, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator.	3	
IV	Analogue Integrated circuits: Functional block diagram of operational amplifier, ideal operational amplifier, inverting and non inverting amplifier, comparator.	3	15%
	Digital ICs: Logic Gates.	1	
	Electronic Instrumentation: Principle and block diagram of digital multimeter, principle of digital storage oscilloscope, principle and block diagram of function generator.	3	
SECOND INTERNAL EXAM			
V	Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver.	3	20%
	Radar system: Principle, block diagram of pulsed radar.	1	
	Satellite communication: concept of geo-stationary satellite, satellite transponder, advantages, principle of Global Positioning System.	3	
VI	Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse, principle and block diagram of GSM.	2	20%
	Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.	2	
	Entertainment and Security Electronics Technology: Basic principles of cable TV, CCTV, DTH system, HDTV, Plasma, LCD, LED TV.	3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
MA102	DIFFERENTIAL EQUATIONS	3-1-0-4	2015
Course Objectives This course introduces basic ideas of differential equations, both ordinary and partial, which are widely used in the modeling and analysis of a wide range of physical phenomena and has got applications across all branches of engineering. The course also introduces Fourier series which is used by engineers to represent and analyze periodic functions in terms of their frequency components.			
Syllabus Homogeneous linear ordinary differential equations, non-homogeneous linear ordinary differential equations, numerical solutions of ordinary differential equations, Fourier series, partial differential equations, applications of partial differential equations.			
Expected outcome At the end of the course students will have acquired basic knowledge of differential equations and methods of solving them and their use in analyzing typical mechanical or electrical systems. The included set of assignments will familiarize the students with the use of software packages for analyzing systems modeled by differential equations.			
Text Books: - Kreyszig, E., Advanced Engineering Mathematics, Wiley - Srivastava, A. C. and Srivastava, P. K., Engineering Mathematics, Vol 2. PHI Learning Pvt. Ltd. References Books: - Bali, N. P. and Goyal, M., Engineering Mathematics, Lakshmy Publications - Datta, Mathematical Methods for Science and Engineering. Cengage Learning - Edwards, C. H. and Penney, D. E., Differential Equations and Boundary Value Problems. Computing and Modelling, Pearson. - Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi. - Jordan, D. W. and Smith, P., Mathematical Techniques, Oxford University Press - Pal, S and Bhunia, S. C., Engineering Mathematics, Oxford, 2015 - Ross, S. L., Differential Equations, Wiley			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	HOMOGENEOUS LINEAR DIFFERENTIAL EQUATIONS (Text Book 1: Sections: 1.7, 2.1, 2.2, 2.4, 2.6, 3.1, 3.2) Existence and Uniqueness theorem for solutions of initial value problems (without proof). Basic theory of solutions of homogeneous differential equations (superposition principle, basis of solutions, general and	5	15%

	particular solutions).		
	Methods of solving homogeneous linear differential equations with constant coefficients of orders two or higher. Modelling of free oscillations of a mass-spring system. (For practice and submission as assignment only: Solutions of separable, exact and first order linear differential equations and orthogonal trajectories)	4	
II	NON-HOMOGENEOUS LINEAR ORDINARY DIFFERENTIAL EQUATIONS (Text Book 1: Sections: 2.7—2.10, 3.3) Basic theory of non-homogeneous linear differential equations. Methods of solving non-homogeneous linear differential equations with constant coefficients	4	15%
	Method of undetermined coefficients and method of variation of parameters.	4	
	Legendre and Cauchy’s differential equations. Modelling of forced oscillations of mass-spring system and electric circuits. (For practice and submission as assignment only: Sketching, plotting and interpretation of solutions of differential equations using suitable software packages)	2	
FIRST INTERNAL EXAM			
III	NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS (Text Book 1: sections 21.1, 21.2) Basic idea of numerical solutions of differential equations. Euler-method, improved Euler method, Runge-kutta method of fourth order (without proof)	6	15%
	Predictor-corrector method of Adams-Moulton (without proof). Error bounds of these methods. (For practice and submission as assignment only: Implementation of the above numerical methods in any programming language or using software packages)	2	

IV	FOURIER SERIES (Text Book 1: Sections: 11.1-11.2) Periodic Functions- Orthogonality of Sine and Cosine functions-Fourier series of periodic functions, Euler’s formula, Condition for Convergence of Fourier series (without proof)	3	15%
	Fourier series for even and odd functions, Half range expansion (For practice and submission as assignment only: Plots of partial sums of Fourier series and demonstration of convergence using plotting software)	6	
SECOND INTERNAL EXAM			
V	PARTIAL DIFFERENTIAL EQUATION (Text Book 2: Section: 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.9, 5.1.10, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.2.10) Formation of PDEs, solutions of first order PDEs, General integral, complete integral, Lagrange’s linear equation,	5	20%
	Higher order PDE-Solution of Linear Homogeneous PDE with Constant Coefficients.	5	
VI	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (Text Book 2: Section: 6.1, 6.2, 6.3, 6.4, 6.7, 6.8, 6.9, 6.9.1, 6.9.2) Method of Separation of Variables	2	20%
	Modelling Vibrations of a Stretched string-One dimensional wave equation and its Solution by Fourier series.	4	
	Heat transfer through an insulated rod-one dimensional heat equation. Solution of heat equation by Fourier series in special cases– insulated rod with ends at zero temperatures, insulated rod with ends at non-zero temperatures. (For practice and submission as assignment only: Plots of partial sums of Fourier series solutions of PDEs and demonstration of convergence using plotting software)	4	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE102	DESIGN AND ENGINEERING	2-0-2-3	2015
Course Objectives The purpose of this course is:- 1. To excite the student on creative design and its significance; 2. To make the student aware of the processes involved in design; 3. To make the student understand the interesting interaction of various segments of humanities, sciences and engineering in the evolution of a design; 4. To get an exposure as to how to engineer a design.			
Syllabus Design and its objectives; Role of science, engineering and technology in design; Engineering as a business proposition; Creative design and the Design Process; Design evaluation and communication of designs; Design for function and strength; Material selection and design detailing; Role of standards in design Engineering the design; Design for “X”; Product centered and user centered design; Aesthetics and ergonomics; Concepts of value engineering, concurrent engineering and reverse engineering in design; Culture based design; Modular design; Design optimization needs; User interface; Intelligent and autonomous products; Internet of things; Advanced products and human psychology; Life cycle design; Product and its environment; Design as a marketing tool; Products and IPR; Product liability.			
Expected outcome The student will be:- 1. Able to appreciate the different elements involved in good designs and to apply them in practice when called for. 2. Aware of the product oriented and user oriented aspects that make the design a success. 3. Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course; 4. Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.			
References Books: • Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN-13: 978-0124158917 ISBN-10: 0124158919 • Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5 • Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer • Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9 • Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic			

Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2

- Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

Web pages:

1. E-Book (Free download): <http://opim.wharton.upenn.edu/~ulrich/designbook.html>
2. http://www2.warwick.ac.uk/fac/sci/wmg/ftmsc/modules/modulelist/peuss/designforx/design_for_x_notes_section_5.pdf

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength;	L2	15%
	How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.	L3	
	An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions-Ceiling fan? Group Presentation and discussion.	P4	
II	Design process- Different stages in design and their significance; Defining the design space; Analogies and “thinking outside of the box”; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design.	L2	15%
	Design Communication; Realization of the concept into a configuration, drawing and model. Concept of “Complex is Simple”. Design for function and strength. Design detailing- Material selection, Design visualisation- Solid modelling; Detailed 2D drawings; Tolerancing; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.	L3	
	An exercise in the detailed design of two products (Stapler/ door/clock)	P4	
FIRST INTERNAL EXAM			
III	Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.	L2	15%
	Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling;	L3	

	manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design.		
	List out the standards organizations. Prepare a list of standard items used in any engineering specialization. Develop any design with over 50% standard items as parts.	P4	
IV	Design for “X”; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. List out the design requirements(x) for designing a rocket shell of 3 meter diameter and 8 meter length.	L4	15%
	Design mineral water bottles that could be packed compactly for transportation.	P4	
SECOND INTERNAL EXAM			
V	Product centred and user centred design. Product centred attributes and user centred attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics.	L2	20%
	Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wet grinders; Printed motifs; Role of colours in design.	L4	
	Make sharp corners and change them to smooth curves-check the acceptance. Examine the possibility of value addition for an existing product.	P6	
VI	Modular design; Design optimization; Intelligent and autonomous products; User interfaces; communication between products; autonomous products; internet of things; human psychology and the advanced products. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability.	L3	20%
	Group presentation of any such products covering all aspects that could make or mar it.	P6	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
PH110	ENGINEERING PHYSICS LAB	0-0-2-1	2015
Course Objectives This course is designed (i) to impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course and (ii) to develop the experimental skills of the students.			
List of Exercises / Experiments (Minimum of 8 mandatory) Basics 1. Study of application of Cathode Ray Oscilloscope (CRO) for Frequency and Amplitude measurements. Lissajous figures (useful for different types of polarized light.) 2. Temperature measurement – Thermocouple 3. Measurement of strain using strain gauge and Wheatstones bridge. Waves, Oscillations and Ultrasonics 4. Wave length and velocity measurement of ultrasonic waves in a liquid using ultrasonic diffractometer. 5. The LCR Circuit – Forced and damped harmonic oscillations. 6. Melde's string apparatus. Measurement of frequency in the transverse and longitudinal mode. Interference 7. Wave length measurement of a monochromatic source of light using Newton's Rings method. 8. Determination of refractive index of a liquid using Newton's Rings apparatus. 9. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method. Diffraction 10. To determine the slit or pinhole width. 11. To measure wavelength using a millimeter scale as a grating. 12. Determination the wavelength of He-Ne laser or any standard laser using diffraction grating. 13. To determine the wavelength of monochromatic light using grating. 14. Determination of dispersive power and resolving power of a plane transmission grating.			

Polarisation

15. Kerr Effect - To demonstrate the Kerr effect in nitrobenzene solution and to measure the light intensity as a function of voltage across the Kerr cell using photo detector.
16. To measure the light intensity of plane polarised light as a function of the analyzer position.
17. Laurent's Half Shade Polarimeter -To observe the rotation of the plane of polarization of monochromatic light by sugar solution and hence to determine the concentration of solution of optically active substance.

Laser & Photonics

18. To determine the speed of light in air using laser.
19. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
20. Determination of the particle size of lycopodium powder.
21. I-V characteristics of solar cell
22. To measure Planck's constant using photo electric cell.
23. Measurement of wavelength of laser using grating.

Reference Books:

- Avadhanulu, M. N., Dani, A. A. and Pokley, P. M., Experiments in Engineering Physics, S. Chand & Co.
- Gupta, S. K., Engineering Physics Practicals, Krishna Prakashan Pvt. Ltd.
- Koser, A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd
- Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications
- Sasikumar, P. R. Practical Physics, PHI.

Website:

- <http://www.indosawedu.com>

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CY 110	ENGINEERING CHEMISTRY LAB	0-0-2-1	2015
List of Exercises / Experiments (Minimum of 8 mandatory) 1. Estimation of Total Hardness – EDTA method. 2. Estimation of Iron in Iron ore. 3. Estimation of Copper in Brass. 4. Estimation of dissolved oxygen by Winklers method. 5. Estimation of chloride in water. 6. Preparation of Urea formaldehyde and Phenol-formaldehyde resin. 7. Determination of Flash point and Fire point of oil by Pensky Martin Apparatus. 8. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution. 9. Determination of molar absorptivity of a compound other than Fe^{3+}. 10. Analysis of IR spectra of any three organic compounds. 11. Analysis of ^1H NMR spectra of any three organic compounds. 12. Calibration of pH meter and determination of pH of a solution. 13. Verification of Nernst equation for electrochemical cell. 14. Potentiometric titrations: acid – base and redox titrations 15. Conductivity measurements of salt solutions. 16. Flame photometric estimation of Na^+ to find out the salinity in sand.			
Expected outcome The student will be able to apply and demonstrate the theoretical concepts of Engineering Chemistry.			
References: • Practical Engineering Chemistry Lab Manual, Owl book publishers			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CE110	CIVIL ENGINEERING WORKSHOP	0-0-2-1	2015
List of Exercises / Experiments (Minimum of 8 mandatory) (For Civil Engineering Branch) Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape and cross staff. Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm. Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm. Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. – To create an awareness of measurements and units (use tape or other simple measuring instruments like vernier caliper, screw gauge etc.). Testing of building materials: The student should do the compression testing of any three construction materials and compare the strength (brick, hollow block, laterite block, cement concrete cube, stone block, and so on). Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements. Introduction to simple plumbing and sanitary fittings. Home assignment 1: Preparation of a building model - The students in batches should prepare and submit a building model for a given plinth area in a given site plan constrained by a boundary wall. The minimum requirements of a residential building viz., drawing cum dining room, one bed room and a kitchen should be included. The concept of an energy efficient building should also be included in the model. Home assignment 2: Report preparation -The student should collect the construction details of any one unique Civil Engineering structure, prepare and submit a detailed report with neat illustrations. Home assignment 3: Report preparation - The students should collect samples of building materials, prepare and submit a detailed report including their market rates. (For branches other than Civil Engineering) Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only. Setting out of a building: The student should set out a building (single room only) as per the			

given building plan using tape and cross staff.

Building area computation: The student should prepare a rough sketch of a given single storeyed building and by taking linear measurements compute plinth area and carpet area of the given building.

Construct a wall of at least a height of 500mm and wall thickness 1brick using English bond (No mortar required) - corner portion – length of side walls at least 600mm.

Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. – To create an awareness of measurements and units (use tape or other simple measuring instruments like vernier calipers, screw gauge etc.).

Horizontal measurements: Find the area of an irregular polygon set out on the field.

Vertical measurements: Find the level difference between any two points.

Computation of Centre of gravity and Moment of inertia of a given rolled steel section by sketching and measurements.

Home assignment 1: Preparation of a building model - The students in batches should prepare and submit a building model for a given plinth area in a given site plan constrained by a boundary wall. The minimum requirements of a residential building viz., drawing cum dining room, one bed room and a kitchen should be included. The concept of an energy efficient building should also be included in the model.

Home assignment 2: Report preparation - The student should collect the construction details of an industrial building related to their branch of study, prepare and submit a detailed report with neat illustrations.

Home assignment 3: Report preparation - The students should collect samples of building materials, prepare and submit a detailed report about their market rates.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
ME110	MECHANICAL ENGINEERING WORKSHOP	0-0-2-1	2015
Course Objectives Introduction to manufacturing processes and applications. Familiarization of various tools, measuring devices, practices and machines used in various workshop sections.			
List of Exercises / Experiments (Minimum of 8 mandatory)			
Sl. No.	Name of Shop floor	Exercises	No of sessions
1	General	Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc. And accessories (b) Components: Bearings, seals, O-rings, circlips, keys etc.	1
2	Carpentry	Any one model from the following: 1. T-Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joint	2
3	Smithy	(a) Demonstrating the forgability of different materials (MS, Al, Alloy steel and Cast steel) in cold and hot states. (b) Observing the qualitative differences in the hardness of these materials (c) Determining the shape and dimensional variations of Al test specimen due to forging under different states by visual inspection and measurements	2
4	Foundry	Any one exercise from the following 1. Bench moulding 2. Floor moulding 3. Core making	2
5	Sheet metal	Any one exercise from the following Making 1. Cylindrical 2. Conical 3. Prismatic shaped jobs from sheet metal	2
6	Welding	Any one exercise from the following Making joints using Electric arc welding. Bead formation in horizontal, vertical and overhead positions	2
7	Fitting and Assembly	Filing exercise and any one of the following exercises Disassembling and reassembling of 1. Cylinder piston assembly 2. Tail stock assembly 3. Time piece/clock 4. Bicycle or any machine.	2
8	Machines	Demonstration and applications of Drilling machine, Grinding machine, Shaping machine, Milling machine and lathe	2

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE110	ELECTRICAL ENGINEERING WORKSHOP	0-0-2-1	2015
Course Objectives The objective of this course is to familiarize the students with commonly used components, accessories and measuring equipment in Electrical installations. The course also provides hands on experience in setting up of simple wiring circuits.			
List of Exercises / Experiments (Minimum of 8 mandatory) - Identify different types of cables/wires and switches and their uses. - Identify different types of fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage. - Wiring of simple light circuit for controlling light/fan point (PVC conduit wiring). - Wiring of light/fan circuit using Two way switches (Staircase wiring) - Wiring of fluorescent lamps and light sockets (6 A) - Wiring of Power circuit for controlling power device (16A socket) - Godown wiring / Tunnel wiring - Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter. - Measurement of voltage, current, resistance, inductance, and capacitance in a given RLC circuit using LCR meter and Multimeter. - Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit. - Wiring of backup power supply including inverter, battery and load for domestic installations. - Demonstration and measurement of power consumption of electric iron, mixer grinder, single phase pump, exhaust fan, etc.			
Expected outcome - Familiarity with supply arrangements and their limitations, knowledge of standard voltages and their tolerances, safety aspects of electrical systems and importance of protective measures in wiring systems. - Knowledge about the types of wires, cables and other accessories used in wiring. Creating awareness of energy conservation in electrical systems. - Students should be able to wire simple lighting circuits for domestic buildings, distinguish between light and power circuits. - To measure electrical circuit parameters and current, voltage and power in a circuit. - Familiarity with backup power supply in domestic installation.			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EC110	ELECTRONICS ENGINEERING WORKSHOP	0-0-2-1	2015

Course Objectives

This course gives the basic introduction of electronic hardware systems and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

List of Exercises / Experiments (Minimum of 8 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.]
2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools, Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, CRO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]
4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter.]
5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning(**Any Four circuits**)
 1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
 2. LED blinking circuit using a stable multi-vibrator with transistor BC 107.
 3. Square wave generation using IC 555 timer in IC base.
 4. Sine wave generation using IC 741 OP-AMP in IC base.
 5. RC coupled amplifier with transistor BC 107.
 6. AND and NAND gates in diode transistor logic.
8. Familiarization of electronic systems (**Any three systems**)

- | |
|---|
| <ol style="list-style-type: none">1. Setting up of a PA system with different microphones, loud speakers, mixer etc.2. Assembling and dismantling of desktop computer/laptop/mobile phones.3. Coil/Transformer winding.4. Identify the subsystems of TV, DTH, CCTV, Cable TV, CRO, Function generator etc.5. Screen printing and PCB pattern transfer6. Soldering & de-soldering of SMD using hot air soldering station.7. Introduction to robotics- Familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations. |
| Expected outcome
Student can identify the active and passive electronic components. Student gets hands-on assembling, testing, assembling, dismantling, fabrication and repairing systems by making use of the various tools and instruments available in the Electronics Workshop. |
| |

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CS110	COMPUTER SCIENCE WORKSHOP	0-0-2-1	2015
Course Objectives - To familiarize students with basic hardware and software tools - To implement algorithms studied in the course Introduction to Computing & Problem Solving. - To learn the implementation of control structures, Iterations and recursive functions, Lists, Tuples and Dictionaries. - To implement operations of files. - To implement a small micro project using Python			
List of Exercises / Experiments (Minimum of 8 mandatory) List of Exercises: Introduction: Familiarization of hardware components of a desktop computer (motherboard, cards, memory, slots, power, cables etc.) Familiarization of Operating systems and various tools, particularly those for scientific computing, open source tools etc. Programming exercises in Python based on the course Introduction To Computing and Problem Solving (BE 101-05). The exercises may include programs using the following concepts– Decision making, branching and looping - Variables , Expressions & Conditional statements - Iteration statements (While , For etc.) Function & Function calls - Function calls, Math functions - Parameters and arguments - Adding new functions, Recursion Strings - String traversal - String searching, Comparison - Other important String methods Lists, Tuples and Dictionaries - Traversing List, List Operations			

2. Creation of Dictionary and Operations 3. Lists and Tuples 5. Files and Operations 1. Files - defining, opening/closing, operations 2. Pickling 6. Micro Project: Students are expected to do a micro project by using Python, preferably related to the Web
Expected outcome 1. Students are able to identify common hardware components and their purpose 2. Students gain sufficient awareness about latest software tools. 3. Students are able to develop programs in Python for common problems of reasonable complexity.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CH110	CHEMICAL ENGINEERING WORKSHOP	0-0-2-1	2015
Course Objectives To impart in students the basic knowledge in chemical engineering through simple experiments and demonstrations.			
List of Exercises / Experiments (Minimum of 8 mandatory) 1. Preparation of soap 2. Determination of flash and fire point 3. Preparation of Biodiesel 4. Specific gravity measurement 5. Fabrication of FRP laminates/ Study of filtration equipments 6. Study of distillation column 7. Study of absorption column 8. Study of heat exchanger 9. Study of size reduction equipment 10. Preparation of Pigment			
Expected outcome Students will have a thorough understanding of the basic concepts that they learn in the theory paper “Introduction to Chemical Engineering”.			

Course code	Course Name	L-T-P Credits	Year of Introduction
CS201	DISCRETE COMPUTATIONAL STRUCTURES	3-1-0-4	2016
Pre-requisite: NIL			
Course Objectives 1. To introduce mathematical notations and concepts in discrete mathematics that is essential for computing. 2. To train on mathematical reasoning and proof strategies. 3. To cultivate analytical thinking and creative problem solving skills.			
Syllabus Review of Set theory, Countable and uncountable Sets, Review of Permutations and combinations, Pigeon Hole Principle, Recurrence Relations and Solutions, Algebraic systems (semigroups, monoids, groups, rings, fields), Posets and Lattices, Propositional and Predicate Calculus, Proof Techniques.			
Expected Outcome: Students will be able to 1. identify and apply operations on discrete structures such as sets, relations and functions in different areas of computing. 2. verify the validity of an argument using propositional and predicate logic. 3. construct proofs using direct proof, proof by contraposition, proof by contradiction and proof by cases, and by mathematical induction. 4. solve problems using algebraic structures. 5. solve problems using counting techniques and combinatorics. 6. apply recurrence relations to solve problems in different domains.			
Text Books 1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw–Hill Pub.Co.Ltd, New Delhi, 2003. 2. Ralph. P. Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, 4/e, Pearson Education Asia, Delhi, 2002. References: 1. Liu C. L., “Elements of Discrete Mathematics”, 2/e, McGraw–Hill Int. editions, 1988. 2. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, “Discrete Mathematical Structures”, Pearson Education Pvt Ltd., New Delhi, 2003 3. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 5/e, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2003. 4. Richard Johnsonbaugh, “Discrete Mathematics”, 5/e, Pearson Education Asia, New Delhi, 2002. 5. Joe L Mott, Abraham Kandel, Theodore P Baker, “Discrete Mathematics for Computer Scientists and Mathematicians”, 2/e, Prentice-Hall India, 2009.			

Course Plan			
Module	Contents	Hou rs (54)	End Sem Exam Marks
I	Review of elementary set theory : Algebra of sets – Ordered pairs and Cartesian products – Countable and Uncountable sets	3	15 %
	Relations :- Relations on sets –Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations - Partial ordering- Posets – Hasse diagrams - Meet and Join – Infimum and Supremum	6	
	Functions :- <i>Injective, Surjective and Bijective functions - Inverse of a function- Composition</i>	1	
II	Review of Permutations and combinations, Principle of inclusion exclusion, Pigeon Hole Principle,	3	15 %
	Recurrence Relations: Introduction- Linear recurrence relations with constant coefficients– Homogeneous solutions – Particular solutions – Total solutions	4	
	Algebraic systems:- Semigroups and monoids - Homomorphism, Subsemigroups and submonoids	2	
FIRST INTERNAL EXAM			
III	Algebraic systems (contd...):- Groups, definition and elementary properties, subgroups, Homomorphism and Isomorphism, Generators - Cyclic Groups, Cosets and Lagrange’s Theorem	6	15 %
	Algebraic systems with two binary operations- rings, fields-sub rings, ring homomorphism	2	
IV	Lattices and Boolean algebra :- Lattices –Sublattices – Complete lattices – Bounded Lattices - Complemented Lattices – Distributive Lattices – Lattice Homomorphisms.	7	15 %
	Boolean algebra – sub algebra, direct product and homomorphisms	3	
SECOND INTERNAL EXAM			
V	Propositional Logic:- Propositions – Logical connectives – Truth tables	2	20 %
	Tautologies and contradictions – Contra positive – Logical	3	

	equivalences and implications		
	Rules of inference: Validity of arguments.	3	
VI	Predicate Logic:- Predicates – Variables – Free and bound variables – Universal and Existential Quantifiers – Universe of discourse.	3	20 %
	Logical equivalences and implications for quantified statements – Theory of inference : Validity of arguments.	3	
	Proof techniques: Mathematical induction and its variants – Proof by Contradiction – Proof by Counter Example – Proof by Contra positive.	3	
END SEMESTER EXAM			

Question Paper Pattern:

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
- There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS202	Computer Organization and Architecture	3-1-0-4	2016
Pre-requisite: CS203 Switching theory and logic design			
Course Objectives 1. To impart an understanding of the internal organization and operations of a computer. 2. To introduce the concepts of processor logic design and control logic design.			
Syllabus Fundamental building blocks and functional units of a computer. Execution phases of an instruction. Arithmetic Algorithms. Design of the processing unit – how arithmetic and logic operations are performed. Design of the control unit – hardwired and microprogrammed control. I/O organisation – interrupts, DMA, different interface standards. Memory Subsystem – different types.			
Expected outcome Students will be able to: 1. identify the basic structure and functional units of a digital computer. 2. analyze the effect of addressing modes on the execution time of a program. 3. design processing unit using the concepts of ALU and control logic design. 4. identify the pros and cons of different types of control logic design in processors. 5. select appropriate interfacing standards for I/O devices. 6. identify the roles of various functional units of a computer in instruction execution.			
Text Books: 1. Hamacher C., Z. Vranesic and S. Zaky, <i>Computer Organization</i> ,5/e, McGraw Hill, 2011. 2. Mano M. M., <i>Digital Logic & Computer Design</i>, 4/e, Pearson Education, 2013.			
References: 1. Mano M. M., <i>Digital Logic & Computer Design</i>, 4/e, Pearson Education, 2013. 2. Patterson D.A. and J. L. Hennessey, <i>Computer Organization and Design</i>, 5/e, Morgan Kauffmann Publishers, 2013. 3. William Stallings, <i>Computer Organization and Architecture: Designing for Performance</i>, Pearson, 9/e, 2013. 4. Chaudhuri P., <i>Computer Organization and Design</i>, 2/e, Prentice Hall, 2008. 5. Rajaraman V. and T. Radhakrishnan, <i>Computer Organization and Architecture</i>, Prentice Hall, 2011. 6. Messmer H. P., <i>The Indispensable PC Hardware Book</i>, 4/e, Addison-Wesley, 2001			
Course Plan			
Module	Contents	Hours (51)	Sem.ExamMarks
I	Basic Structure of computers –functional units – basic operational concepts –bus structures – software. Memory locations and addresses – memory operations – instructions and instruction sequencing – addressing modes – ARM Example (programs not required). Basic I/O operations – stacks subroutine calls.	6	15%

II	Basic processing unit – fundamental concepts – instruction cycle - execution of a complete instruction –multiple- bus organization – sequencing of control signals. Arithmetic algorithms: Algorithms for multiplication and division of binary and BCD numbers — array multiplier —Booth’s multiplication algorithm — restoring and non-restoring division — algorithms for floating point, multiplication and division.	10	15%
FIRST INTERNAL EXAMINATION			
III	I/O organization: accessing of I/O devices – interrupts –direct memory access –buses –interface circuits –standard I/O interfaces (PCI, SCSI, USB)	8	15%
IV	Memory system : basic concepts –semiconductor RAMs –memory system considerations – semiconductor ROMs –flash memory –cache memory and mapping functions.	9	15%
SECOND INTERNAL EXAMINATION			
V	Processor Logic Design: Register transfer logic – inter register transfer – arithmetic, logic and shift micro operations –conditional control statements. Processor organization: –design of arithmetic unit, logic unit, arithmetic logic unit and shifter –status register –processor unit –design of accumulator.	9	20%
VI	Control Logic Design: Control organization – design of hardwired control –control of processor unit –PLA control. Micro-programmed control: Microinstructions –horizontal and vertical micro instructions – micro-program sequencer –micro programmed CPU organization.	9	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions..

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS204	Operating Systems	3-1-0-4	2016
Pre-requisite: CS205 Data structures			
Course Objectives 1. To impart fundamental understanding of the purpose, structure, functions of operating system. 2. To impart the key design issues of an operating system			
Syllabus Basic concepts of Operating System, its structure, Process management, inter-process communication, process synchronization, CPU Scheduling, deadlocks, Memory Management, swapping, segmentation, paging, Storage Management - disk scheduling, RAID, File System Interface-implementation. Protection.			
Expected outcome Students will be able to: 1. identify the significance of operating system in computing devices. 2. exemplify the communication between application programs and hardware devices through system calls. 3. compare and illustrate various process scheduling algorithms. 4. apply appropriate memory and file management schemes. 5. illustrate various disk scheduling algorithms. 6. appreciate the need of access control and protection in an operating system.			
Text Book: 1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts, 9/e, Wiley India, 2015.			
References: 1. Garry Nutt, Operating Systems: 3/e, Pearson Education, 2004 2. Bhatt P. C. P., An Introduction to Operating Systems: Concepts and Practice, 3/e, Prentice Hall of India, 2010. 3. William Stallings, Operating Systems: Internals and Design Principles, Pearson, Global Edition, 2015. 4. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, Pearson, 4/e, 2015. 5. Madnick S. and J. Donovan, Operating Systems, McGraw Hill, 2001. 6. Hanson P. B., Operating System Principle, Prentice Hall of India, 2001. 7. Deitel H. M., An Introduction to Operating System Principles, Addison-Wesley, 1990.			
Course Plan			
Module	Contents	Hours (52)	Sem. Exam marks

I	Introduction: Functions of an operating system. Single processor, multiprocessor and clustered systems – overview. Kernel Data Structures – Operating Systems used in different computing environments. Operating System Interfaces and implementation - User Interfaces, System Calls – examples. Operating System implementation – approaches. Operating System Structure – Monolithic, Layered, Micro-kernel, Modular. System Boot process.	7	15%
II	Process Management: Process Concept – Processes-States – Process Control Block – Threads. Scheduling – Queues – Schedulers – Context Switching. Process Creation and Termination. Inter Process Communication: Shared Memory, Message Passing, Pipes.	9	15%
FIRST INTERNAL EXAMINATION			
III	Process Synchronization: Critical Section- Peterson's solution. Synchronization – Locks, Semaphores, Monitors, Classical Problems – Producer Consumer, Dining Philosophers and Readers-Writers Problems	9	15%
IV	CPU Scheduling – Scheduling Criteria – Scheduling Algorithms. Deadlocks – Conditions, Modeling using graphs. Handling – Prevention – Avoidance – Detection-Recovery.	8	15%
SECOND INTERNAL EXAMINATION			
V	Memory Management: Main Memory – Swapping – Contiguous Memory allocation – Segmentation – Paging – Demand paging	9	20%
VI	Storage Management: Overview of mass storage structure- disks and tapes. Disk structure – accessing disks. Disk scheduling and management. Swap Space. File System Interface: File Concepts – Attributes – operations – types – structure – access methods. File system mounting. Protection. File system implementation. Directory implementation – allocation methods. Free space Management. Protection– Goals, Principles, Domain. Access Matrix.	10	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS205	Data Structures	3-1-0-4	2016
Pre-requisite: B101-05 Introduction to Computing and Problem Solving			
Course Objectives 1. To impart a thorough understanding of linear data structures such as stacks, queues and their applications. 2. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications. 3. To impart familiarity with various sorting, searching and hashing techniques and their performance comparison. 4. To impart a basic understanding of memory management.			
Syllabus Introduction to various programming methodologies, terminologies and basics of algorithms analysis, Basic Abstract and Concrete Linear Data Structures, Non-linear Data Structures, Memory Management, Sorting Algorithms, Searching Algorithms, Hashing.			
Expected Outcome: Students will be able to 1. compare different programming methodologies and define asymptotic notations to analyze performance of algorithms. 2. use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently. 3. represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications. 4. illustrate and compare various techniques for searching and sorting. 5. appreciate different memory management techniques and their significance. 6. illustrate various hashing techniques.			
Text Books: 1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009. 2. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning, 2005. References 1. Horwitz E., S. Sahni and S. Anderson, Fundamentals of Data Structures in C, University Press (India), 2008. 2. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication, 1983. 3. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill, 1995. 4. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008 5. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series, 1986. 6. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall, 2004. 7. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI, 1987. 8. Martin Barrett, Clifford Wagner, And Unix: Tools For Software Design, John Wiley, 2008 reprint.			

COURSE PLAN			
Module	Contents	Hours (56)	Sem. Exam Marks
I	Introduction to programming methodologies – structured approach, stepwise refinement techniques, programming style, documentation – analysis of algorithms: frequency count, definition of Big O notation, asymptotic analysis of simple algorithms. Recursive and iterative algorithms.	9	15%
II	Abstract and Concrete Data Structures- Basic data structures – vectors and arrays. Applications, Linked lists:- singly linked list, doubly linked list, Circular linked list, operations on linked list, linked list with header nodes, applications of linked list: polynomials,.	9	15%
III	Applications of linked list (continued): Memory management, memory allocation and de-allocation. First-fit, best-fit and worst-fit allocation schemes Implementation of Stacks and Queues using arrays and linked list, DEQUEUE (double ended queue). Multiple Stacks and Queues, Applications.	9	15%
IV	String: - representation of strings, concatenation, substring searching and deletion. Trees: - m-ary Tree, Binary Trees – level and height of the tree, complete-binary tree representation using array, tree traversals (Recursive and non-recursive), applications. Binary search tree – creation, insertion and deletion and search operations, applications.	10	15%
V	Graphs – representation of graphs, BFS and DFS (analysis not required) applications. Sorting techniques – <i>Bubble sort</i> , <i>Selection Sort</i> , Insertion sort, Merge sort, Quick sort, Heaps and Heap sort. Searching algorithms (Performance comparison expected. Detailed analysis not required)	09	20%
VI	Linear and Binary search. (Performance comparison expected. Detailed analysis not required) Hash Tables – Hashing functions – Mid square, division, folding, digit analysis, collision resolution and Overflow handling techniques.	10	20%

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

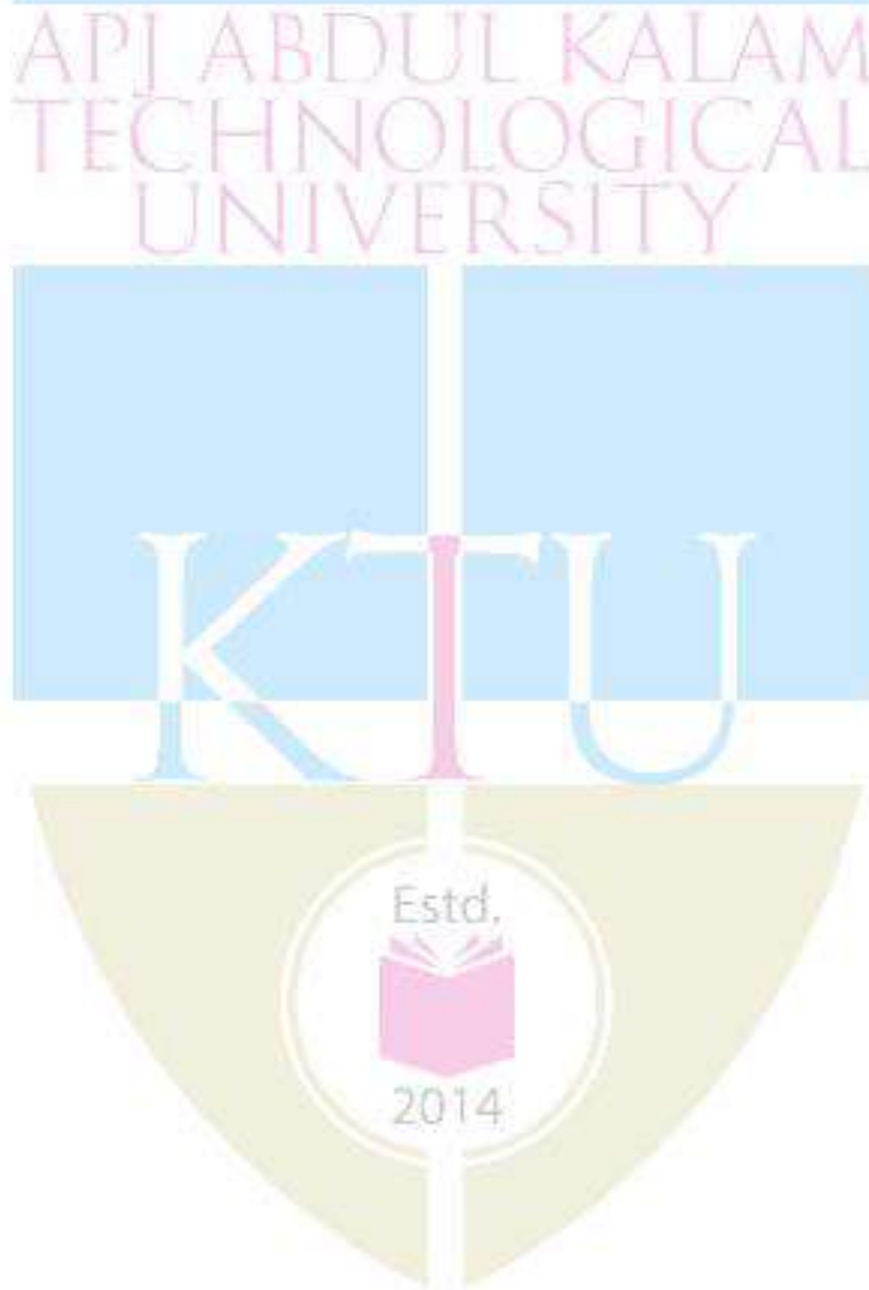
Course code	Course Name	L-T-P - Credits	Year of Introduction
CS206	Object Oriented Design and Programming	2-1-0-3	2016
Pre-requisite: CS205 Data structures			
Course Objectives 1. To introduce basic concepts of object oriented design techniques. 2. To give a thorough understanding of Java language. 3. To provide basic exposure to the basics of multithreading, database connectivity etc. 4. To impart the techniques of creating GUI based applications.			
Syllabus Object oriented concepts, Object oriented systems development life cycle, Unified Modeling Language, Java Overview, Classes and objects, Parameter passing, Overloading, Inheritance, Overriding, Packages, Exception Handling, Input/Output, Threads and multithreading, Applets, Event Handling mechanism, Working with frames and graphics, AWT Controls, Swings, Java database connectivity.			
Expected outcome. Students will be able to: 1. apply object oriented principles in software design process. 2. develop Java programs for real applications using java constructs and libraries. 3. understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using Java language. 4. implement Exception Handling in java. 5. use graphical user interface and Event Handling in java. 6. develop and deploy Applet in java.			
Text Books: 1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011. 2. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.			
References: 1. Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013. 2. Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008. 3. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005. 4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004. 5. Sierra K., Head First Java, 2/e, O'Reilly, 2005. 6. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014. 7.			
Course Plan			
Module	Contents	Hours (42)	Sem. ExamMarks
I	Object oriented concepts, Object oriented systems development life cycle. Unified Modeling Language, UML class diagram, Use-case diagram. Java Overview: Java virtual machine, <i>data types</i> , <i>operators</i> , <i>control statements</i> , Introduction to Java programming.	08	15%

II	Classes fundamentals, objects, methods, constructors, parameter passing, overloading, access control keywords.	07	15%
FIRST INTERNAL EXAMINATION			
III	Inheritance basics, method overriding, abstract classes, interface. Defining and importing packages. Exception handling fundamentals, <u>multiple catch and nested try statements.</u>	06	15%
IV	Input/Output: files, stream classes, reading console input. Threads: thread model, use of Thread class and Runnable interface, thread synchronization, multithreading.	06	15%
SECOND INTERNAL EXAMINATION			
V	String class - basics. Applet basics and methods. Event Handling: delegation event model, event classes, sources, listeners.	07	20%
VI	Introduction to AWT: working with frames, graphics, color, font. AWT Control fundamentals. Swing overview. Java database connectivity: JDBC overview, creating and executing queries, dynamic queries.	08	20%
END SEMESTER EXAM			

Question Paper Pattern:

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
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- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts

6. Part E
- Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/design questions.



Course code	Course Name	L-T-P -Credits	Year of Introduction
CS207	ELECTRONIC DEVICES & CIRCUITS	3-0-0-3	2016
Pre-requisite: BE101-04 Introduction to Electronics Engg.			
Course Objectives: 1. To introduce to the students the fundamental concepts of electronic devices and circuits for engineering applications 2. To develop the skill of analysis and design of various analog circuits using electronic devices 3. To provide comprehensive idea about working principle, operation and applications of electronic circuits 4. To equip the students with a sound understanding of fundamental concepts of operational amplifiers 5. To expose to the diversity of operations that operational amplifiers can perform in a wide range of applications 6. To expose to a variety of electronic circuits/systems using various analog ICs			
Syllabus RC Circuits, Diode Circuits, Regulated power supplies, Field effect transistor , DC analysis of BJT, RC Coupled amplifier, MOSFET amplifiers, Feedback amplifiers, Power amplifiers, Oscillators, Multivibrators, Operational Amplifier and its applications, Timer IC.			
Expected Outcome: Students will be able to 1. explain, illustrate, and design the different electronic circuits using electronic components 2. design circuits using operational amplifiers for various applications			
Text Books: 1. David A Bell, Electronic Devices and Circuits, Oxford University Press, 2008 2. Salivahanan S. and V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008 References : 1. Neamen D., Electronic Circuits, Analysis and Design, 3/e, TMH, 2007 2. Robert Boylestad and L Nashelsky, Electronic Devices and Circuit Theory, Pearson. 3. Bogart T. F., Electronic Devices Circuits, 6/e, Pearson, 2012. 4. Maini A. K. and V. Agrawal, Electronic Devices and Circuits, Wiley India, 2011. 5. K.Gopakumar, Design and Analysis of Electronic Circuits, Phasor Books, Kollam, 2013 6. Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010.			
Course Plan			
Module	Contents	Hou rs (40)	Sem Exam Marks
1	Wave shaping circuits: Sinusoidal and non-sinusoidal wave shapes, Principle and working of RC differentiating and integrating circuits, Conversion of one non-sinusoidal wave shape into another. Clipping circuits - Positive, negative and biased clipper.	5	15%

	Clamping circuits - Positive, negative and biased clamper. Voltage multipliers- Voltage doubler and tripler. Simple sweep circuit using transistor as a switch.		
2	Regulated power supplies: Review of simple zener voltage regulator, Shunt and series voltage regulator using transistors, Current limiting and fold back protection, 3 pin regulators-78XX and 79XX, IC 723 and its use as low and high voltage regulators, DC to DC conversion, Circuit/block diagram and working of SMPS.	4	15 %
	Field effect transistors: JFET – Structure, principle of operation and characteristics, Comparison with BJT. MOSFET- Structure, Enhancement and Depletion types, principle of operation and characteristics.	3	
FIRST INTERNAL EXAM			
3	Amplifiers: Introduction to transistor biasing, operating point, concept of load line, thermal stability, fixed bias, self bias, voltage divider bias. Classification of amplifiers, RC coupled amplifier - voltage gain and frequency response. Multistage amplifiers - effect of cascading on gain and bandwidth. Feedback in amplifiers - Effect of negative feedback on amplifiers. MOSFET Amplifier- Circuit diagram and working of common source MOSFET amplifier.	7	15 %
4	Oscillators: Classification, criterion for oscillation, analysis of Wien bridge oscillator, Hartley and Crystal oscillator. Non-sinusoidal oscillators: Astable, monostable and bi-stable multivibrators using transistors (Only design equations and working of circuit are required, Analysis not required).	5	15 %
SECOND INTERNAL EXAM			
5	Operational amplifiers: Differential amplifier, characteristics of op-amps(gain, bandwidth, slew rate, CMRR, offset voltage, offset current), comparison of ideal and practical op-amp(IC741), applications of op-amps- scale changer, sign changer, adder/summing amplifier, subtractor, integrator, differentiator, Schmitt trigger, Wien bridge oscillator.	8	20 %

6	Integrated circuits: Active filters – Low pass and high pass (first and second order) active filters using op-amp with gain (No analysis required). D/A and A/D convertors – important specifications, Sample and hold circuit. Binary weighted resistor and R-2R ladder type D/A convertors. (concepts only). Flash, dual slope and successive approximation type A/D convertors. Circuit diagram and working of Timer IC555, astable and monostable multivibrators using 555.	8	20 %
END SEMESTER EXAM			

Question Paper Pattern:

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
- There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS232	Free and Open Source Software Lab	0-0-3-1	2016

Pre-requisite: CS204 Operating systems

Course Objectives: To expose students to FOSS environment and introduce them to use open source packages in open source platform.

List of Exercises/Experiments:

- Getting started with Linux basic commands for directory operations, displaying directory structure in tree format etc.
- Linux commands for operations such as redirection, pipes, filters, job control, changing ownership/permissions of files/links/directory.
- Advanced linux commands curl, wget, ftp, ssh and grep
- Shell Programming : Write shell script to show various system configuration like
 - Currently logged user and his login name
 - Your current shell
 - Your home directory
 - Your operating system type
 - Your current path setting
 - Your current working directory
 - Number of users currently logged in
- Write shell script to show various system configurations like
 - your OS and version, release number, kernel version
 - all available shells
 - computer CPU information like processor type, speed etc
 - memory information
 - hard disk information like size of hard-disk, cache memory, model etc
 - File system (Mounted)
- Write a shell script to implement a menu driven calculator with following functions
 - Addition
 - Subtraction
 - Multiplication
 - Division
 - Modulus
- Write a script called addnames that is to be called as follows
./addnames ulist username
 Here *ulist* is the name of the file that contains list of user names and *username* is a particular student's username. The script should
 - check that the correct number of arguments was received and print a message, in case the number of arguments is incorrect
 - check whether the ulist file exists and print an error message if it does not
 - check whether the username already exists in the file. If the username exists, print a message stating that the name already exists. Otherwise, add the username to the end of the list.

8. Version Control System setup and usage using GIT. Try the following features.
- Creating a repository
 - Checking out a repository
 - Adding content to the repository
 - Committing the data to a repository
 - Updating the local copy
 - Comparing different revisions
 - Revert
 - Conflicts and a conflict Resolution
9. Shell script which starts on system boot up and kills every process which uses more than a specified amount of memory or CPU.
10. Introduction to packet management system : Given a set of RPM or DEB, build and maintain, and serve packages over http or ftp. Configure client systems to access the package repository.
11. Perform simple text processing using Perl, Awk.
12. Running PHP : simple applications like login forms after setting up a LAMP stack
13. Virtualisation environment (e.g., xen, kqemu, virtualbox or lguest) to test applications, new kernels and isolate applications. It could also be used to expose students to other alternate OS such as freeBSD
14. Compiling from source : learn about the various build systems used like the auto* family, cmake, ant etc. instead of just running the commands. This could involve the full process like fetching from a cvs and also include autoconf, automake etc.,
15. Kernel configuration, compilation and installation : Download / access the latest kernel source code from *kernel.org*, compile the kernel and install it in the local system. Try to view the source code of the kernel
16. GUI Programming: Create scientific calculator – using any one of Gambas, GTK, QT
17. Installing various software packages. Either the package is yet to be installed or an older version is present. The student can practice installing the latest version. (Internet access is needed).
- Install samba and share files to windows
 - Install Common Unix Printing System(CUPS)
18. Set up the complete network interface by configuring services such as gateway, DNS, IP tables etc. using *ifconfig*

Expected outcome:

The students will be able to:

1. Identify and apply various Linux commands
2. Develop shell scripts and GUI for specific needs
3. Use tools like GIT
4. Perform basic level application deployment, kernel configuration and installation, packet management and installation etc.

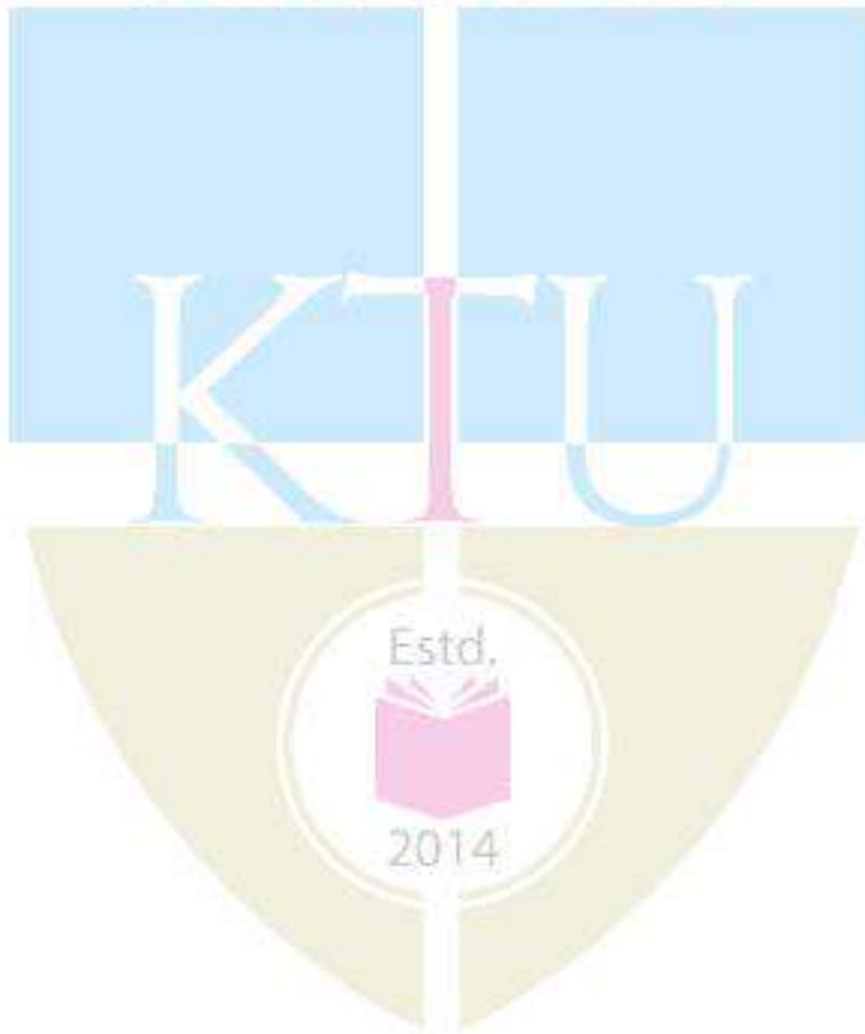
Course No.	Course Name	L-T-P - Credits	Year of Introduction
CS233	ELECTRONICS CIRCUITS LAB	0-0-3-1	2016
Pre-requisite: CS207 Electronic devices & circuits			
Course Objectives: 1. To introduce the working of analog electronic circuits. 2. To design, implement and demonstrate analog circuits using electronic components. 3. To provide hands-on experience to the students so that they are able to put theoretical concepts to practice. 4. To use computer simulation tools such as PSPICE, or Multisim to the simulation of electronic circuits. 5. To create an ability to develop descriptions, explanations, predictions and models using evidence. 6. To create an ability to communicate effectively the scientific procedures and explanations about the experiments in oral/report forms.			
List of Exercises/Experiments : (Minimum 13 experiments are to be done in the semester, at least 6 each should be selected from the first(Exp. 1-10) and second(Exp. 11-20) half. Experiment no. 18 is compulsory). 1. Forward and reverse characteristics of PN diode and Zener diode 2. Input and output characteristics of BJT in CE configuration and evaluation of parameters 3. RC integrating and differentiating circuits-Transient response with different time constant 4. RC low pass and high pass circuits- Frequency response with sinusoidal input 5. Clipping circuits (Positive, negative and biased) - Transient and transfer characteristics 6. Clamping circuits (Positive, negative and biased)- Transient characteristics 7. Bridge Rectifier - with and without filter- ripple factor and regulation 8. Simple Zener regulator- Line and load characteristics 9. RC coupled CE amplifier – Mid band gain and frequency response 10. RC phase shift or Wien bridge oscillator using transistor 11. Astable and Monostable multivibrators using transistors 12. Series voltage regulator (Two transistors)- Line and load characteristics 13. Voltage regulator using LM 723)- Line and load characteristics 14. Astable and mono stable multivibrators using 555 Timer 15. Inverting and non-inverting amplifier using op-amp IC741 16. Instrumentation amplifier using op-amp IC741 17. RC phase shift or Wien bridge oscillator using op-amp IC741 18. Simulation of simple circuits (at least 6 from above) using any SPICE software(Transient, AC and DC analysis)			

Expected Outcome:

Students will be able to:

1. identify basic electronic components, design and develop electronic circuits.
2. Design and demonstrate functioning of various discrete analog circuits
3. Be familiar with computer simulation of electronic circuits and how to use it proficiently for design and development of electronic circuits.
4. Understand the concepts and their applications in engineering.
5. Communicate effectively the scientific procedures and explanations in formal technical presentations/reports.

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Course code	Course Name	L-T-P - Credits	Year of Introduction
CS234	DIGITAL SYSTEMS LAB	0-0-3-1	2016
Pre-requisite: CS203 Switching theory and logic design			
Course Objectives: 1. To familiarize students with digital ICs, the building blocks of digital circuits 2. To provide students the opportunity to set up different types of digital circuits and study their behaviour			
List of Exercises/Experiments : (minimum 12 exercises/experiments are mandatory) 1. Familiarizations and verification of the truth tables of basic gates and universal gates. 2. Verification of Demorgan's laws for two variables. 3. Implementation of half adder and full adder circuits using logic gates. 4. Implementation of half subtractor and full subtractor circuits using logic gates. 5. Implementation of parallel adder circuit. 6. Realization of 4 bit adder/subtractor and BCD adder circuits using IC 7483. 7. Implementation of a 2 bit magnitude comparator circuit using logic gates. 8. Design and implementation of code convertor circuits 9. a) BCD to excess 3 code b) binary to gray code 10. Implementation of multiplexer and demultiplexer circuits using logic gates. Familiarization with various multiplexer and demultiplexer ICs. 11. Realization of combinational circuits using multiplexer/demultiplexer ICs. 12. Implementation of SR, D, JK, JK master slave and T flip flops using logic gates. Familiarization with IC 7474 and IC 7476. 13. Implementation of shift registers using flip flop Integrated Circuits. 14. Implementation of ring counter and Johnson counter using flip flop Integrated Circuits. 15. Realization of asynchronous counters using flip flop ICs. 16. Realization of synchronous counters using flip flop ICs. Familiarization with various counter Integrated Circuits. 17. Implementation of a BCD to 7 segment decoder and display. 18. Simulation of Half adder, Full adder using VHDL. <i>(Note: The experiments may be done using hardware components and/or VHDL)</i>			
Course outcome: Students will be able to: 1. identify and explain the digital ICs and their use in implementing digital circuits. 2. design and implement different kinds of digital circuits.			

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS208	Principles of Database Design	2-1-0-3	2016
Pre-requisite: CS205 Data structures			
Course Objectives - To impart the basic understanding of the theory and applications of database management systems. - To give basic level understanding of internals of database systems. - To expose to some of the recent trends in databases.			
Syllabus: Types of data, database and DBMS, Languages and users. Software Architecture, E-R and Extended E-R Modelling, Relational Model – concepts and languages, relational algebra and tuple relational calculus, SQL, views, assertions and triggers, relational db design, FDs and normal forms, Secondary storage organization, indexing and hashing, query optimization, concurrent transaction processing and recovery principles, recent topics.			
Expected outcome. Students will be able to: - define, explain and illustrate the fundamental concepts of databases. - construct an Entity-Relationship (E-R) model from specifications and to perform the transformation of the conceptual model into corresponding logical data structures. - model and design a relational database following the design principles. - develop queries for relational database in the context of practical applications - define, explain and illustrate fundamental principles of data organization, query optimization and concurrent transaction processing. - appreciate the latest trends in databases.			
Text Books: - Elmasri R. and S. Navathe, <i>Database Systems: Models, Languages, Design and Application Programming</i>, Pearson Education, 2013. - Sliberschatz A., H. F. Korth and S. Sudarshan, <i>Database System Concepts</i>, 6/e, McGraw Hill, 2011.			
References: - Powers S., <i>Practical RDF</i>, O'Reilly Media, 2003. - Plunkett T., B. Macdonald, <i>et al.</i>, <i>Oracle Big Data Hand Book</i>, Oracle Press, 2013.			
Course Plan			
Module	Contents	Hours (42)	Sem. Exam Marks
I	Introduction: Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. (Reading: Elmasri Navathe, Ch. 1 and 2. Additional Reading: Silberschatz, Korth, Ch. 1) Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-	06	15%

	Relationship Diagram, Weak Entity Sets, Relationships of degree greater than 2 (Reading: Elmasri Navathe, Ch. 7.1-7.8)		
II	Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema (Reading: Elmasri Navathe, Ch. 3 and 8.1, Additional Reading: Silbershatz, Korth, Ch. 2.1-2.4) Database Languages: Concept of DDL and DML relational algebra (Reading: Silbershatz, Korth, Ch 2.5-2.6 and 6.1-6.2, Elmasri Navathe, Ch. 6.1-6.5)	06	15%
FIRST INTERNAL EXAM			
III	Structured Query Language (SQL): Basic SQL Structure, examples, Set operations, Aggregate Functions, nested sub-queries (Reading: Elmasri Navathe, Ch. 4 and 5.1) Views, assertions and triggers (Reading: Elmasri Navathe, Ch. 5.2-5.3, Optional reading: Silbershatz, Korth Ch. 5.3).	07	15%
IV	Relational Database Design: Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover (proofs not required). Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions (Reading: Elmasri and Navathe, Ch. 14.1-14.5, 15.1-15.2. Additional Reading: Silbershatz, Korth Ch. 8.1-8.5)	07	15%
SECOND INTERNAL EXAM			
V	Physical Data Organization: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+-Trees (basic structure only, algorithms not needed), (Reading Elmasri and Navathe, Ch. 17.1-17.4) Query Optimization: heuristics-based query optimization, (Reading Elmasri and Navathe, Ch. 18.1, 18.7)	07	20%
VI	Transaction Processing Concepts: overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability. Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, (Reading Elmasri and Navathe, Ch. 20.1-20.5 (except 20.5.4-20.5.5) , Silbershatz, Korth Ch. 15.1 (except 15.1.4-15.1.5), Ch. 16.1 – 16.5) Recent topics (preliminary ideas only): Semantic Web and RDF(Reading: Powers Ch.1, 2), GIS, biological databases (Reading: Elmasri and Navathe Ch. 23.3-23.4) Big Data (Reading: Plunkett and Macdonald, Ch. 1, 2)	09	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module I and II; All four questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module I and II; Two questions have to be answered. Each question can have a maximum of three subparts
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering module III and IV; All four questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering module III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course No.	Course Name	L-T-P - Credits	Year of Introduction
CS231	DATA STRUCTURES LAB	0-0-3-1	2016
Pre-requisite: CS205 Data structures			
Course Objectives 1. To implement basic linear and non-linear data structures and their major operations. 2. To implement applications using these data structures. 3. To implement algorithms for various sorting techniques.			
List of Exercises/Experiments : (Minimum 12 are to be done) 1. Implementation of Stack and Multiple stacks using one dimensional array. ** 2. Application problems using stacks: Infix to post fix conversion, postfix and pre-fix evaluation, MAZE problem etc. ** 3. Implementation of Queue, DEQUEUE and Circular queue using arrays. 4. Implementation of various linked list operations. ** 5. Implementation of stack, queue and their applications using linked list. 6. Implementation of trees using linked list 7. Representation of polynomials using linked list, addition and multiplication of polynomials. ** 8. Implementation of binary trees using linked lists and arrays- creations, insertion, deletion and traversal. ** 9. Implementation of binary search trees – creation, insertion, deletion, search 10. Application using trees 11. Implementation of sorting algorithms – bubble, insertion, selection, quick (recursive and non-recursive), merge sort (recursive and non-recursive), and heap sort.** 12. Implementation of searching algorithms – linear search, binary search.** 13. Representation of graphs and computing various parameters (in degree, out degree etc.) - adjacency list, adjacency matrix. 14. Implementation of BFS, DFS for each representation. 15. Implementation of hash table using various mapping functions, various collision and overflow resolving schemes.** 16. Implementation of various string operations.			

17. Simulation of first-fit, best-fit and worst-fit allocations.

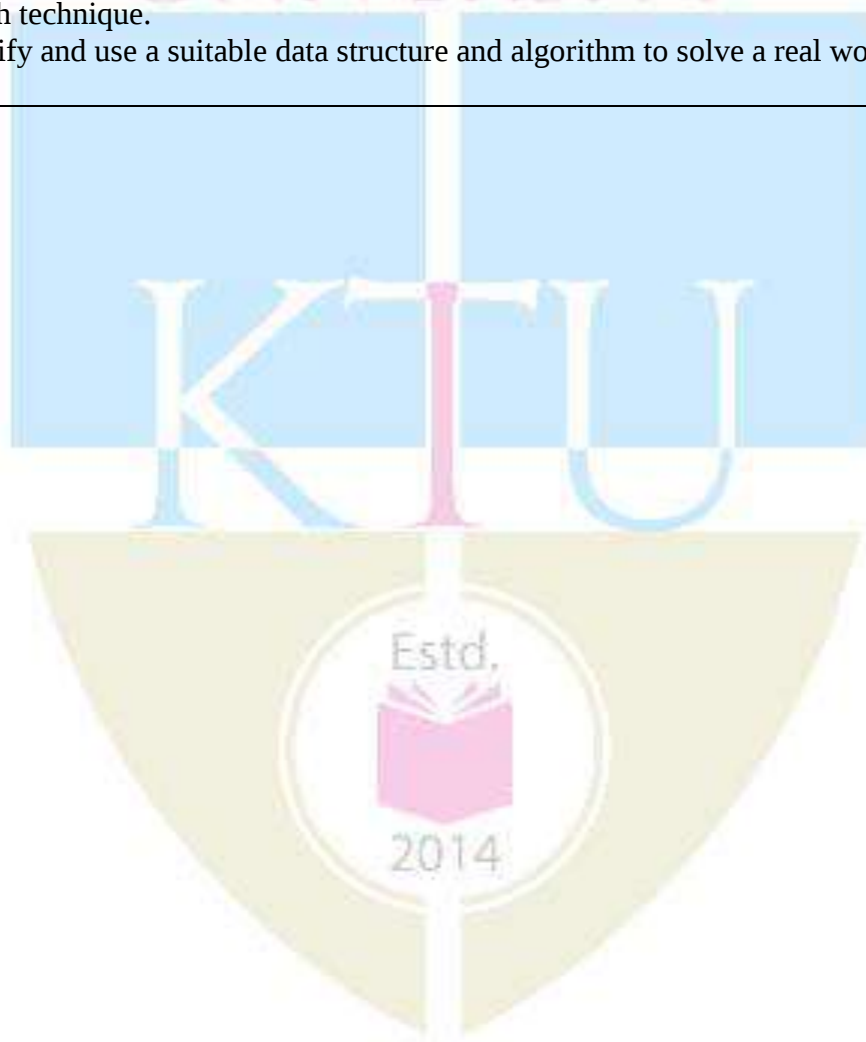
18. Simulation of a basic memory allocator and garbage collector using doubly linked list.

**** mandatory.**

Expected Outcome:

Students will be able to:

1. appreciate the importance of structure and abstract data type, and their basic usability in different applications
2. analyze and differentiate different algorithms based on their time complexity.
3. implement linear and non-linear data structures using linked lists.
4. understand and apply various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems.
5. implement various kinds of searching and sorting techniques, and decide when to choose which technique.
6. identify and use a suitable data structure and algorithm to solve a real world problem.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS301	THEORY OF COMPUTATION	3-1-0-4	2016
Prerequisite: Nil			
Course Objectives - To introduce the concept of formal languages. - To discuss the Chomsky classification of formal languages with discussion on grammar and automata for regular, context-free, context sensitive and unrestricted languages. - To discuss the notions of decidability and halting problem.			
Syllabus Introduction to Automata Theory, Structure of an automaton, classification of automata, grammar and automata for generating each class of formal languages in the Chomsky Hierarchy, decidability and Halting problem.			
Expected Outcome The Students will be able to - Classify formal languages into regular, context-free, context sensitive and unrestricted languages. - Design finite state automata, regular grammar, regular expression and Myhill- Nerode relation representations for regular languages. - Design push-down automata and context-free grammar representations for context-free languages. - Design Turing Machines for accepting recursively enumerable languages. - Understand the notions of decidability and undecidability of problems, Halting problem.			
Text Books - John E Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages, and Computation, 3/e, Pearson Education, 2007 - John C Martin, Introduction to Languages and the Theory of Computation, TMH, 2007 - Michael Sipser, Introduction To Theory of Computation, Cengage Publishers, 2013			
References Dexter C. Kozen, Automata and Computability, Springer 1999.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Automata Theory and its significance. Type 3 Formalism: Finite state automata – Properties of transition functions, Designing finite automata, NFA, Finite Automata with Epsilon Transitions, Equivalence of NFA and DFA, Conversion of NFA to DFA, Equivalence and Conversion of NFA with and without Epsilon Transitions.	10	15 %
II	Myhill-Nerode Theorem, Minimal State FA Computation. Finite State Machines with Output- Mealy and Moore machine (Design Only), Two- Way Finite Automata. Regular Grammar, Regular Expressions, Equivalence of regular expressions and NFA with epsilon transitions. Converting Regular Expressions to NFA with epsilon transitions Equivalence of DFA and regular expressions, converting DFA to Regular Expressions.	10	15 %

FIRST INTERNAL EXAM			
III	Pumping Lemma for Regular Languages, Applications of Pumping Lemma. Closure Properties of Regular sets (Proofs not required), Decision Problems related with Type 3 Formalism Type 2 Formalism:- Context-Free Languages (CFL), Context-Free Grammar (CFG), Derivation trees, Ambiguity, Simplification of CFG, Chomsky Normal Form, Greibach normal forms	09	15 %
IV	Non-Deterministic Pushdown Automata (NPDA), design. Equivalence of acceptance by final state and empty stack in PDA. Equivalence between NPDA and CFG, Deterministic Push Down Automata, Closure properties of CFLs (Proof not required), Decision Problems related with Type 3 Formalism.	08	15 %
SECOND INTERNAL EXAM			
V	Pumping Lemma for CFLs, Applications of Pumping Lemma. Type 1 Formalism: Context-sensitive Grammar. Linear Bounded Automata (Design not required) Type 0 Formalism: Turing Machine (TM) – Basics and formal definition, TMs as language acceptors, TMs as Transducers, Designing Turing Machines.	09	20 %
VI	Variants of TMs -Universal Turing Machine, Multi- tape TMs, Non Deterministic TMs, Enumeration Machine (Equivalence not required), Recursively Enumerable Languages, Recursive languages, Properties of Recursively Enumerable Languages and Recursive Languages, Decidability and Halting Problem. Chomsky Hierarchy	08	20 %
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered. A question can have a maximum of three sub-parts.

There should be at least 60% analytical/numerical questions.

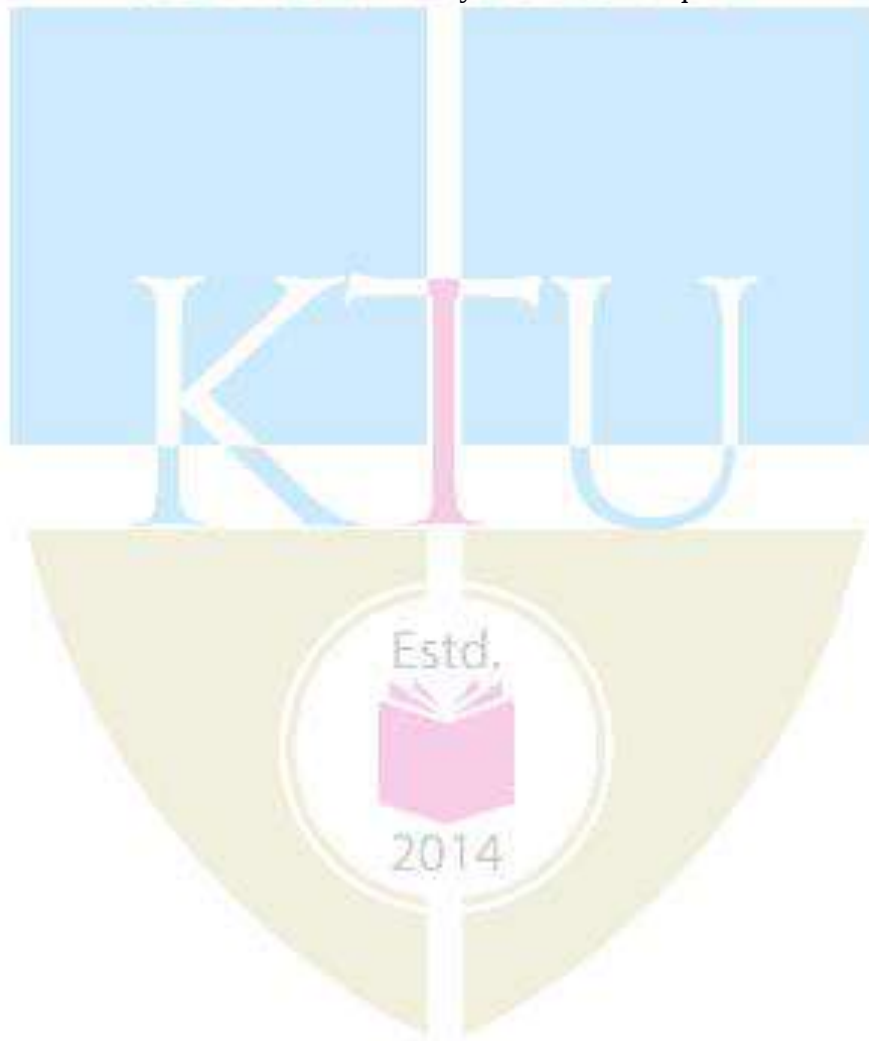
Course code	Course Name	L-T-P - Credits	Year of Introduction
CS302	Design and Analysis of Algorithms	3-1-0-4	2016
Prerequisite: Nil			
Course Objectives - To introduce the concepts of Algorithm Analysis, Time Complexity, Space Complexity. - To discuss various Algorithm Design Strategies with proper illustrative examples. - To introduce Complexity Theory.			
Syllabus Introduction to Algorithm Analysis, Notions of Time and Space Complexity, Asymptotic Notations, Recurrence Equations and their solutions, Master's Theorem, Divide and Conquer and illustrative examples, AVL trees, Red-Black Trees, Union-find algorithms, Graph algorithms, Divide and Conquer, Dynamic Programming, Greedy Strategy, Back Tracking and Branch and Bound, Complexity classes			
Expected outcome The students will be able to - Analyze a given algorithm and express its time and space complexities in asymptotic notations. - Solve recurrence equations using Iteration Method, Recurrence Tree Method and Master's Theorem. - Design algorithms using Divide and Conquer Strategy. - Compare Dynamic Programming and Divide and Conquer Strategies. - Solve Optimization problems using Greedy strategy. - Design efficient algorithms using Back Tracking and Branch Bound Techniques for solving problems. - Classify computational problems into P, NP, NP-Hard and NP-Complete.			
Text Books - Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Computer Algorithms, Universities Press, 2007 [Modules 3,4,5] - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, MIT Press, 2009 [Modules 1,2,6]			
References - Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson Education, 1999. - Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2011. - Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, Pearson Education, 1995. - Richard E. Neapolitan, Kumarss Naimipour, Foundations of Algorithms using C++ Psuedocode, Second Edition, 1997.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks

I	Introduction to Algorithm Analysis Time and Space Complexity- Elementary operations and Computation of Time Complexity- Best, worst and Average Case Complexities- Complexity Calculation of simple algorithms Recurrence Equations: Solution of Recurrence Equations – Iteration Method and Recursion Tree Methods	04 04	15 %
II	Master's Theorem (Proof not required) – examples, Asymptotic Notations and their properties- Application of Asymptotic Notations in Algorithm Analysis- Common Complexity Functions AVL Trees – rotations, Red-Black Trees insertion and deletion (Techniques only; algorithms not expected). B-Trees – insertion and deletion operations. Sets- Union and find operations on disjoint sets.	05 05	15%
FIRST INTERNAL EXAM			
III	Graphs – DFS and BFS traversals, complexity, Spanning trees – Minimum Cost Spanning Trees, single source shortest path algorithms, Topological sorting, strongly connected components.	07	15%
IV	Divide and Conquer: The Control Abstraction, 2 way Merge sort, Strassen's Matrix Multiplication, Analysis Dynamic Programming : The control Abstraction- The Optimality Principle- Optimal matrix multiplication, Bellman-Ford Algorithm	04 05	15%
SECOND INTERNAL EXAM			
V	Analysis, Comparison of Divide and Conquer and Dynamic Programming strategies Greedy Strategy: - The Control Abstraction- the Fractional Knapsack Problem, Minimal Cost Spanning Tree Computation- Prim's Algorithm – Kruskal's Algorithm.	02 04 03	20%
VI	Back Tracking: -The Control Abstraction – The N Queen's Problem, 0/1 Knapsack Problem Branch and Bound: Travelling Salesman Problem. Introduction to Complexity Theory :- Tractable and Intractable Problems- The P and NP Classes- Polynomial Time Reductions - The NP- Hard and NP-Complete Classes	03 03 03	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part C

- a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
5. Part D
- a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
- a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS303	SYSTEM SOFTWARE	2-1-0-3	2016
Prerequisite: Nil			
Course Objectives To make students understand the design concepts of various system software like Assembler, Linker, Loader and Macro pre-processor, Utility Programs such as Text Editor and Debugger.			
Syllabus Different types of System Software, SIC & SIC/XE Architecture and Programming, Basic Functions of Assembler, Assembler Design, Single pass and 2 Pass Assemblers and their Design, Linkers and Loaders, Absolute Loader and Relocating loader, Design of Linking Loader, Macro Processor and its design, Fundamentals of Text Editor Design, Operational Features of Debuggers			
Expected Outcome The Students will be able to - distinguish different software into different categories.. - design, analyze and implement one pass, two pass or multi pass assembler. - design, analyze and implement loader and linker. - design, analyze and implement macro processors. - critique the features of modern editing /debugging tools.			
Text book Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education Asia, 1997.			
References - D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw Hill. http://gcc.gnu.org/onlinedocs/gcc-2.95.3/cpp_1.html - The C Preprocessor - J Nithyashri, System Software, Second Edition, Tata McGraw Hill. - John J. Donovan, Systems Programming, Tata McGraw Hill Edition 1991. - Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, Linux Device Drivers, Third Edition, O.Reilly Books M. Beck, H. Bohme, M. Dziadzka, et al., Linux Kernel Internals, Second Edition, Addison Wesley Publications, - Peter Abel, IBM PC Assembly Language and Programming, Third Edition, Prentice Hall of India. - Writing UNIX device drivers - George Pajari – Addison Wesley Publications (Ebook : http://tocs.ulb.tu-darmstadt.de/197262074.pdf).			
Course Plan			
Module	Contents	Hours	End Sem Exam. Marks

I	Introduction : System Software Vs. Application Software, Different System Software– Assembler, Linker, Loader, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating System(Basic Concepts only) SIC & SIC/XE Architecture, Addressing modes, SIC & SIC/XE Instruction set, Assembler Directives and Programming.	2	15%
		6	
II	Assemblers Basic Functions of Assembler. Assembler output format – Header, Text and End Records- Assembler data structures, Two pass assembler algorithm, Hand assembly of SIC/XE program, Machine dependent assembler features.	6	15 %
FIRST INTERNAL EXAM			
III	Assembler design options: Machine Independent assembler features – program blocks, Control sections, Assembler design options- Algorithm for Single Pass assembler, Multi pass assembler, Implementation example of MASM Assembler	7	15 %
IV	Linker and Loader Basic Loader functions - Design of absolute loader, Simple bootstrap Loader, Machine dependent loader features- Relocation, Program Linking, Algorithm and data structures of two pass Linking Loader, Machine dependent loader features, Loader Design Options.	7	15 %
SECOND INTERNAL EXAM			
V	Macro Preprocessor:- Macro Instruction Definition and Expansion. One pass Macro processor Algorithm and data structures, Machine Independent Macro Processor Features, Macro processor design options	7	20 %
VI	Device drivers: Anatomy of a device driver, Character and block device drivers, General design of device drivers	2	20 %
	Text Editors: Overview of Editing, User Interface, Editor Structure.	2	
	Debuggers :- Debugging Functions and Capabilities, Relationship with other parts of the system, Debugging Methods- By Induction, Deduction and Backtracking.	4	
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules I and II; Allfour questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.



Course code	Course Name	L-T-P - Credits	Year of Introduction
CS306	Computer Networks	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives - To build an understanding of the fundamental concepts of computer networking. - To introduce the basic taxonomy and terminology of computer networking. - To introduce advanced networking concepts.			
Syllabus Concept of layering, LAN technologies (Ethernet), Flow and error control techniques, switching, IPv4/IPv6, routers and routing algorithms (distance vector, link state), TCP/UDP and sockets, congestion control, Application layer protocols.			
Expected Outcome The students will be able to - Visualise the different aspects of networks, protocols and network design models. - Examine various Data Link layer design issues and Data Link protocols. - Analyse and compare different LAN protocols. - Compare and select appropriate routing algorithms for a network. - Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.			
Text Books - Andrew S. Tanenbaum, Computer Networks, 4/e, PHI. - Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill. - Larry L. Peterson & Bruce S. Dave, Computer Networks-A Systems Approach, 5/e, Morgan Kaufmann, 2011.			
References - Fred Halsall, Computer Networking and the Internet, 5/e. - James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e. - Keshav, An Engineering Approach to Computer Networks, Addison Wesley, 1998. - Request for Comments (RFC) Pages - IETF -https://www.ietf.org/rfc.html W. Richard Stevens. TCP/IP Illustrated volume 1, Addison-Wesley, 2005. - William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction – Uses – Network Hardware – LAN –MAN – WAN, Internetworks – Network Software – Protocol hierarchies – Design issues for the layers – Interface & Service – Service Primitives. Reference models – OSI – TCP/IP.	07	15%
II	Data Link layer Design Issues – Flow Control and ARQ techniques. Data link Protocols – HDLC. DLL in Internet. MAC Sub layer – IEEE 802 FOR LANs & MANs, IEEE 802.3, 802.4, 802.5. Bridges - Switches – High Speed LANs - Gigabit Ethernet. Wireless LANs - 802.11 a/b/g/n, 802.15.PPP	08	15%
FIRST INTERNAL EXAMINATION			

III	Network layer – Routing – Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP, OSPF, Routing for mobile hosts.	07	15%
IV	Congestion control algorithms – QoS. Internetworking – Network layer in internet. IPv4 - IP Addressing – Classless and Classfull Addressing. Sub-netting.	07	15%
SECOND INTERNAL EXAMINATION			
V	Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP, Exterior Routing Protocols – BGP. IPv6 – Addressing – Issues, ICMPv6.	07	20%
VI	Transport Layer – TCP & UDP. Application layer –FTP, DNS, Electronic mail, MIME, SNMP. Introduction to World Wide Web.	07	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
- There should be at least 60% analytical/numerical questions.

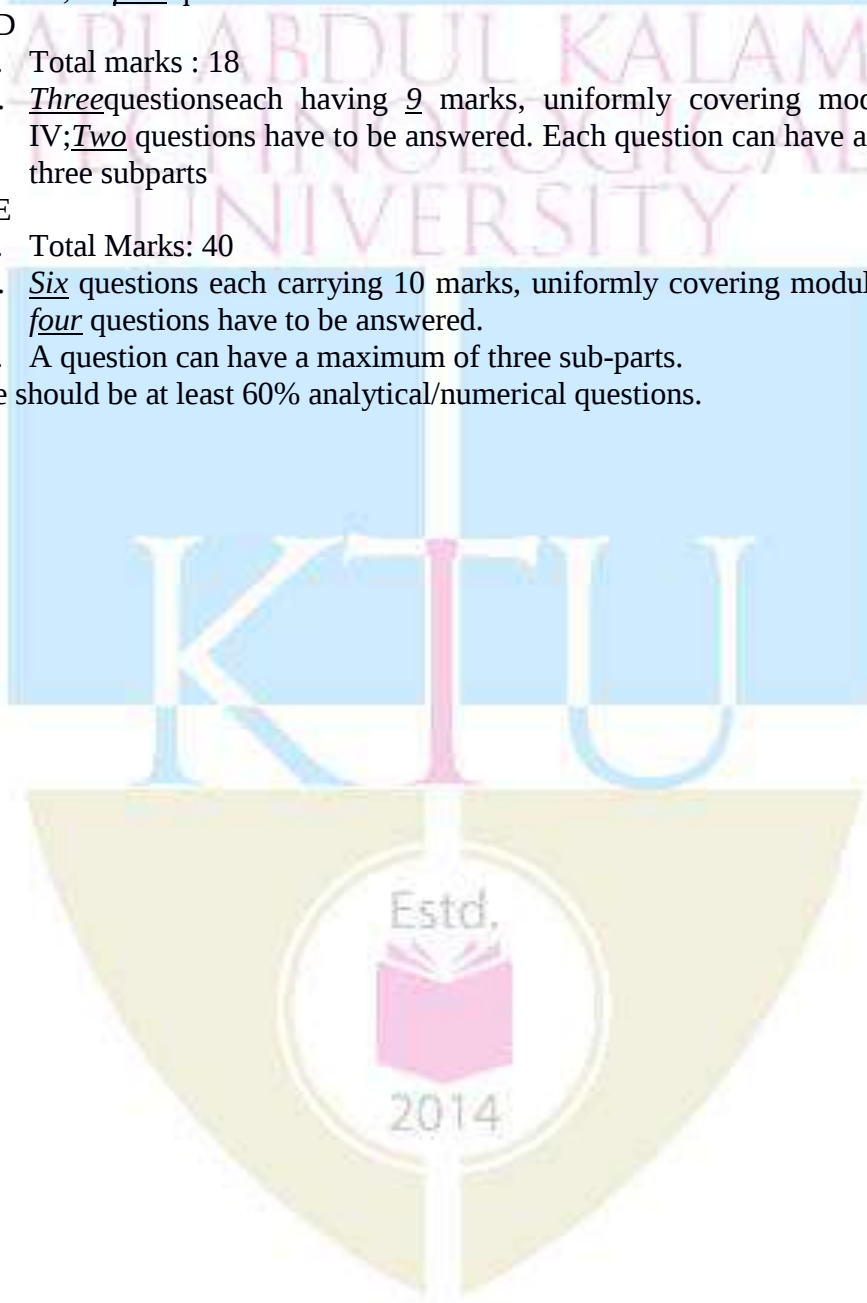
Course code.	Course Name	L-T-P-Credits	Year of Introduction
CS307	DATA COMMUNICATION	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives - To introduce fundamental communication models. - To discuss various time domain and frequency domain concepts of data communication. - To introduce the concepts of encoding, multiplexing and spread spectrum.			
Syllabus Data Transmission, Transmission Impairments, Channel Capacity, Transmission media, Wireless propagation, Signal encoding Techniques, Multiplexing, Digital data transmission techniques, Sampling theorem, Error detection and correction, Spread spectrum, Basic principles of switching.			
Expected Outcome The Students will be able to - Identify and list the various issues present in the design of a data communication system. - Apply the time domain and frequency domain concepts of signals in data communication. - Compare and select transmission media based on transmission impairments and channel capacity. - Select and use appropriate signal encoding techniques and multiplexing techniques for a given scenario. - Design suitable error detection and error correction algorithms to achieve error free data communication and explain different switching techniques.			
Text Books - Curt M. White, Fundamentals of Networking and Communication 7/e, Cengage learning. [Chapter 3,4,9,10] - Forouzan B. A., Data Communications and Networking, 5/e, Tata McGraw Hill, 2013. [Chapters:3,4, 5, 6,7,8] - Schiller J., Mobile Communications, 2/e, Pearson Education, 2009. [Chapters:2,3] - William Stallings, Data and Computer Communication 9/e, Pearson Education, Inc. [Chapters: 4, 5, 6, 7, 8, 9].			
References - Forouzan B. A., Data Communications and Networking, 4/e, Tata McGraw Hill, 2007. - Tanenbaum A. S. and D. Wetherall, Computer Networks, Pearson Education, 2013.			
COURSE PLAN			
Module	Contents	Hours	End Sem. Exam Marks

I	Data Transmission: Communication model Simplex, half duplex and full duplex transmission - Periodic Analog signals: Sine wave, phase, wavelength, time and frequency domain, bandwidth - Digital Signals; Digital data Transmission:- Analog & Digital data, Analog & Digital signals, Analog & Digital transmission – Transmission Impairments: Attenuation, Delay distortion, Noise - Channel capacity: Nyquist Bandwidth, Shannon's Capacity formula.	08	15%
II	Transmission media - Guided Transmission Media: Twisted pair, Coaxial cable, optical fiber, Wireless Transmission, Terrestrial microwave, Satellite microwave. Wireless Propagation: Ground wave propagation, Sky Wave propagation, LoS Propagation.	07	15%
FIRST INTERNAL EXAM			
III	Signal Encoding techniques - Digital Data Digital Signals: NRZ, Multilevel binary, Biphase - Digital Data Analog Signals : ASK, FSK, PSK - Analog Data Digital Signals: Sampling theorem, PCM, Delta Modulation - Analog Data Analog Signals: AM, FM, PM.	07	15%
IV	Multiplexing- Space Division Multiplexing-Frequency Division Multiplexing: Wave length Division Multiplexing - Time Division multiplexing: Characteristics, Digital Carrier system, SONET/SDH-Statistical time division multiplexing: Cable Modem - Code Division Multiplexing. Multiple Access– CDMA.	07	15%
SECOND INTERNAL EXAM			
V	Digital Data Communication Techniques - Asynchronous transmission, Synchronous transmission-Detecting and Correcting Errors-Types of Errors-Error Detection: Parity check, Cyclic Redundancy Check (CRC) - Error Control Error Correction: Forward Error Correction and Hamming Distance.	06	20%
VI	Spread Spectrum Techniques-Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS). Basic principles of switching - Circuit Switched Networks, Structure of Circuit Switch - Packet Switching: Datagram Networks, Virtual Circuit Networks, Structure of packet switches.	07	20%
END SEMESTER EXAM			

Question Paper Pattern

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 - Total marks : 12
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- Part B

- a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
- a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
5. Part D
- a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
- a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.



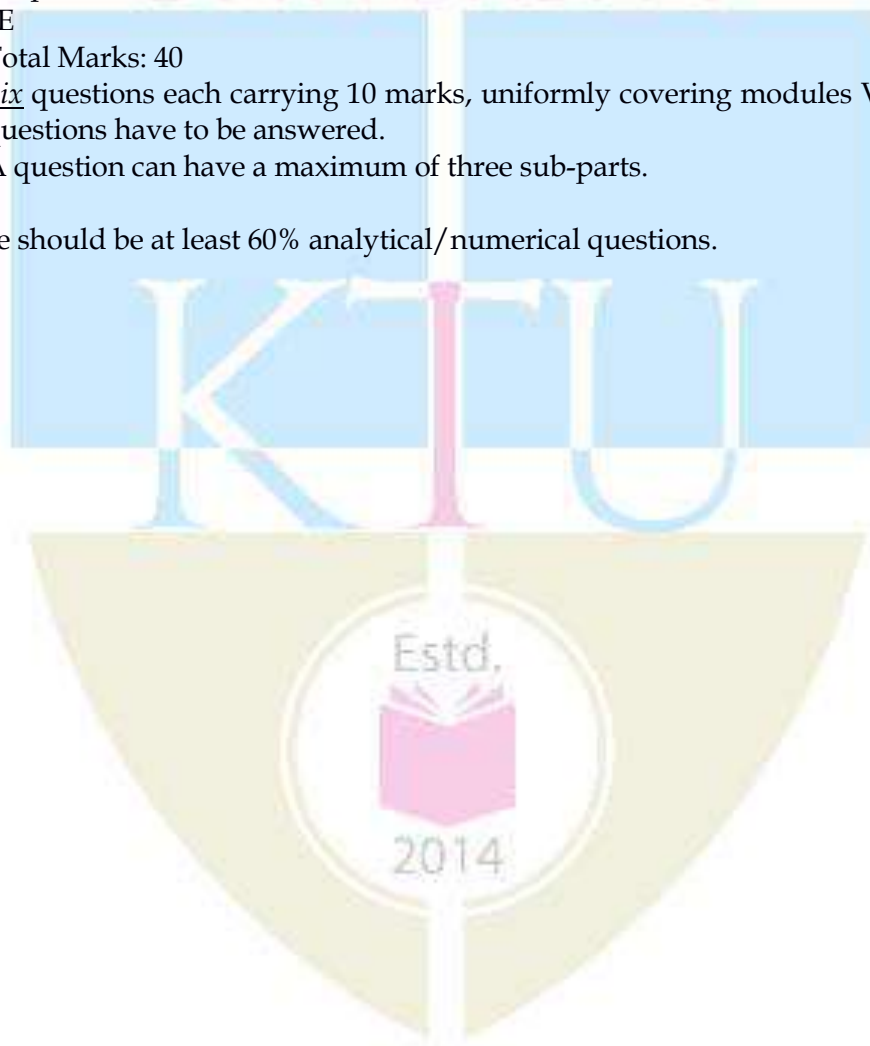
Course code	Course Name	L-T-P-Credits	Year of Introduction
CS308	Software Engineering and Project Management	3-0-0-3	2016
Pre-requisite: Nil			
Course Objectives - To introduce the fundamental concepts of software engineering. - To build an understanding on various phases of software development. - To introduce various software process models.			
Syllabus Introduction to software engineering, Software process models, Software development phases, Requirement analysis, Planning, Design, Coding, Testing, Maintenance.			
Expected Outcome The students will be able to - Identify suitable life cycle models to be used. - Analyze a problem and identify and define the computing requirements to the problem. - Translate a requirement specification to a design using an appropriate software engineering methodology. - Formulate appropriate testing strategy for the given software system. - Develop software projects based on current technology, by managing resources economically and keeping ethical values.			
References - Ian Sommerville, Software Engineering, University of Lancaster, Pearson Education, Seventh edition, 2004. K. K. Aggarwal and Yogesh Singh, Software Engineering, New age International Publishers, Second edition, 2005. - Roger S. Pressman, Software Engineering : A practitioner's approach, McGraw Hill publication, Eighth edition, 2014 - S.A. Kelkar, Software Project Management: A concise study, PHI, Third edition, 2012. - Walker Royce, Software Project Management : A unified frame work, Pearson Education, 1998			
COURSE PLAN			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to software engineering- scope of software	07	15%

	engineering - historical aspects, economic aspects, maintenance aspects, specification and design aspects, team programming aspects. Software engineering a layered technology - processes, methods and tools. Software process models - prototyping models, incremental models, spiral model, waterfall model.		
II	Process Framework Models: Capability maturity model (CMM), ISO 9000. Phases in Software development - requirement analysis- requirements elicitation for software, analysis principles, software prototyping, specification.	06	15%
FIRST INTERNAL EXAM			
III	Planning phase - project planning objective, software scope, empirical estimation models- COCOMO, single variable model, staffing and personal planning. Design phase - design process, principles, concepts, effective modular design, top down, bottom up strategies, stepwise refinement.	07	15%
IV	Coding - programming practice, verification, size measures, complexity analysis, coding standards. Testing - fundamentals, white box testing, control structure testing, black box testing, basis path testing, code walk-throughs and inspection, testing strategies-Issues, Unit testing, integration testing, Validation testing, System testing.	07	15%
SECOND INTERNAL EXAM			
V	Maintenance-Overview of maintenance process, types of maintenance. Risk management: software risks - risk identification-risk monitoring and management. Project Management concept: People - Product-Process-Project.	07	20%
VI	Project scheduling and tracking: Basic concepts-relation between people and effort-defining task set for the software project-selecting software engineering task Software configuration management: Basics and standards User interface design - rules. Computer aided software engineering tools - CASE building blocks, taxonomy of CASE tools, integrated CASE environment.	08	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper - A, B, C, D, E
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 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II;

- Allfour questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
 4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.
 5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
 6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.
 7. There should be at least 60% analytical/numerical questions.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS309	GRAPH THEORY AND COMBINATORICS	2-0-2-3	2016
Prerequisite: Nil			
Course Objectives To introduce the fundamental concepts in graph theory, including properties and characterization of graphs/ trees and Graphs theoretic algorithms			
Syllabus Introductory concepts of graphs, Euler and Hamiltonian graphs, Planar Graphs, Trees, Vertex connectivity and edge connectivity, Cut set and Cut vertices, Matrix representation of graphs, Graphs theoretic algorithms.			
Expected Outcome The Students will be able to - Demonstrate the knowledge of fundamental concepts in graph theory, including properties and characterization of graphs and trees. - Use graphs for solving real life problems. - Distinguish between planar and non-planar graphs and solve problems. - Develop efficient algorithms for graph related problems in different domains of engineering and science.			
Text Books - Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001 - Narasimha Deo, Graph theory, PHI, 1979. - Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd., 2010			
References R. Diestel, <i>Graph Theory</i>, free online edition, 2016: diestel-graph-theory.com/basic.html.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introductory concepts - What is graph – Application of graphs – finite and infinite graphs – Incidence and Degree – Isolated vertex, pendent vertex and Null graph. Paths and circuits – Isomorphism, sub graphs, walks, paths and circuits, Connected graphs, disconnect graphs.	09	15 %
II	Euler graphs, Hamiltonian paths and circuits, Dirac's theorem for Hamiltonicity, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation	10	15 %
FIRST INTERNAL EXAM			
III	Trees – properties, pendent vertex, Distance and centres - Rooted and binary tree, counting trees, spanning trees.	07	15 %
IV	Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits, Planar graphs, Different representation of planar graphs, Euler's theorem, Geometric dual, Combinatorial dual.	09	15 %
SECOND INTERNAL EXAM			

V	Matrix representation of graphs- Adjacency matrix, Incidence Matrix, Circuit matrix, Fundamental Circuit matrix and Rank, Cut set matrix, Path matrix	08	20 %
VI	Graphs theoretic algorithms - Algorithm for computer representation of a graph, algorithm for connectedness and components, spanning tree, shortest path.	07	20 %
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; Allfour questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
- There should be at least 60% analytical/numerical questions.

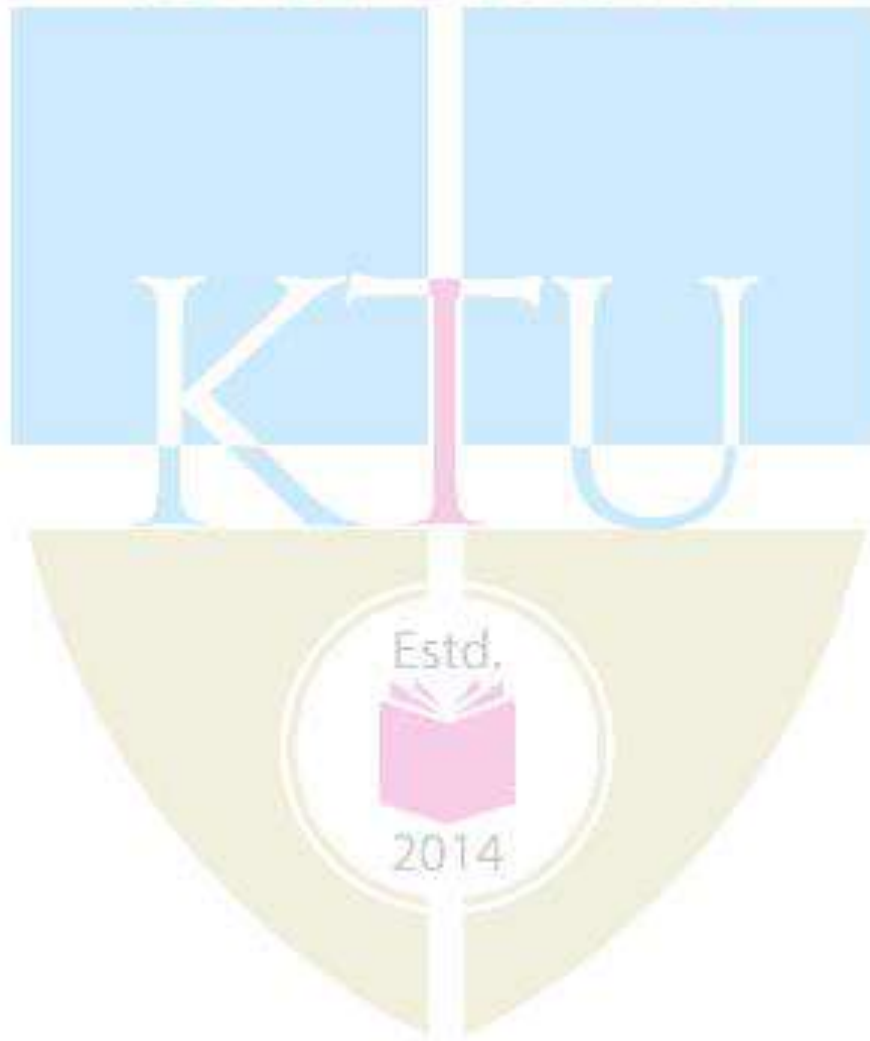
Course code	Course Name	L-T-P Credits	Year of Introduction
CS331	SYSTEM SOFTWARE LAB	0-0-3-1	2016
Prerequisite: Nil			
Course Objectives To build an understanding on design and implementation of different types of system software.			
List of Exercises/Experiments: (Exercises/experiments marked with * are mandatory from each part. Total 12 Exercises/experiments are mandatory)			
<u>Part A</u> - Simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. - FCFS - SJF - Round Robin (pre-emptive) - Priority - Simulate the following file allocation strategies. - Sequential - Indexed - Linked - Implement the different paging techniques of memory management. - Simulate the following file organization techniques * - Single level directory - Two level directory - Hierarchical - Implement the banker's algorithm for deadlock avoidance.* - Simulate the following disk scheduling algorithms. * - FCFS - SCAN - C-SCAN - Simulate the following page replacement algorithms - FIFO - LRU - LFU - Implement the producer-consumer problem using semaphores. * - Write a program to simulate the working of the dining philosopher's problem.*			
<u>Part B</u> - Implement the symbol table functions: create, insert, modify, search, and display. - Implement pass one of a two pass assembler. * - Implement pass two of a two pass assembler. * - Implement a single pass assembler. * - Implement a two pass macro processor * - Implement a single pass macro processor. - Implement an absolute loader. - Implement a relocating loader. - Implement pass one of a direct-linking loader. - Implement pass two of a direct-linking loader. - Implement a simple text editor with features like insertion / deletion of a character, word, and sentence. - Implement a symbol table with suitable hashing.*			

Expected Outcome

The students will be able to

- i. Compare and analyze CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
- ii. Implement basic memory management schemes like paging.
- iii. Implement synchronization techniques using semaphores etc.
- iv. Implement banker's algorithm for deadlock avoidance.
- v. Implement memory management schemes and page replacement schemes and file allocation and organization techniques.
- vi. Implement system software such as loaders, assemblers and macro processor.

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Course code	Course Name	L-T-P-Credits	Year of Introduction
CS332	MICROPROCESSOR LAB	0-0-3-1	2016
Pre-requisite: CS305 Microprocessors and Microcontrollers			
Course Objectives - To practice assembly language programming on 8086. - To practice fundamentals of interfacing/programming various peripheral devices with microprocessor/microcontroller.			
List of Exercises/ Experiments: (Minimum 12 Exercises/ Experiments are mandatory. Exercises/ Experiments marked with * are mandatory)			
I. Assembly Language Programming Exercises/Experiments using 8086 Trainer kit - Implementation of simple decimal arithmetic and bit manipulation operations.* - Implementation of code conversion between BCD, Binary, Hexadecimal and ASCII. - Implementation of searching and sorting of 16-bit numbers. - Programming exercises using stack and subroutines.*			
II. Exercises/Experiments using MASM (PC Required) - Study of Assembler and Debugging commands. - Implementation of decimal arithmetic(16 and 32 bit) operations.* - Implementation of String manipulations.* - Implementation of searching and sorting of 16-bit numbers. - Implementation of Matrix operations like addition, transpose, multiplication etc.			
III. Interfacing Exercises/Experiments with 8086 trainer kit through Assembly Language Programming - Interfacing with stepper motor - Rotate through any given sequence.* - Interfacing with 8255 (mode0 and mode1 only).* - Interfacing with 8279 (Rolling message, 2 key lock out and N-key roll over implementation).* - Interfacing with 8253/54 Timer/Counter. - Interfacing with Digital-to-Analog Converter.* - Interfacing with Analog-to- Digital Converter. - Interfacing with 8259 Interrupt Controller.			
IV. Exercises/Experiments using 8051 trainer kit - Familiarization of 8051 trainer kit by executing simple Assembly Language programs such as decimal arithmetic and bit manipulation.* - Implementation of Timer programming (in mode1). - Implementation of stepper motor interfacing, ADC/DAC interfacing and sensor interfacing with 8251 through Assembly Language programming.			
Expected Outcome The students will be able to - Develop assembly language programs for problem solving using software interrupts and various assembler directives. - Implement interfacing of various I/O devices to the microprocessor/microcontroller through assembly language programming.			

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS334	Network Programming Lab	0-0-3-1	2016
Pre-requisite: CS307 Data Communication			
Course Objectives - To introduce Network related commands and configuration files in Linux Operating System. - To introduce tools for Network Traffic Analysis and Network Monitoring. - To practice Network Programming using Linux System Calls. - To design and deploy Computer Networks.			
List of Exercises/ Experiments (12 Exercises/ Experiments are to be completed . Exercises/ Experiments marked with * are mandatory) - Getting started with Basics of Network configurations files and Networking Commands in Linux. - To familiarize and understand the use and functioning of System Calls used for Operating system and network programming in Linux. <u>Familiarization and implementation of programs related to Process and thread.</u> <u>Implement the First Readers-Writers Problem.</u> <u>Implement the Second Readers-Writers problem.</u> <u>Implement programs for Inter Process Communication using PIPE, Message Queue and Shared Memory.</u> - Implement Client-Server communication using Socket Programming and TCP as transport layer protocol.* - Implement Client-Server communication using Socket Programming and UDP as transport layer protocol.* - Implement a multi user chat server using TCP as transport layer protocol.* - Implement Concurrent Time Server application using UDP to execute the program at remoteserver. Client sends a time request to the server, server sends its system time back to the client. Client displays the result.* - Implement and simulate algorithm for Distance vector routing protocol. - Implement and simulate algorithm for Link state routing protocol. - Implement Simple Mail Transfer Protocol.* - Develop concurrent file server which will provide the file requested by client if it exists. If not server sends appropriate message to the client. Server should also send its process ID (PID) to clients for display along with file or the message.* - Using Wireshark observe data transferred in client server communication using UDP and identify the UDP datagram. - Using Wireshark observe Three Way Handshaking Connection Establishment, Data Transfer and Three Way Handshaking Connection Termination in client server communication using TCP. - Develop a packet capturing and filtering application using raw sockets. - Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure the following services in the network- TELNET, SSH, FTP server, Web server, File server, DHCP server and DNS server.* - Install network simulator NS-2 in any of the Linux operating system and simulate wired and wireless scenarios.			
Expected Outcome The students will be able to - Use network related commands and configuration files in Linux Operating System. - Develop operating system and network application programs. - Analyze network traffic using network monitoring tools.			

Course code	Course Name	L-T-P Credits	Year of Introduction
CS361	SOFT COMPUTING	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrids.			
Syllabus Introduction to Soft Computing, Artificial Neural Networks, Fuzzy Logic and Fuzzy systems, Genetic Algorithms, hybrid systems.			
Expected Outcome The Students will be able to - Learn soft computing techniques and their applications. - Analyze various neural network architectures. - Define the fuzzy systems. - Understand the genetic algorithm concepts and their applications. - Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution.			
Text Books S. N. Sivanandam and S. N. Deepa, Principles of soft computing – John Wiley & Sons, 2007. - Timothy J. Ross, Fuzzy Logic with engineering applications, John Wiley & Sons, 2016.			
References N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009. - Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.1998 R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007. - Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control- Narosa Pub., 2001. - Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 1992 - Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning- Addison Wesley, 1989.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Soft Computing Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.	07	15%
II	Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm	07	15%
FIRST INTERNAL EXAM			

III	Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations	07	15%
IV	Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda – cuts for fuzzy sets, Defuzzification methods	07	15%
SECOND INTERNAL EXAM			
V	Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules - Decomposition of rules – Aggregation of rules, Fuzzy Inference Systems - Mamdani and Sugeno types, Neuro-fuzzy hybrid systems – characteristics - classification	07	20%
VI	Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - cross over – mutation, Stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic-Fuzzy rule based system	07	20%
END SEMESTER EXAMINATION			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three sub-parts
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.
- There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS362	Computer Vision	3-0-0-3	2016
Pre-requisite: NIL			
Course Objectives - To build an understanding on detailed models of image formation. - To expose the students to image feature detection and matching. - To introduce fundamental algorithms for pattern recognition. - To introduce various classification techniques. - To expose the students to various structural pattern recognition and feature extraction techniques.			
Syllabus Image formation and Image model with Components of a vision system, Multiple images and the Geometry of multiple views, High level vision, Basics of pattern recognition, Linear discriminant based classifiers and tree classifiers, Unsupervised Methods, Recent Advances in Pattern Recognition.			
Expected Outcome The students will be able to - Appreciate the detailed models of image formation. - Analyse the techniques for image feature detection and matching. - Apply various algorithms for pattern recognition. - Examine various clustering algorithms. - Analyze structural pattern recognition and feature extraction techniques.			
Text Books: - Bernd Jahne and Horst HauBecker, Computer vision and Applications, Academic press, 2000. - David A. Forsyth & Jean Ponce, Computer vision – A Modern Approach, Prentice Hall, 2002.			
References C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001. - Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, 2004. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.			
COURSE PLAN			
Module	Contents	Hours	End Sem. Exam Marks

I	Image formation and Image model- Components of a vision system- Cameras- camera model and camera calibration- Radiometry- Light in space- Light in surface - Sources, shadows and shading.	06	15%
II	Multiple images-The Geometry of multiple views- Stereopsis- Affine structure from motion- Elements of Affine Geometry Affine structure and motion from two images- Affine structure and motion from multiple images- From Affine to Euclidean images.	07	15%
FIRST INTERNAL EXAM			
III	High level vision- Geometric methods- Model based vision- Obtaining hypothesis by pose consistency, pose clustering and using Invariants, Verification.	07	15%
IV	Introduction to pattern and classification, supervised and unsupervised learning, Clustering Vs classification, Bayesian Decision Theory- Minimum error rate classification Classifiers, discriminant functions, decision surfaces- The normal density and discriminant-functions for the Normal density.	07	15%
SECOND INTERNAL EXAM			
V	Linear discriminant based classifiers and tree classifiers Linear discriminant function based classifiers- Perceptron- Minimum Mean Squared Error (MME) method, Support Vector machine, Decision Trees: CART, ID3.	07	20%
VI	Unsupervised Methods Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Different distance functions and similarity measures, K-means algorithm. Recent Advances in Pattern Recognition Neural network structures for pattern recognition, Pattern classification using Genetic Algorithms.	08	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II;

Two questions have to be answered. Each question can have a maximum of three subparts.

4. Part C

a. Total marks : 12

b. Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.

5. Part D

a. Total marks : 18

b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts

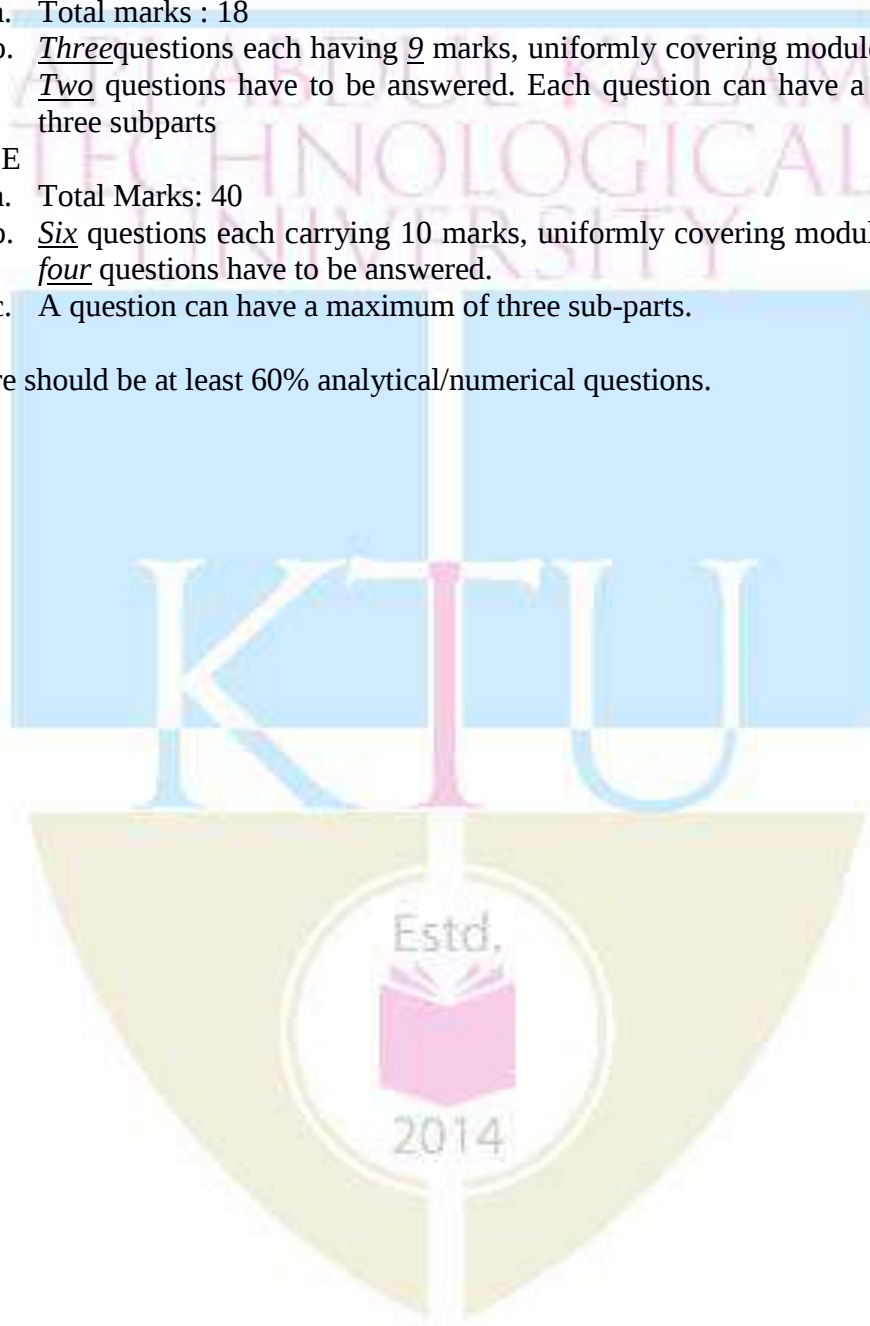
6. Part E

a. Total Marks: 40

b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.

c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.



Course code	Course Name	L-T-P - Credits	Year of Introduction
CS364	Mobile Computing	3-0-0-3	2016
Pre-requisite: CS307 Data Communication			
Course Objectives - To impart basic understanding of the wireless communication systems. - To expose students to various aspects of mobile and ad-hoc networks.			
Syllabus Mobile Computing Application and Services, Mobile Computing Architecture, Emerging Technologies, Intelligent Networks and Internet, Wireless LAN, MAC layer routing, Mobile transport layer Security Issues in mobile computing.			
Expected Outcome Student is able to - Explain various Mobile Computing application, services and architecture. - Understand various technology trends for next generation cellular wireless networks. - Describe protocol architecture of WLAN technology. - Understand Security Issues in mobile computing.			
Text Books - Asoke K. Talukder, Hasan Ahmad, Mobile Computing Technology- Application and Service Creation, 2nd Edition, McGraw Hill Education. - Jochen Schiller, Mobile Communications, Pearson Education Asia, 2008. - Jonathan Rodriguez , Fundamentals of 5G Mobile Networks, ,Wiley Publishers, 2015 - Theodore S. Rappaport, Wireless Communications Principles and Practice, 2/e, PHI, New Delhi, 2004.			
References Andrew S. Tanenbaum, Computer Networks, PHI, Third edition, 2003.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to mobile computing, Middleware and Gateways, Application and services, Internet-Ubiquitous networks, Architecture and three-tier architecture for Mobile Computing, Design consideration for Mobile Computing.	06	15%
II	Spread spectrum – Direct sequence, Frequency hopping. Medium Access Control - SDMA, FDMA, TDMA, CDMA, Cellular concepts- channel assignment strategy- hand off strategy interface and system capacity- improving coverage and capacity in cellular system, Satellite Systems-GEO, LEO, MEO. Wireless Communication Systems- Telecommunication Systems- GSM-GSM services & features, architecture -DECT features & characteristics, architecture.	06	15%
FIRST INTERNAL EXAM			
III	Wireless LANS: Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, Cellular Networks: Channel allocation, multiple access, location management, Handoffs. MAC Layer & Management, Routing - Classification of Routing	07	15%

	Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.		
IV	Mobile internet-mobile network layer-mobile IP-dynamic host configuration protocol-, mobile transport layer-implications of TCP on mobility-indirect TCP-snooping TCP- mobile TCP transmission-selective retransmission, Transaction oriented TCP- Support for mobility-file systems-WAP.	07	15%
SECOND INTERNAL EXAM			
V	Mobile Transport Layer - Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Protocols and Platforms for Mobile Computing - WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Linux for Mobile Devices, Android.	08	20%
VI	Security issues in mobile computing, Information Security, Components of Information Security, Next Generation Networks-LTE – Architecture & Interface – LTE radio planning and tools, 5G architecture, MIMO, Super core concept, Features and Application Case Study – Setting up an adhoc network system, LiFi.	08	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be *five* parts in the question paper – A, B, C, D, E
- Part A
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 - Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
- Part B
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
- Part C
 - Total marks : 12
 - Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
- Part E
 - Total Marks: 40
 - Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - A question can have a maximum of three sub-parts.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS365	OPTIMIZATION TECHNIQUES	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives - To build an understanding on the basics of optimization techniques. - To introduce basics of linear programming and meta- heuristic search techniques.			
Syllabus Basics of Operations Research - Formulation of optimization problems - Linear Programming - Transportation Problem - Assignment Problem - Network flow Problem - Tabu Search - Genetic Algorithm - Simulated Annealing – Applications.			
Expected Outcome The Students will be able to - Formulate mathematical models for optimization problems. - Analyze the complexity of solutions to an optimization problem. - Design programs using meta-heuristic search concepts to solve optimization problems. - Develop hybrid models to solve an optimization problem.			
Text Books G. Zapfel, R. Barune and M. Bogl, Meta heuristic search concepts: A tutorial with applications to production and logistics, Springer, 2010. - Hamdy A. Taha, Operations Research – An introduction, Pearson Education, 2010. - Rao S.S., Optimization Theory and Applications, Wiley Eastern, 1984.			
References - Gass S. I., Introduction to Linear Programming, Tata McGraw Hill. - Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley, 1989. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India, 2004. - Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman, 1993.			
COURSE PLAN			
Module	Contents	Hours	End Sem. Exam Marks
I	Decision-making procedure under certainty and under uncertainty - Operations Research-Probability and decision- making- Queuing or Waiting line theory-Simulation and Monte- Carlo Technique- Nature and organization of optimization problems- Scope and hierarchy of optimization- Typical applications of optimization.	08	15%
II	Essential features of optimization problems - Objective function-Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions, Investment costs and operating costs in objective function - Optimizing profitably constraints-Internal and external constraints-Formulation of optimization problems. Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions.	07	15%

FIRST INTERNAL EXAM			
III	Necessary and sufficient conditions for optimum of unconstrained functions-Numerical methods for unconstrained functions - One-dimensional search - Gradient-free search with fixed step size. Linear Programming - Basic concepts of linear programming - Graphical interpretation-Simplex method - Apparent difficulties in the Simplex method.	06	15%
IV	Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution.	06	15%
SECOND INTERNAL EXAM			
V	Network analysis by linear programming and shortest route, maximal flow problem. Introduction to Non-traditional optimization, Computational Complexity – NP-Hard, NP-Complete. Tabu Search-Basic Tabu search, Neighborhood, Candidate list, Short term and Long term memory	07	20%
VI	Genetic Algorithms- Basic concepts, Encoding, Selection, Crossover, Mutation. Simulated Annealing - Acceptance probability, Cooling, Neighborhoods, Cost function. Application of GA and Simulated Annealing in solving sequencing and scheduling problems and Travelling salesman problem.	08	20%
END SEMESTER EXAM			

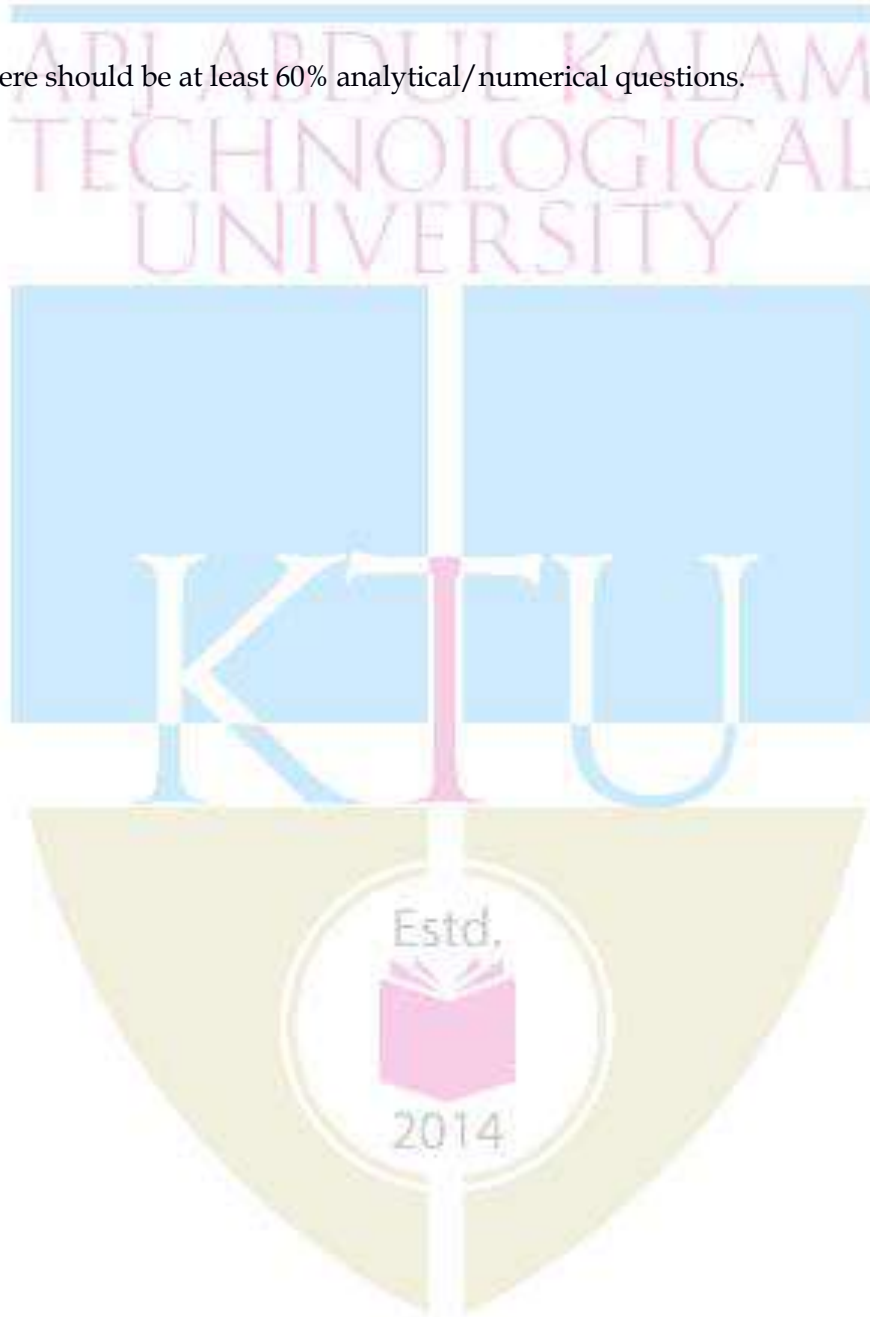
Question Paper Pattern

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 - Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.
- Part D
 - Total marks : 18
 - Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts

6. Part E

- a. Total Marks: 40
- b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
- c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

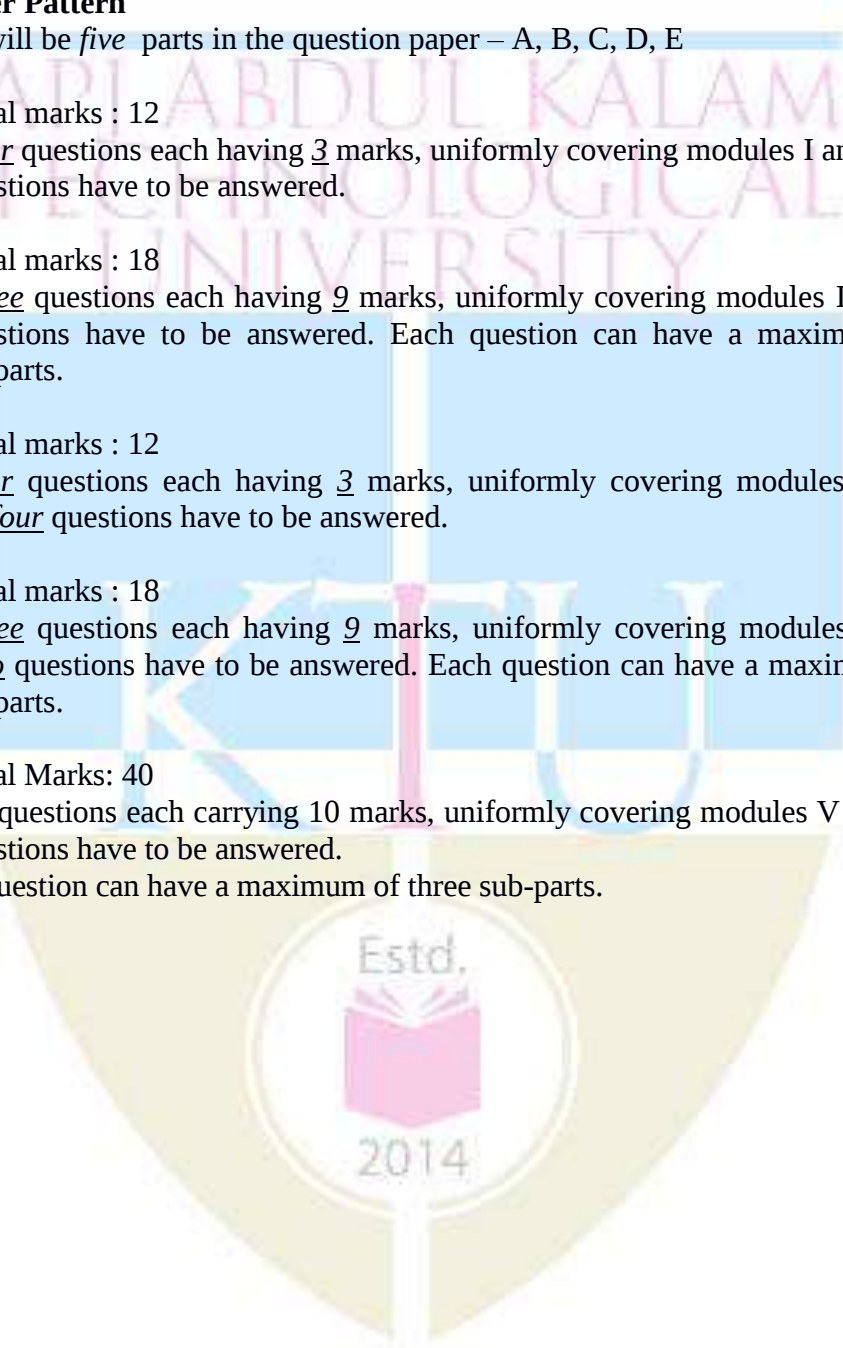


Course code	Course Name	L-T-P Credits	Year of Introduction
CS366	Natural language processing	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives - To introduce the fundamentals of Language processing from the algorithmic viewpoint. - To discuss various issues those make natural language processing a hard task. - To discuss some applications of Natural Language Processing (NLP).			
Syllabus Levels of Language Analysis, Syntax, Semantics and Pragmatics of Natural Language, Language Processing, Issues and approaches to solutions, Applications of Natural Language Processing (NLP).			
Expected Outcome The student able to 1. appreciate the fundamental concepts of Natural Language Processing. 2. design algorithms for NLP tasks. 3. develop useful systems for language processing and related tasks involving text processing.			
Text Books 1. D. Jurafsky and J. H. Martin, Speech and Language Processing, Prentice Hall India, 2000 2. James Allen, Natural Language Understanding, 2e, The Benjamin/Cummings Publishing Company Inc., Redwood City, CA.			
References 1. Charniak, Eugene, Introduction to Artificial intelligence, Addison-Wesley, 1985.. 2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 1999. 3. U. S. Tiwary and Tanveer Siddiqui, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Natural Language Understanding- Levels of language analysis- Syntax, Semantics, Pragmatics. Linguistic Background- An Outline of English Syntax.	8	15%
II	Lexicons, POS Tagging, Word Senses. Grammars and Parsing- Features, Agreement and Augmented Grammars.	7	15%
FIRST INTERNAL EXAM			
III	Grammars for Natural Language, Parsing methods and Efficient Parsing. Ambiguity Resolution- Statistical Methods. Probabilistic Context Free Grammar.	9	15%
IV	Semantics and Logical Form: Linking Syntax and Semantics- Ambiguity Resolution- other Strategies for Semantic Interpretation- Scoping and the Interpretation of Noun Phrases.	6	15%
SECOND INTERNAL EXAM			
V	Knowledge Representation and Reasoning- Local Discourse	8	20%

	Context and Reference- Using World Knowledge- Discourse Structure- Defining a Conversational Agent.		
VI	Applications- Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization.	4	20%
END SEMESTER EXAM			

Question Paper Pattern

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3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; Allfour questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts.
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.



Course code	Course Name	L-T-P - Credits	Year of Introduction
CS368	Web Technologies	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives - To impart the design, development and implementation of Dynamic Web Pages. - To develop programs for Web using Scripting Languages. - To give an introduction to Data Interchange formats in Web.			
Syllabus Basics of Internet and World Wide Web, HTML and XHTML, Cascading Style Sheets, Frameworks, Basics of JavaScript, JQuery, Introduction to XML and JSON, Overview of PHP			
Expected Outcome The student will be able to - Understand different components in web technology and to know about CGI and CMS. - Develop interactive Web pages using HTML/XHTML. - Present a professional document using Cascaded Style Sheets. - Construct websites for user interactions using JavaScript and JQuery. - Know the different information interchange formats like XML and JSON. - Develop Web applications using PHP.			
Text Books P. J. Deitel, H.M. Deitel, Internet & World Wide Web How To Program, 4/e, Pearson International Edition 2010. - Robert W Sebesta, Programming the World Wide Web, 7/e, Pearson Education Inc., 2014.			
References - Bear Bibeault and Yehuda Katz, jQuery in Action, Second Edition, Manning Publications.[Chapter 1] Black Book, Kogent Learning Solutions Inc. 2009. - Bob Boiko, Content Management Bible, 2nd Edition, Wiley Publishers. [Chapter 1, 2] - Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009. - Dream Tech, Web Technologies: HTML, JS, PHP, Java, JSP, ASP.NET, XML, AJAX, - Jeffrey C Jackson, Web Technologies A Computer Science Perspective, Pearson Education Inc. 2009. - Lindsay Bassett, Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON 1st Edition, O'Reilly.[Chapter 1,2,3,4] - Matthew MacDonald, WordPress: The Missing Manual, 2nd Edition, O'Reilly Media. [Chapter 1]			
Web Resources www.w3.org/CGI/ old.tree.ro/en/strategy-white-papers/content-management-systems.pdf httpd.apache.org/download.cgi https://alistapart.com/article/frameworks http://getbootstrap.com/css/ https://www.w3.org/TR/WD-DOM/introduction.html			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks

I	Introduction to the Internet: The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol. Common Gateway Interface(CGI), Content Management System – Basics <i>Case Study:</i> Apache Server, WordPress.	06	15%
II	Introduction to HTML/XHTML : Origins and Evolution of HTML and XHTML, Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.	07	15%
FIRST INTERNAL EXAM			
III	Introduction to Styles sheets and Frameworks Cascading Style Sheets: Levels of Style Sheets - Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags. Frameworks: Overview and Basics of Responsive CSS Frameworks - Bootstrap.	06	15%
IV	Introduction to JavaScript and jQuery The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics-Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions. Callback Functions, JavaScript HTML DOM. Introduction to jQuery: Overview and Basics.	07	15%
SECOND INTERNAL EXAMINATION			
V	Introduction to Data Interchange Formats XML: The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. JSON(Basics Only): Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML.	08	20%
VI	Introduction to PHP: Origins and Uses of PHP, Overview of PHP - General Syntactic Characteristics - Primitives, Operations, and Expressions - Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.	08	20%
END SEMESTER EXAM			

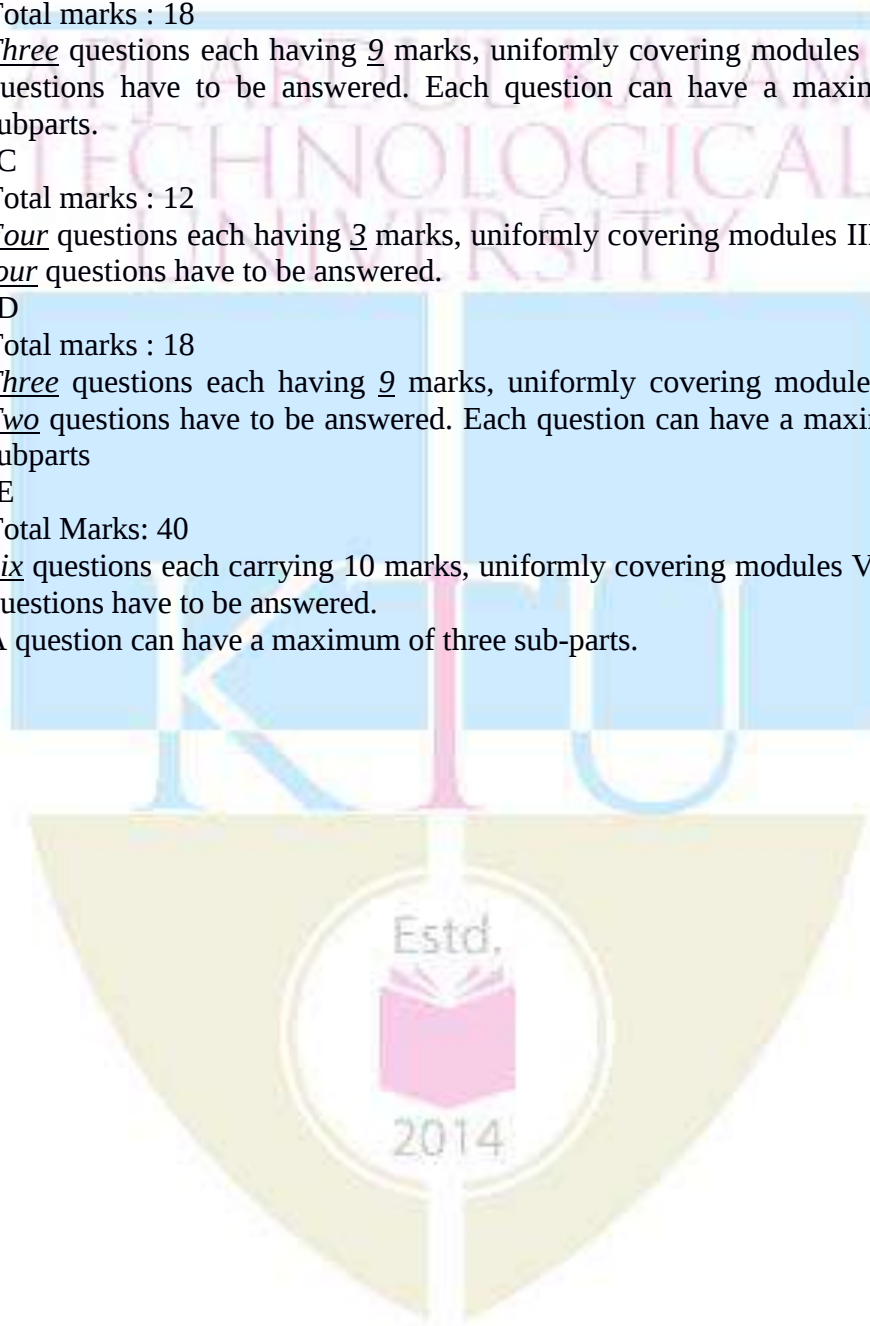
Assignment:

It is highly recommended to give assignment based on:

1. JavaScript Frameworks (like AngularJS or/and NodeJS)
2. Any PHP web app based on frameworks (like Laravel, CodeIgniter, CakePHP, Zend etc.)

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules I and II; All four questions have to be answered.
3. Part B
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules I and II; Two questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules III and IV; All four questions have to be answered.
5. Part D
 - a. Total marks : 18
 - b. Three questions each having 9 marks, uniformly covering modules III and IV; Two questions have to be answered. Each question can have a maximum of three subparts
6. Part E
 - a. Total Marks: 40
 - b. Six questions each carrying 10 marks, uniformly covering modules V and VI; four questions have to be answered.
 - c. A question can have a maximum of three sub-parts.



Course code.	Course Name	L-T-P - Credits	Year of Introduction
CS372	HIGH PERFORMANCE COMPUTING	3-0-0-3	2016
Pre-requisites : CS202 Computer Organization and Architecture			
Course Objectives - To introduce the concepts of Modern Processors. - To introduce Optimization techniques for serial code. - To introduce Parallel Computing Paradigms. - To introduce Parallel Programming using OpenMP and MPI.			
Syllabus Modern processors - pipelining-superscalarity-multicore processors- Mutithreaded processors- vector processors- basic optimization techniques for serial code - taxonomy of parallel computing paradigms- shared memory computers- distributed-memory computers- Hierarchical Systems- networks- basics of parallelization - data parallelism - function parallelism- Parallel scalability- shared memory parallel programming with OpenMp - Distributed-memory parallel programming with MPI.			
Expected Outcome The students will be able to - appreciate the concepts used in Modern Processors for increasing the performance. - appreciate Optimization techniques for serial code. - appreciate Parallel Computing Paradigms. - identify the performance issues in Parallel Programming using OpenMP and MPI.			
Text Book Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series, 2011.			
References - Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998. - Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Modern Processors : Stored Program Computer Architecture- General purpose cache- based microprocessor-Performance based metrics and benchmarks- Moore's Law- Pipelining- Superscalarity- SIMD- Memory Hierarchies Cache- mapping- prefetch- Multicore processors- Mutithreaded processors- Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture.	07	15%

II	Basic optimization techniques for serial code : scalar profiling- function and line based runtime profiling- hardware performance counters- common sense optimizations- simple measures, large impact- elimination of common subexpressions- avoiding branches- using simd instruction sets- the role of compilers - general optimization options- inlining - aliasing- computational accuracy- register optimizations- using compiler logs- c++ optimizations - temporaries- dynamic memory management- loop kernels and iterators data access optimization: balance analysis and light speed estimates- storage order- case study: jacobi algorithm and dense matrix transpose.	07	15%
FIRST INTERNAL EXAM			
III	Parallel Computers : Taxonomy of parallel computing paradigms- Shared memory computers- Cache coherence- UMA - ccNUMA- Distributed-memory computers- Hierarchical systems- Networks- Basic performance characteristics- Buses- Switched and fat- tree networks- Mesh networks- Hybrids - Basics of parallelization - Why parallelize - Data Parallelism - Function Parallelism- Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Refined performance models- Choosing the right scaling baseline- Case Study: Can slow processors compute faster- Load balance.	07	15%
IV	Distributed memory parallel programming with MPI : message passing - introduction to MPI – example - messages and point-to-point communication - collective communication – nonblocking point-to-point communication- virtual topologies - MPI parallelization of Jacobi solver- MPI implementation - performance properties	08	15%
SECOND INTERNAL EXAM			
V	Shared memory parallel programming with OpenMp : introduction to OpenMp - parallel execution - data scoping- OpenMp work sharing for loops- synchronization - reductions - loop scheduling - tasking - case study: OpenMp- parallel jacobi algorithm- advanced OpenMpwavefront parallelization- Efficient OpenMP programming: Profiling OpenMP programs - Performance pitfalls- Case study: Parallel Sparse matrix-vector multiply.	08	20%
VI	Efficient MPI programming : MPI performance tools- communication parameters- Synchronization, serialization, contention- Reducing communication overhead- optimal domain decomposition- Aggregating messages – Nonblocking Vs Asynchronous communication- Collective communication- Understanding intra-node point-to-point communication.	08	20%
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
 - a. Total marks : 12

Course code	Course Name	L-T-P Credits	Year of Introduction
CS401	COMPUTER GRAPHICS	4-0-0-4	2016
Course Objectives : - To introduce concepts of graphics input and display devices. - To discuss line and circle drawing algorithms. - To introduce 2D and 3D transformations and projections. - To introduce fundamentals of image processing.			
Syllabus: Basic Concepts in Computer Graphics. Input devices. Display devices. Line and circle drawing Algorithms. Solid area scan-conversion. Polygon filling. Two dimensional transformations. Windowing, clipping. 3D Graphics, 3D transformations. Projections – Parallel, Perspective. Hidden Line Elimination Algorithms. Image processing – digital image representation – edge detection – Robert, Sobel, Canny edge detectors. Scene segmentation and labeling – region-labeling algorithm – perimeter measurement.			
Expected Outcome: The Students will be able to : - compare various graphics devices - analyze and implement algorithms for line drawing, circle drawing and polygon filling - apply geometrical transformation on 2D and 3D objects - analyze and implement algorithms for clipping - apply various projection techniques on 3D objects - summarize visible surface detection methods - interpret various concepts and basic operations of image processing			
Text Books: - Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996 E. Gose, R. Johnsonbaugh and S. Jost., Pattern Recognition and Image Analysis, PHI PTR, 1996 (Module VI – Image Processing part) - William M. Newman and Robert F. Sproull , Principles of Interactive Computer Graphics. McGraw Hill, 2e, 1979 - Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 1986.			
References: - David F. Rogers , Procedural Elements for Computer Graphics, Tata McGraw Hill, 2001. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision, Thomson India Edition, 2007. - Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 2017			

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Basic concepts in Computer Graphics – Types of Graphic Devices – Interactive Graphic inputs – Raster Scan and Random Scan Displays.	7	15%
II	Line Drawing Algorithm- DDA, Bresenham's algorithm – Circle Generation Algorithms –Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers – solid area scan conversion – polygon filling algorithms	8	15%
FIRST INTERNAL EXAM			
III	Two dimensional transformations. Homogeneous coordinate systems – matrix formulation and concatenation of transformations. Windowing concepts –Window to Viewport Transformation- Two dimensional clipping-Line clipping – Cohen Sutherland, Midpoint Subdivision algorithm	8	15%
IV	Polygon clipping-Sutherland Hodgeman algorithm, Weiler-Atherton algorithm, Three dimensional object representation- Polygon surfaces, Quadric surfaces – Basic 3D transformations	8	15%
SECOND INTERNAL EXAM			
V	Projections – Parallel and perspective projections – vanishing points. Visible surface detection methods– Back face removal- Z-Buffer algorithm, A-buffer algorithm, Depth-sorting method, Scan line algorithm.	9	20%
VI	Image processing – Introduction - Fundamental steps in image processing – digital image representations – relationship between pixels – gray level histogram –spatial convolution and correlation – edge detection – Robert, Prewitt, Sobel.	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. **Part A**
 - a. **Total marks : 40**
 - b. **TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
3. **Part B**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
4. **Part C**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
5. **Part D**
 - a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS402	DATA MINING AND WAREHOUSING	3-0-0-3	2016
Course Objectives: - To introduce the concepts of data Mining and its applications - To understand investigation of data using practical data mining tools. - To introduce Association Rules Mining - To introduce advanced Data Mining techniques			
Syllabus: Data Mining, Applications, Data Mining Models, Data Warehousing and OLAP, Challenges, Tools, Data Mining Principles, Data Preprocessing: Data Preprocessing Concepts, Data Visualization, Data Sets and Their Significance, Classification Models, Multi Resolution Spatial Data Mining, Classifiers, Association Rules Mining, Cluster Analysis, Practical Data Mining Tools, Advanced Data Mining Techniques, Web Mining, Text Mining, CRM Applications and Data Mining, Data warehousing.			
Expected Outcome: The Student will be able to : - identify the key process of Data mining and Warehousing - apply appropriate techniques to convert raw data into suitable format for practical data mining tasks - analyze and compare various classification algorithms and apply in appropriate domain - evaluate the performance of various classification methods using performance metrics - make use of the concept of association rule mining in real world scenario - select appropriate clustering and algorithms for various applications - extend data mining methods to the new domains of data			
Text Books: - Dunham M H, "Data Mining: Introductory and Advanced Topics", Pearson Education, New Delhi, 2003. - Jaiwei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Elsevier, 2006.			
References: - M Sudeep Elayidom, "Data Mining and Warehousing", 1st Edition, 2015, Cengage Learning India Pvt. Ltd. - Mehmed Kantardzic, "Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003. - Pang-Ning Tan and Michael Steinbach, "Introduction to Data Mining", Addison Wesley, 2006.			

Course Plan			
Module	Contents	Hours	End Sem Exam . Marks
I	Data Mining:- Concepts and Applications, Data Mining Stages, Data Mining Models, Data Warehousing (DWH) and On-Line Analytical Processing (OLAP), Need for Data Warehousing, Challenges, Application of Data Mining Principles, OLTP Vs DWH, Applications of DWH	6	15%
II	Data Preprocessing: Data Preprocessing Concepts, Data Cleaning, Data integration and transformation, Data Reduction, Discretization and concept hierarchy.	6	15%
FIRST INTERNAL EXAM			
III	Classification Models: Introduction to Classification and Prediction, Issues regarding classification and prediction, Decision Tree- ID3, C4.5, Naive Bayes Classifier.	6	15%
IV	Rule based classification- 1R. Neural Networks-Back propagation. Support Vector Machines, Lazy Learners-K Nearest Neighbor Classifier. Accuracy and error Measures-evaluation. Prediction:-Linear Regression and Non-Linear Regression.	6	15%
SECOND INTERNAL EXAM			
V	Association Rules Mining: Concepts, Apriori and FP-Growth Algorithm. Cluster Analysis: Introduction, Concepts, Types of data in cluster analysis, Categorization of clustering methods. Partitioning method: K-Means and K-Medoid Clustering.	8	20
VI	Hierarchical Clustering method: BIRCH. Density-Based Clustering –DBSCAN and OPTICS. Advanced Data Mining Techniques: Introduction, Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining. Text Mining. Graph mining:- Apriori based approach for mining frequent subgraphs. Social Network Analysis:- characteristics of social networks. Link mining:- Tasks and challenges.	8	20
END SEMESTER EXAMINATION			

Question Paper Pattern

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. **Part A**
 - a. **Total marks : 40**
 - b. **TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
3. **Part B**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
4. **Part C**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
5. **Part D**
 - a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS403	PROGRAMMING PARADIGMS	3-0-0-3	2016
Course Objectives: - To introduce the basic constructs that underlie all programming languages - To introduce the basics of programming language design and implementation - To introduce the organizational framework for learning new programming languages.			
Syllabus: Names, Scopes, and Bindings - Binding Time, Scope Rules, Storage Management, Overloading, Polymorphism; Control Flow - Expression Evaluation, Structured and Unstructured Flow, Non-determinacy; Data Types - Type Systems, Type Checking, Equality Testing and Assignment; Subroutines and Control Abstraction - Static and Dynamic Links, Calling Sequences, Parameter Passing, Exception Handling, Co-routines; Functional and Logic Languages; Data Abstraction and Object Orientation -Encapsulation, Inheritance, Dynamic Method Binding; Innovative features of Scripting Languages; Concurrency - Threads, Synchronization, Language-Level Mechanisms; Run-time program Management.			
Expected Outcome: The Students will be able to : - compare scope and binding of names in different programming languages - analyze control flow structures in different programming languages - appraise data types in different programming languages - analyze different control abstraction mechanisms - appraise constructs in functional, logic and scripting languages - analyze object oriented constructs in different programming languages - compare different concurrency constructs - interpret the concepts of run- time program management			
Text book: Scott M L, Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers, 2009.			
References: - David A Watt, Programming Language Design Concepts, Wiley Dreamtech, 2004 - Ghezzi C and M. Jazayeri, Programming Language Concepts, 3rd Edn, Wiley.1997 - Kenneth C Loudon, Programming Languages: Principles and Practice, 3rd Edn., Cengage Learning, 2011. - Pratt T W, M V Zelkowitz, and T. V. Gopal, Programming Languages: Design and Implementation, 4th Edn., Pearson Education, 2001 - R W Sebesta, Concepts of Programming Languages, 11th Edn., Pearson Education, 2015 - Ravi Sethi, Programming Languages: Concepts & Constructs, 2nd Edn., Pearson Education, 2006 - Tucker A B and R E Noonan, Programming Languages: Principles and Paradigms, 2nd Edn, McGraw Hill, 2006.			

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Names, Scopes and Bindings:- Names and Scopes, Binding Time, Scope Rules, Storage Management, Binding of Referencing Environments. Control Flow: - Expression Evaluation, Structured and Unstructured Flow, Sequencing, Selection, Iteration, Recursion, Non-determinacy.	7	15 %
II	Data Types:-Type Systems, Type Checking, Records and Variants, Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output, Equality Testing and Assignment.	7	15 %
FIRST INTERNAL EXAM			
III	Subroutines and Control Abstraction: - Static and Dynamic Links, Calling Sequences, Parameter Passing, Generic Subroutines and Modules, Exception Handling, Co-routines.	7	15 %
IV	Functional and Logic Languages:- Lambda Calculus, Overview of Scheme, Strictness and Lazy Evaluation, Streams and Monads, Higher-Order Functions, Logic Programming in Prolog, Limitations of Logic Programming.	7	15 %
SECOND INTERNAL EXAM			
V	Data Abstraction and Object Orientation:-Encapsulation, Inheritance, Constructors and Destructors, Aliasing, Overloading, Polymorphism, Dynamic Method Binding, Multiple Inheritance. Innovative features of Scripting Languages:-Scoping rules, String and Pattern Manipulation, Data Types, Object Orientation.	7	20 %
VI	Concurrency:- Threads, Synchronization. Run-time program Management:- Virtual Machines, Late Binding of Machine Code, Reflection, Symbolic Debugging, Performance Analysis.	7	20 %
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. **Part A**
 - a. **Total marks : 40**
 - b. **TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
3. **Part B**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
4. **Part C**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
5. **Part D**
 - a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS404	Embedded Systems	3-0-0-3	2016
Course Objectives: - To introduce the technologies behind embedded computing systems. - To introduce and discuss various software components involved in embedded system design and development. - To expose students to the recent trends in embedded system design.			
Syllabus: Introduction to embedded systems, basic components, its characteristics. Modelling embedded systems, firmware development. Integration and testing of embedded systems, development environment. Characteristics of RTOS, interrupt handling, creating tasks in a typical RTOS. Embedded product development life cycle.			
Expected Outcome: The Student will be able to : - demonstrate the role of individual components involved in a typical embedded system - analyze the characteristics of different computing elements and select the most appropriate one for an embedded system - model the operation of a given embedded system - substantiate the role of different software modules in the development of an embedded system - develop simple tasks to run on an RTOS - examine the latest trends prevalent in embedded system design			
References: - J Staunstrup and Wayne Wolf, Hardware / Software Co-Design: Principles and Practice, Prentice Hall. - Jean J. Labrose, Micro C/OS II: The Real Time Kernel, 2e, CRC Press, 2002. - Raj Kamal, Embedded Systems: Architecture, Programming and Design, Third Edition, McGraw Hill Education (India), 2014. - Shibu K.V., Introduction to Embedded Systems, McGraw Hill Education (India), 2009. - Steve Heath, Embedded System Design, Second Edition, Elsevier. - Wayne Wolf , Computers as Components-Principles of Embedded Computer System Design, Morgan Kaufmann publishers, Third edition, 2012.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Fundamentals of Embedded Systems- complex systems and microprocessors- Embedded system design process .Specifications- architecture design of embedded system- design of hardware and software components- structural and behavioural description.	6	15%
II	Hardware Software Co-Design and Program Modelling – Fundamental Issues, Computational Models- Data Flow Graph, Control Data Flow Graph, State Machine,. Sequential Model, Concurrent Model, Object oriented model, UML	9	15%

FIRST INTERNAL EXAMINATION			
III	Design and Development of Embedded Product – Firmware Design and Development – Design Approaches, Firmware Development Languages.	6	15%
IV	Integration and Testing of Embedded Hardware and Firmware- Integration of Hardware and Firmware. Embedded System Development Environment – IDEs, Cross Compilers, Disassemblers, Decompilers, Simulators, Emulators and Debuggers.	6	15%
SECOND INTERNAL EXAMINATION			
V	RTOS based Design – Basic operating system services. Interrupt handling in RTOS environment. Design Principles. Task scheduling models. How to Choose an RTOS. Case Study – MicroC/OS-II.	9	20%
VI	Networks – Distributed Embedded Architectures, Networks for embedded systems, Network based design, Internet enabled systems. Embedded Product Development Life Cycle – Description – Objectives -Phases – Approaches1. Recent Trends in Embedded Computing.	6	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All** questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part D**
 - Total marks : 24**
 - THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- There will be **AT LEAST 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS405	COMPUTER SYSTEM ARCHITECTURE	3-0-0-3	2016
Course Objectives: - To impart a basic understanding of the parallel architecture and its operations - To introduce the key features of high performance computers			
Syllabus: Basic concepts of parallel computer models, SIMD computers, Multiprocessors and multi-computers, Cache Coherence Protocols, Multicomputers, Pipelining computers and Multithreading.			
Expected outcome : The Students will be able to : - summarize different parallel computer models - analyze the advanced processor technologies - interpret memory hierarchy - compare different multiprocessor system interconnecting mechanisms - interpret the mechanisms for enforcing cache coherence - analyze different message passing mechanisms - analyze different pipe lining techniques - appraise concepts of multithreaded and data flow architectures			
Text Book: K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.			
References: - H P Hayes, Computer Architecture and Organization, McGraw Hill, 1978. K. Hwang & Briggs , Computer Architecture and Parallel Processing, McGraw Hill International, 1986 - M J Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House, 2012. - M Sasikumar, D Shikkare and P Raviprakash, Introduction to Parallel Processing, PHI, 2014. - P M Kogge, The Architecture of Pipelined Computer, McGraw Hill, 1981. - P V S Rao , Computer System Architecture, PHI, 2009. - Patterson D. A. and Hennessy J. L., Morgan Kaufmann , Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann Pub, 4/e, 2010.			

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Parallel computer models - Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multivector and SIMD computers, Architectural development tracks, Conditions of parallelism.	6	15%
II	Processors and memory hierarchy - Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.	8	15%
FIRST INTERNAL EXAM			
III	Multiprocessors system interconnects - Hierarchical bus systems, Cross bar switch and multiport memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem	7	15%
IV	Message Passing Mechanisms-Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques - Linear Pipeline processors and Nonlinear pipeline processors	8	15%
SECOND INTERNAL EXAM			
V	Instruction pipeline design, Arithmetic pipeline design - Super Scalar Pipeline Design	8	20%
VI	Multithreaded and data flow architectures - Latency hiding techniques, Principles of multithreading - Multithreading Issues and Solutions, Multiple context Processors, Fine-grain Multicomputer- Fine-grain Parallelism. Dataflow and hybrid architecture	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. **Part A**
 - a. **Total marks : 40**
 - b. **TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
3. **Part B**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question *uniformly* covers **modules I & II**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
4. **Part C**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question *uniformly* covers **modules III & IV**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
5. **Part D**
 - a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS407	DISTRIBUTED COMPUTING	3-0-0-3	2016
Course Objectives: - To introduce fundamental principles of distributed systems, technical challenges and key design issues. - To impart knowledge of the distributed computing models, algorithms and the design of distributed system.			
Syllabus: Introduction to distributed computing, Design issues, Distributed Computing Models, System models, Inter-process communication, Distributed file system, Name Service , Distributed mutual exclusion , Distributed system design.			
Expected Outcome The Students will be able to : - distinguish distributed computing paradigm from other computing paradigms - identify the core concepts of distributed systems - illustrate the mechanisms of inter process communication in distributed system - apply appropriate distributed system principles in ensuring transparency, consistency and fault-tolerance in distributed file system - compare the concurrency control mechanisms in distributed transactional environment - outline the need for mutual exclusion and election algorithms in distributed systems			
Text Books: - George Coulouris, Jean Dollimore and Tim Kindberg , Distributed Systems: Concepts and Design, Fifth Edition , Pearson Education, 2011 - Pradeep K Sinha, Distributed Operating Systems : Concepts and Design, Prentice Hall of India			
References: - A S Tanenbaum and M V Steen , Distributed Systems: Principles and paradigms, Pearson Education, 2007 - M Solomon and J Krammer, Distributed Systems and Computer Networks, PHI			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Evolution of Distributed Computing -Issues in designing a distributed system- Challenges- Minicomputer model - Workstation model - Workstation-Server model- Processor - pool model - Trends in distributed systems	7	15%
II	System models: Physical models - Architectural models - Fundamental models	6	15%

FIRST INTERNAL EXAM			
III	Interprocess communication: characteristics - group communication - Multicast Communication -Remote Procedure call - Network virtualization. Case study : Skype	7	15%
IV	Distributed file system: File service architecture - Network file system- Andrew file system- Name Service	7	15%
SECOND INTERNAL EXAM			
V	Transactional concurrency control:- Transactions, Nested transactions-Locks-Optimistic concurrency control	7	20%
VI	Distributed mutual exclusion - central server algorithm - ring based algorithm- Maekawa's voting algorithm - Election: Ring -based election algorithm - Bully algorithm	7	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be **FOUR** parts in the question paper - A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question *uniformly* covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have *maximum THREE* subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question *uniformly* covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have *maximum THREE* subparts.
- Part D**
 - Total marks : 24**
 - THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - Any TWO** questions have to be answered.
 - Each question can have *maximum THREE* subparts.
- There will be **AT LEAST 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS409	CRYPTOGRAPHY AND NETWORK SECURITY	3-0-0-3	2016
Course Objectives: - To introduce fundamental concepts of symmetric and asymmetric cipher models. - To introduce fundamental concepts of authentication. - To introduce network security and web security protocols.			
Syllabus: Symmetric Cipher Models - Differential and linear Cryptanalysis- Block Cipher Design principles- Primitive operations- Key expansions- Inverse Cipher- Principles of Public key Cryptography Systems - Authentication functions- Message authentication codes- Hash functions- Digital signatures- Authentication protocols- Network security - Web Security - secure Socket Layer and Transport layer Security- Secure electronic transaction –Firewalls.			
Expected Outcome: The Students will be able to : - summarize different classical encryption techniques - identify mathematical concepts for different cryptographic algorithms - demonstrate cryptographic algorithms for encryption/key exchange - summarize different authentication and digital signature schemes - identify security issues in network, transport and application layers and outline appropriate security protocols			
Text Books: - Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill. 2010 - William Stallings, Cryptography and Network Security, Pearson Education, 2014			
References: B. Schneier , Applied Cryptography, Protocols, Algorithms, and Source Code in C, 2 nd Edn, Wiley, 1995. - Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, PHI, 2002			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Symmetric Cipher Models- Substitution techniques- Transposition techniques- Rotor machines-Steganography. Simplified DES- Block Cipher principles- The Data Encryption Standard, Strength of DES- Differential and linear Cryptanalysis. Block Cipher Design principles- Block Cipher modes of operations.	7	15 %
II	IDEA: Primitive operations- Key expansions- One round, Odd round, Even Round- Inverse keys for decryption. AES: Basic Structure- Primitive operation- Inverse Cipher- Key Expansion, Rounds, Inverse Rounds. Stream Cipher –RC4.	7	15 %
FIRST INTERNAL EXAM			

III	Public key Cryptography: - Principles of Public key Cryptography Systems, Number theory- Fundamental Theorem of arithmetic, Fermat's Theorem, Euler's Theorem, Euler's Totient Function, Extended Euclid's Algorithm, Modular arithmetic. RSA algorithm-Key Management - Diffie-Hellman Key Exchange, Elliptic curve cryptography	7	15 %
IV	Authentication requirements- Authentication functions- Message authentication codes- Hash functions- SHA -1, MD5, Security of Hash functions and MACs- Authentication protocols-Digital signatures-Digital signature standards.	7	15 %
SECOND INTERNAL EXAM			
V	Network security: Electronic Mail Security: Pretty good privacy-S/MIME. IP Security: Architecture- authentication Header-Encapsulating Security payload- Combining Security associations-Key management.	7	20 %
VI	Web Security: Web Security considerations- secure Socket Layer and Transport layer Security- Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Encrypted tunnels.	7	20 %
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All** questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part D**
 - Total marks : 24**
 - THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS431	COMPILER DESIGN LAB	0-0-3-1	2016
Pre-requisite : CS331 System Software Lab			
Course Objectives: - To implement the different Phases of compiler. - To implement and test simple optimization techniques. - To give exposure to compiler writing tools.			
List of Exercises/Experiments : - Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new lines. - Implementation of Lexical Analyzer using Lex Tool - Generate YACC specification for a few syntactic categories. - Program to recognize a valid arithmetic expression that uses operator +, -, *, and /. - Program to recognize a valid variable which starts with a letter followed by any number of letters or digits. - Implementation of Calculator using LEX and YACC - Convert the BNF rules into YACC form and write code to generate abstract syntax tree - Write program to find ϵ - closure of all states of any given NFA with ϵ transition. - Write program to convert NFA with ϵ transition to NFA without ϵ transition. - Write program to convert NFA to DFA - Write program to minimize any given DFA. - Develop an operator precedence parser for a given language. - Write program to find Simulate First and Follow of any given grammar. - Construct a recursive descent parser for an expression. - Construct a Shift Reduce Parser for a given language. - Write a program to perform loop unrolling. - Write a program to perform constant propagation. - Implement Intermediate code generation for simple expressions. - Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, jump etc.			
Expected Outcome: The Student will be able to : - Implement the techniques of Lexical Analysis and Syntax Analysis. - Apply the knowledge of Lex & Yacc tools to develop programs. - Generate intermediate code. - Implement Optimization techniques and generate machine level code.			

Course code	Course Name	L-T-P Credits	Year of Introduction
CS461	COMPUTATIONAL GEOMETRY	3-0-0-3	2016
Course Objectives: - To introduce techniques for designing efficient algorithms for geometric problems. - To discuss data structures used for geometric problems - To introduce combinatorial complexity of geometric problems. - To study rigorous algorithmic analysis of geometric problems.			
Syllabus: Geometric preliminaries, Plane sweep technique, Line segment intersection, Point location, Searching, Triangulation, Art Gallery theorem, Linear programming, Arrangements of lines, Convex Hulls and Verona Diagrams.			
Expected Outcome: The Students will be able to : - Develop efficient algorithms by exploiting geometric properties, and using appropriate data structures and geometric techniques. - Apply techniques and algorithms for solving problems in diversified fields like database searching, data mining, graphics and image processing, pattern recognition, computer vision, motion planning and robotics. - Perform complexity analysis of algorithms - Identify properties of geometric objects, express them as lemmas or theorems, and prove their correctness - Implement geometric algorithms.			
Text Books: - Franco P. Preparata and Michael Ian Shamos, <i>Computational Geometry an Introduction</i>. Texts and Monographs in Computer Science, Springer Verlag. - Joseph O'Rourke, <i>Computational Geometry in C</i>. Cambridge University Press 2nd Edn. - Mark. de Berg, Marc. van Kreveld, Mark. Overmars and Otfried Cheong, <i>Computational Geometry- Algorithms and Applications</i>. Springer- Verlag 3rd Edn.			
References: - Herbert Edelsbrunner, <i>Algorithms in Combinatorial Geometry</i>, EATCS Monographs on Theoretical Computer Science, Springer Verlag. - Joseph O' Rourke, <i>Art Gallery Theorems</i>. Oxford Press publications.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Geometric Preliminaries, DCEL (Doubly Connected Edge List) data structure, Polygon, Planar Straight Line Graph (PSLG) Area of a triangle, area of a polygon, Determinant used to test position of a point with respect to a directed line. Convex polygons, properties and point location in convex polygon (inside-outside test) Plane sweep algorithm, Algorithm for Line segment intersection problem using plane sweep technique.	6	15%

II	Point location in PSLG – Slab method, Chain method and complexity analysis. Range Searching – 1D Range search, Kd Trees.	6	15%
FIRST INTERNAL EXAM			
III	Polygon Triangulation: Regularization of polygons, properties of triangulations –Proofs, triangulation of monotone polygon – algorithm and complexity analysis. Linear Programming – Half plane intersection, Incremental algorithm and Randomized algorithm	8	15%
IV	Art Gallery Theorem, Guarding Art Gallery, Fisk's proof using three colouring. Arrangements of Lines – Duality, Combinatorics of arrangements, Zone Theorem, Algorithm for Constructing arrangements of lines.	6	15%
SECOND INTERNAL EXAM			
V	Convex Hulls- Convex Hull Algorithms in the Plane -Graham's Scan Algorithm, Jarvi's March, Divide and Conquer Algorithm.	6	20%
VI	Voronoi Diagrams- Properties and applications in the plane. Proofs of properties related to vertices and edges of voronoi diagrams Algorithm for constructing voronoi diagram. Delaunay Triangulation.	8	20%
END SEMESTER EXAM			

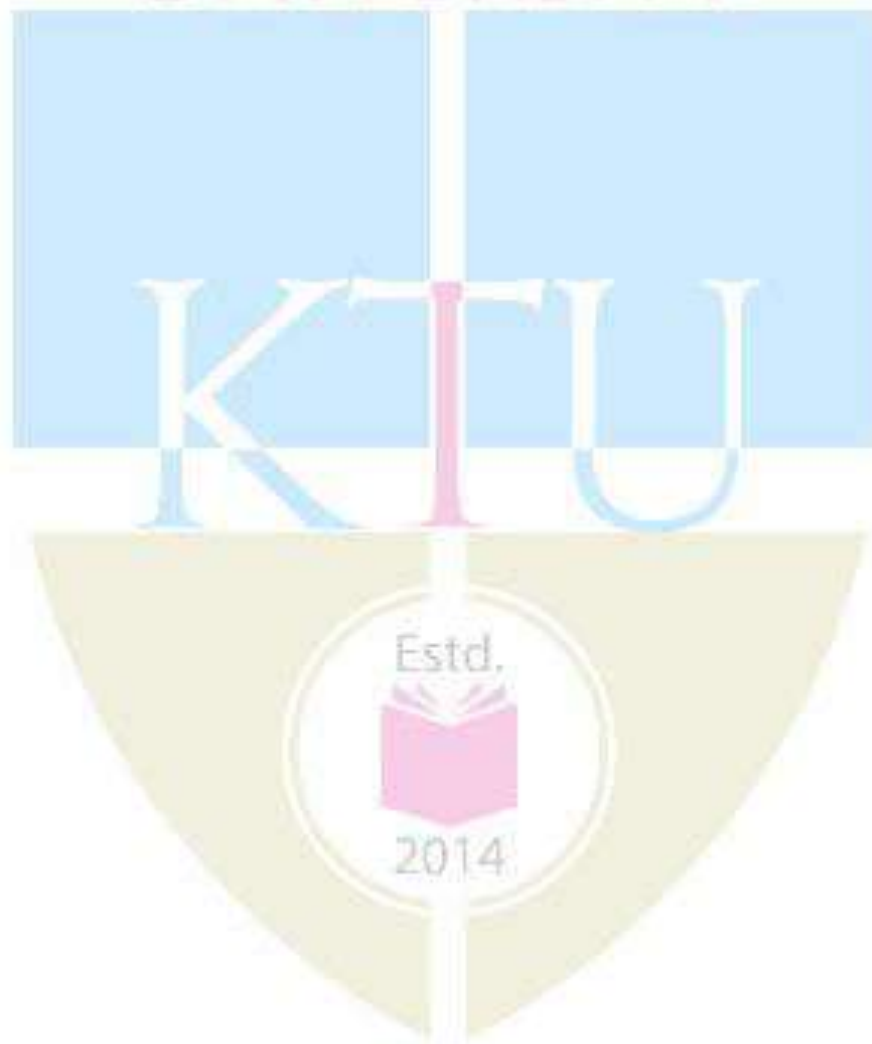
Question Paper Pattern End semester exam)

- There will be **FOUR** parts in the question paper – **A, B, C, D**
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II; THREE** questions from **modules III & IV; FOUR** questions from **modules V & VI)**.
All the TEN questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.

5. Part D

- a. Total marks : 24
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

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Course code	Course Name	L-T-P - Credits	Year of Introduction
CS462	FUZZY SET THEORY AND APPLICATIONS	3-0-0-3	2016
Course Objectives: - To introduce the theory of fuzzy sets. - To discuss theoretical differences between fuzzy sets and classical sets. - To discuss fuzzy logic inference - To introduce fuzzy arithmetic concepts. - To discuss fuzzy inference applications in the area of control.			
Syllabus: Theory of Fuzzy Sets: Classical Sets vs Fuzzy Sets, Types of Fuzzy Sets, Operations on Fuzzy Sets, Zadeh's Extension Principle, Fuzzy Relations, Fuzzy Relational Equations, Possibility Theory and Fuzzy Measures. Applications of Fuzzy Sets: Approximate Reasoning, Fuzzy Relational Inference, Fuzzy Controllers, Efficiency and Effectiveness of inference schemes, Functional Approximation capabilities.			
Expected Outcome: The Student will be able to : - interpret fuzzy set theory and uncertainty concepts - identify the similarities and differences between probability theory and fuzzy set theory and their application conditions - apply fuzzy set theory in modeling and analyzing uncertainty in a decision problem - apply fuzzy control by examining simple control problem examples			
Text Books: - George J Klir and Bo Yuan, "<i>Fuzzy Sets and Fuzzy Logic : Theory and Applications</i>", Prentice Hall NJ,1995. - Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, 2010.			
References: - E P Klement, R Mesiar and E. Pap, Triangular norms, Kluwer Academic Press, Dordrecht, 2000. - H.J. Zimmermann, <i>Fuzzy Set Theory and its Applications</i>, Allied Publishers, New Delhi, 1991. - Kevin M Passino and Stephen Yurkovich, <i>Fuzzy Control</i>, Addison Wesley Longman, 1998. - M Grabisch et al., <i>Aggregation Functions</i>, Series - Encyclopedia Of Mathematics And Its Applications, Cambridge University Press, 2009 - Michal Baczynski and Balasubramaniam Jayaram, <i>Fuzzy Implications</i>, Springer Verlag, Heidelberg, 2008.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Classical sets vs Fuzzy Sets - Need for fuzzy sets - Definition and Mathematical representations - Level Sets - Fuzzy functions - Zadeh's Extension Principle.	06	15%
II	Operations on [0,1] - Fuzzy negation, triangular norms, t-	06	15%

	conorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations		
FIRST INTERNAL EXAMINATION			
III	Fuzzy Binary and n-ary relations - composition of fuzzy relations - Fuzzy Equivalence Relations - Fuzzy Compatibility Relations - Fuzzy Relational Equations	07	15%
IV	Fuzzy Measures - Evidence Theory - Necessity and Belief Measures - Probability Measures vs Possibility Measures	07	15%
SECOND INTERNAL EXAMINATION			
V	Fuzzy Decision Making - Fuzzy Relational Inference - Compositional Rule of Inference - Efficiency of Inference - Hierarchical	08	20%
VI	Fuzzy If-Then Rule Base - Inference Engine - Takagi-Sugeno Fuzzy Systems - Function Approximation Applications <i>Advanced topics: Adaptive fuzzy inference systems: Adaptive networks - Architectures - Learning rules.</i> <i>Adaptive neuro-fuzzy inference systems (ANFIS) - Architectures - Hybrid learning rules.</i>	08	20%
END SEMESTER EXAM			

Question Paper Pattern

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All** questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part D**
 - Total marks : 24**
 - THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P-Credit	Year of Introduction
CS463	DIGITAL IMAGE PROCESSING	3-0-0-3	2016

Course Objectives:

- To introduce and discuss the fundamental concepts and applications of Digital Image Processing.
- To discuss various basic operations in Digital Image Processing.
- To know various transform domains

Syllabus:

Introduction on digital image processing fundamentals; Image Transforms; Spatial and frequency domain filtering; Image segmentation; Morphological Image processing; Representation and Description.

Expected Outcome

The Students will be able to :

- compare different methods for image acquisition, storage and representation in digital devices and computers
- appreciate role of image transforms in representing, highlighting, and modifying image features
- interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain
- apply various methods for segmenting image and identifying image components
- summarise different reshaping operations on the image and their practical applications
- identify image representation techniques that enable encoding and decoding images

Text Books:

1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

References:

1. Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.
3. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing, McGraw Hill Education , 2009.

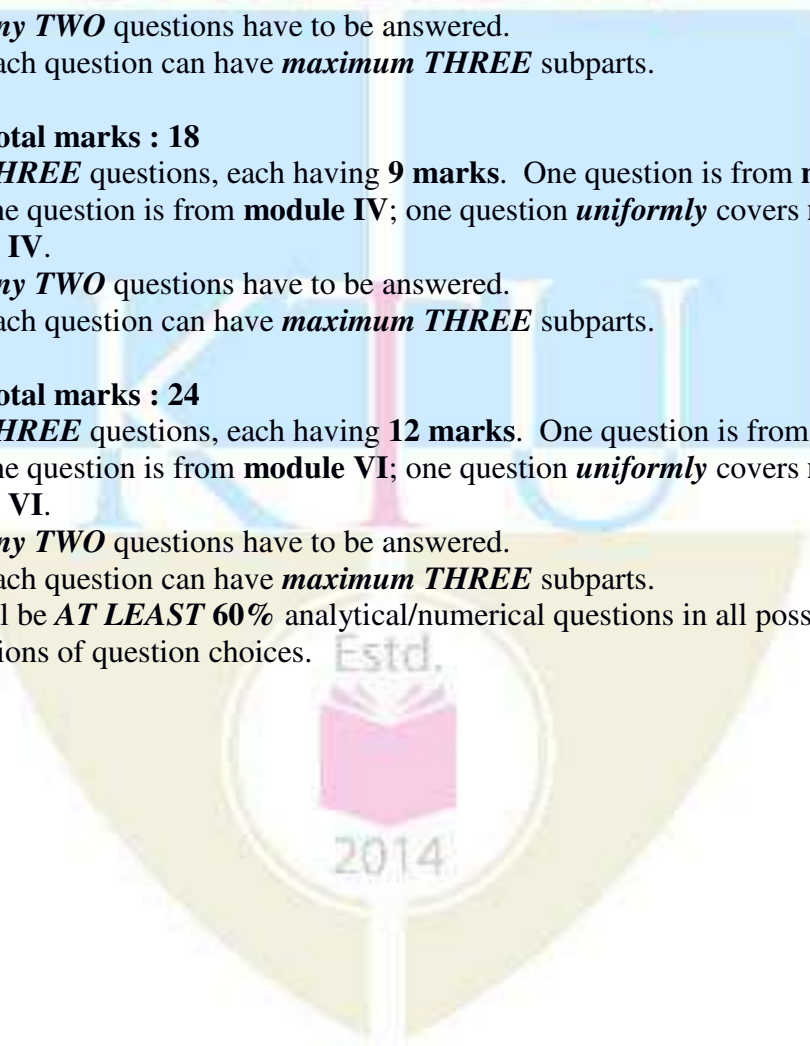
COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; Pixels; coordinate conventions; Imaging Geometry; Spatial Domain; Frequency Domain; sampling and quantization; Basic relationship between pixels; Applications of Image Processing.	6	15%

II	Image transforms and its properties – Unitary transform; Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform;	7	15%
FIRST INTERNAL EXAM			
III	Image Enhancement in spatial domain Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Gray Level Slicing; Bit Plane Slicing; Histogram Processing–Equalization; Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening: Laplacian; Unsharp Masking and High Boost Filtering.	8	15%
IV	Image Enhancement in Frequency Domain Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Gaussian Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.	6	15%
SECOND INTERNAL EXAM			
V	Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators; Line Detection, Corner Detection.	8	20%
VI	Morphological Operations Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing; Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.	7	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. **Part A**
 - a. **Total marks : 40**
 - b. **TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
3. **Part B**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question *uniformly* covers **modules I & II**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
4. **Part C**
 - a. **Total marks : 18**
 - b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question *uniformly* covers **modules III & IV**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
5. **Part D**
 - a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.



Course code	Course Name	L-T-P - Credits	Year of Introduction
CS464	ARTIFICIAL INTELLIGENCE	3-0-0-3	2016
Course Objectives: - To introduce basic principles that drive complex real world intelligence applications. - To introduce and discuss the basic concepts of AI Techniques and Learning			
Syllabus: Introduction to AI, Solving Problems by Searching-uninformed, informed, heuristic, constraint Satisfaction problems -AI Representational Schemes-Learning-Advanced searches-Alpha beta pruning, Expert Systems-Natural Language Processing Concepts.			
Expected Outcome: The Student will be able to : - appreciate the scope and limits of the artificial intelligence (AI) field - assess the applicability, strengths, and weaknesses of the basic knowledge representation - interpret the role of knowledge representation, problem solving, and learning - explain various search algorithms (uninformed, informed, and heuristic) for problem solving - comprehend the fundamentals of Natural Language Processing			
Text Books: - E Rich, K Knight, Artificial Intelligence, 3/e, Tata McGraw Hil, 2009. - George.F.Luger, Artificial Intelligence- Structures and Strategies for Complex Problem Solving, 4/e, Pearson Education. 2002.			
References: D. Poole and A. Mackworth. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010 Available online: http://artint.info/ - Dan W Patterson, Introduction to Artificial Intelligence,Pearson,2009 - Deepak Khemeni,A First course in Artificial Intelligence,Tata McGraw Hill,2013 - Maja J. Mataric ,Robotics Primer,MIT press,2007 - Patrick Henry Winston,Artificial intelligence,Addisson wessley,1992 - Stefan Edelkamp, Stefan Schroedl, Heuristic Search: Theory and Applications, Morgan Kaufman, 2011. - Stuart Jonathan Russell, Peter Norvig, Artificial intelligence, A modern approach,3rd edition, pearson,2010			

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction: What is AI, The foundations of AI, History and applications, Production systems. Structures and strategies for state space search. Informed and Uninformed searches.	5	15%
II	Search Methods: data driven and goal driven search. Depth first and breadth first search, DFS with iterative deepening. Heuristic search-best first search, A * algorithm.AO* algorithm, Constraint Satisfaction. Crypt Arithmetic Problems	8	15%
FIRST INTERNAL EXAMINATION			
III	AI representational schemes- Semantic nets, conceptual dependency, scripts, frames, introduction to agent based problem solving, Machine learning-symbol based-a frame work for symbol based learning.	6	15%
IV	Advanced Search: Heuristics in Games, Design of good heuristic-an example. Min-Max Search Procedure, Alpha Beta pruning,	6	15%
SECOND INTERNAL EXAMINATION			
V	Learning Concepts: Version space search. Back propagation learning. Social and emergent models of learning-genetic algorithm, classifier systems and genetic programming.	9	20%
VI	Expert Systems: rule based expert systems. Natural language processing-natural language understanding problem, deconstructing language. Syntax stochastic tools for language analysis, natural language applications	9	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II; THREE** questions from **modules III & IV; FOUR** questions from **modules V & VI).**
All the TEN questions have to be answered.

3. Part B

- a. **Total marks : 18**
- b. **THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question *uniformly* covers **modules I & II**.
- c. **Any TWO** questions have to be answered.
- d. Each question can have **maximum THREE** subparts.

4. Part C

- a. **Total marks : 18**
- b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question *uniformly* covers **modules III & IV**.
- c. **Any TWO** questions have to be answered.
- d. Each question can have **maximum THREE** subparts.

5. Part D

- a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS465	BIOINFORMATICS	3-0-0-3	2016

Course Objectives:

- To introduce concepts and data representations in bioinformatics
- To introduce fundamentals of Sequence alignment and Gene Recognition
- To discuss predictive methods using DNA and Protein Sequences

Syllabus:

Introduction to bioinformatics and molecular biology: Databases tools and their uses, Data searches and Pairwise Alignments, Multiple Sequence Alignments, Molecular Phylogenetic, Genomics and Gene Recognition, Protein and RNA structure Prediction

Expected Outcome:

The Students will be able to :

- interpret the concepts of bioinformatics
- identify different types of biological sequence
- analyse multiple sequences and find conserved regions
- predict RNA and Protein secondary structures
- analyse genomic sequences and identify encoded gene regions

References:

1. S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications" , ISBN : 978-81-203-4785-4, published by PHI Learning Private Limited, New Delhi, 2015.
2. D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, ISBN 978-81-7758-757-9, Pearson Education, 2006.
3. Andreas D.Baxeavanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins", Third Edition, 2005-2006, ISBN: 978-81-265-2192-0, published by John Wiley & Sons INC. , U.K.
4. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Bioinformatics and Computational Biology, Nature & Scope of Bioinformatics. The central dogma of molecular biology and bio-sequences associated with it, RNA classification –coding and non coding RNA- mRNA, tRNA, miRNA and sRNA, RNAi. DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Evolution	6	15%
II	Importance of databases - Biological databases-primary sequence databases, Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases, Types of databases, Data retrieval tools - Entrez	8	15%

FIRST INTERNAL EXAM			
III	Sequence alignment – local/global, pairwise sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments. Multiple sequence alignment. Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix.	8	20%
IV	Introduction, Advantages, Phylogenetic Trees, Tree topologies, Methods for phylogenetic analysis- Distance Matrix methods, Character based methods. HMM (Hidden Markov Model): Introduction to HMM, Forward algorithm, Viterbi algorithm, applications in Bioinformatics	6	15%
SECOND INTERNAL EXAM			
V	General introduction to Gene expression in prokaryotes and eukaryotes- Prokaryotic Genomes – Gene structure, GC content, Gene Density, Eukaryotic Genomes- Gene structure, GC content, Gene Density, Gene Expression, Transposition, Gene prediction approaches.	8	20%
VI	Protein and RNA structure Prediction: Predicting RNA secondary structure - Nussinov Algorithm, Energy minimisation methods - Zuker Algorithm. Amino Acids, Polypeptide Composition, Protein Structures, Algorithm for protein folding, Structure prediction	6	15%
END SEMESTER EXAM			

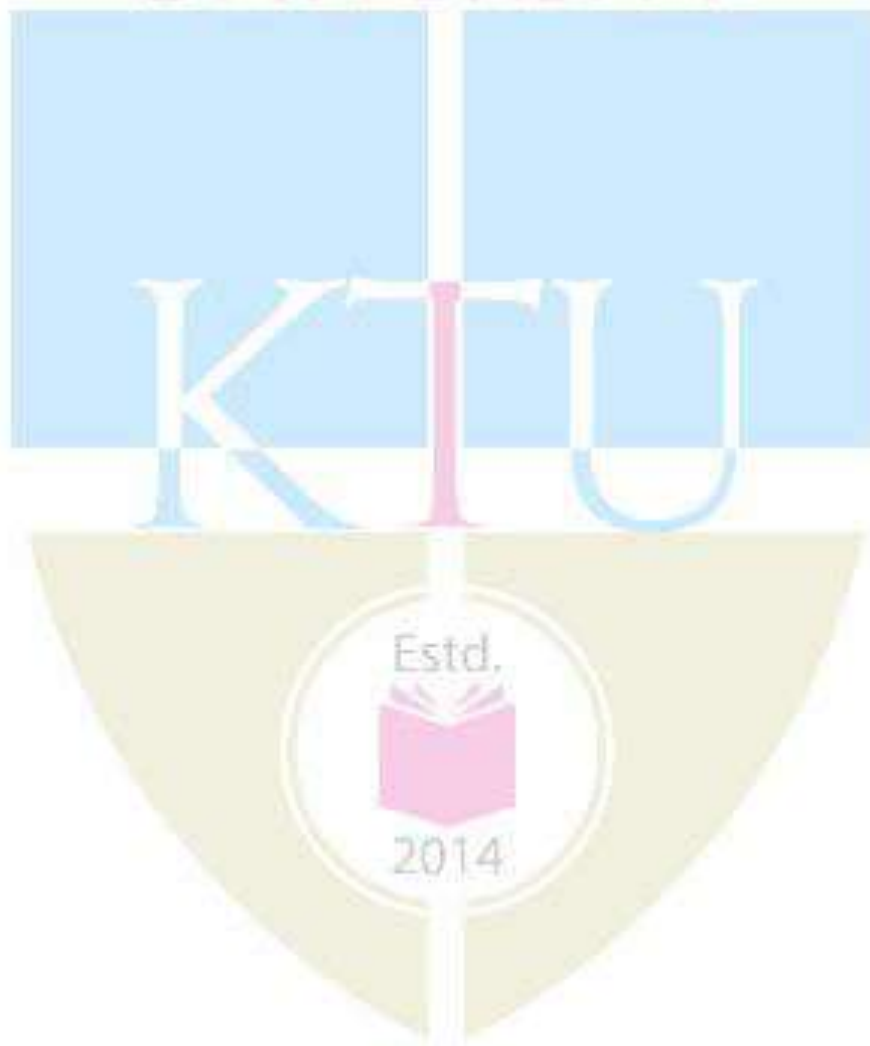
Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All the TEN** questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**

- b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
- c. **Any TWO** questions have to be answered.
- d. Each question can have **maximum THREE** subparts.

5. Part D

- a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS466	DATA SCIENCE	3-0-0-3	2016
Course Objectives: - To introduce fundamental algorithmic ideas to process data. - To introduce and discuss techniques for applying hypotheses and data into actionable predictions. - To introduce documentation and visualization techniques.			
Syllabus: Modern scientific, engineering, and business applications are increasingly dependent on data, existing traditional data analysis technologies were not designed for the complexity of the modern world. Data Science has emerged as a new, exciting and fast-paced discipline that explores novel statistical, algorithmic, and implementation challenges that emerge in processing, storing, and extracting knowledge from Big Data.			
Expected Outcome: The Student will be able to : - explain and discuss the significance of data science and its key functionalities - discuss and demonstrate various models suitable for data science - perform preliminary statistical analysis using R language on simple data sets - perform python-based predication and filtering on simple data sets - perform Hadoop and Map-Reduce for data analysis - perform data visualization techniques at a basic level			
References: - Boris Lublinsky, Kevin T. Smith. Alexcy Yakubovich, "Professional Hadoop Solutions", Wiley, 2015. - Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets". Cambridge University Press, 2014. - Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization and Statistics", Wiley, 2011. - Nina Zumel, John Mount "Practical Data Science with R". Manning Publications. 2014. - Sameer Madhavan , "Mastering Python for Data Science", Packt Publishing Limited, 2015. - Tony Ojeda, Sean Patrick Murphy, Benjarnin Bengfort. Abhijit Dasgupta. "Practical Data Science Cookbook", Packt Publishing Limited, 2014. W. N. Venables. D. M. Smith and the R Core Team, "An Introduction to R", 2013.			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks %
I	Data science process-roles, stages in data science project-working with data from files-working with relational databases-exploring data –managing data-cleaning and sampling for modeling and validation-introduction to NoSQL	6	15

II	Choosing and evaluating models-mapping problems to machine learning, evaluating clustering models, validating models-cluster analysis-k-means algorithm, Naive Bayes-Memorization Methods - Linear and logistic regression-unsupervised methods.	8	20
FIRST INTERNAL EXAM			
III	Reading and getting data into R- ordered and unordered factors - arrays and matrices lists and data frames - reading data from files - probability distributions - statistical models In R manipulating objects - data distribution.	8	15
IV	Python-based data visualization, predication through linear regression, collaborative filtering.	6	15
SECOND INTERNAL EXAM			
V	Introduction distributed file system mar reduce. Algorithm using Map Reduce –Matrix –Vector Multiplication by map reduce – Hadoop – Understanding Map Reduce architecture – writing Hadoop Map-Reduce programs-Loading data into HDFS Map-Reduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.	6	20
VI	Documentation and deployment - producing effective presentations - introduction to graphical analysis – plot() function - display ing multivariate data - matrix plots multiple plots in one window - exporting graph - using graphics parameters. Case studies.	6	15
END SEMESTER EXAM			

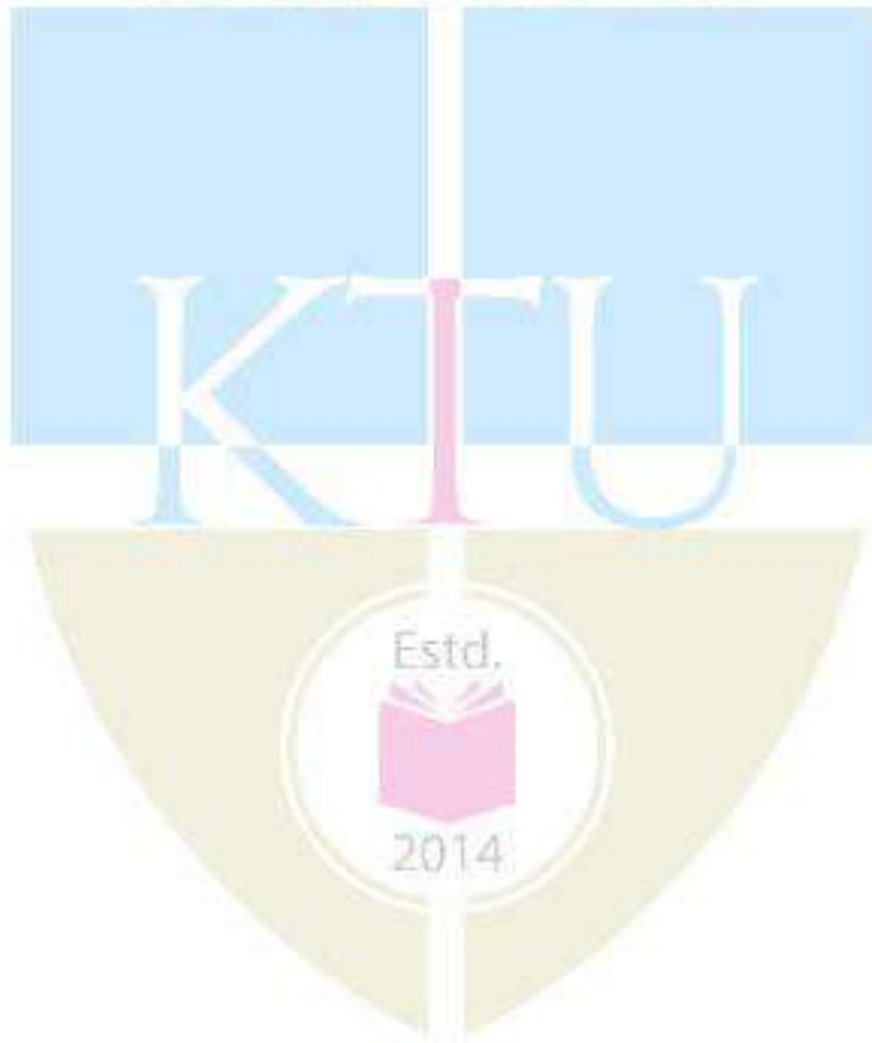
Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – **A, B, C, D**
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.

5. Part D

- a. Total marks : 24
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question *uniformly* covers **modules V & VI**.
 - c. *Any TWO* questions have to be answered.
 - d. Each question can have *maximum THREE* subparts.
6. There will be **AT LEAST 40%** analytical/numerical questions in all possible combinations of question choices.

ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY



Course code	Course Name	L-T-P Credits	Year of Introduction
CS469	COMPUTATIONAL COMPLEXITY	3-0-0-3	2016
Course Objectives: - To introduce the fundamentals of computational complexity theory. - To discuss basic concepts such as computational models, computational complexity measures (e.g., time and space complexity measures), complexity classes, reducibility and completeness notions. - To familiarize the concepts of randomized and approximation algorithms and discuss the related complexity classes.			
Syllabus: Turing machines, decision problems, time and space complexity, polynomial time algorithms, NP and NP-completeness, standard time and space complexity classes, optimization problems and approximation algorithms, randomized algorithms and complexity classes based on randomized machine models, interactive proofs and their relation to approximation.			
Expected Outcome The Students will be able to : - determine whether a problem is computable, and prove that some problems are not computable - categorize problems into appropriate complexity classes - classify problems based on their computational complexity using reductions - analyse optimization problems using the concept of interactive proofs - classify optimization problems into appropriate approximation complexity classes			
Text Books: - Michael Sipser, Introduction to the Theory of Computation, (First edition - PWS Publishing Company, January 1997, or second edition - Thomson Course Technology, 2005). - Sanjeev Arora and Boaz Barak, Computational Complexity: A Modern Approach, Cambridge University Press, 2009			
References: - Christos H Papadimitriou, Computational Complexity, Addison-Wesley, 1994. - M R Garey and D S Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, Freeman, 1979. - Oded Goldreich, Computational Complexity, Cambridge University press, 2008. - Vijay Vazirani, Approximation Algorithms, Springer--Verlag, 2001			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks %
I	Introduction: Easy and hard problems. Algorithms and complexity. Turing machines: Models of computation. Multi-tape deterministic and non-deterministic Turing machines. Decision problems	5	15%

II	The Halting Problem and Undecidable Languages: Counting and diagonalization. Tape reduction. Universal Turing machine. Undecidability of halting. Reductions. Rice's theorem. Deterministic Complexity Classes: DTIME[t]. Linear Speed-up Theorem. P Time. Polynomial reducibility. Polytime algorithms: 2-satisfiability, 2-colourability.	8	15%
FIRST INTERNAL EXAM			
III	NP and NP-completeness: Non-deterministic Turing machines. NTIME[t]. NP. Polynomial time verification. NP-completeness. Cook-Levin Theorem. Polynomial transformations: 3-satisfiability, clique, colourability, Hamilton cycle, partition problems. Pseudo-polynomial time. Strong NP-completeness. Knapsack. NP-hardness.	8	15%
IV	Space complexity and hierarchy theorems: DSPACE[s]. Linear Space Compression Theorem. PSPACE, NPSPACE. PSPACE = NPSPACE. PSPACE-completeness. Quantified Boolean Formula problem is PSPACE-complete. L, NL and NL-completeness. NL=coNL. Hierarchy theorems.	8	15%
SECOND INTERNAL EXAM			
V	Randomized Complexity: The classes BPP, RP, ZPP. Interactive proof systems: IP = PSPACE.	6	20%
VI	Optimization and approximation: Combinatorial optimization problems. Relative error. Bin-packing problem. Polynomial and fully polynomial approximation schemes. Vertex cover, traveling salesman problem, minimum partition.	7	20%
END SEMESTER EXAM			

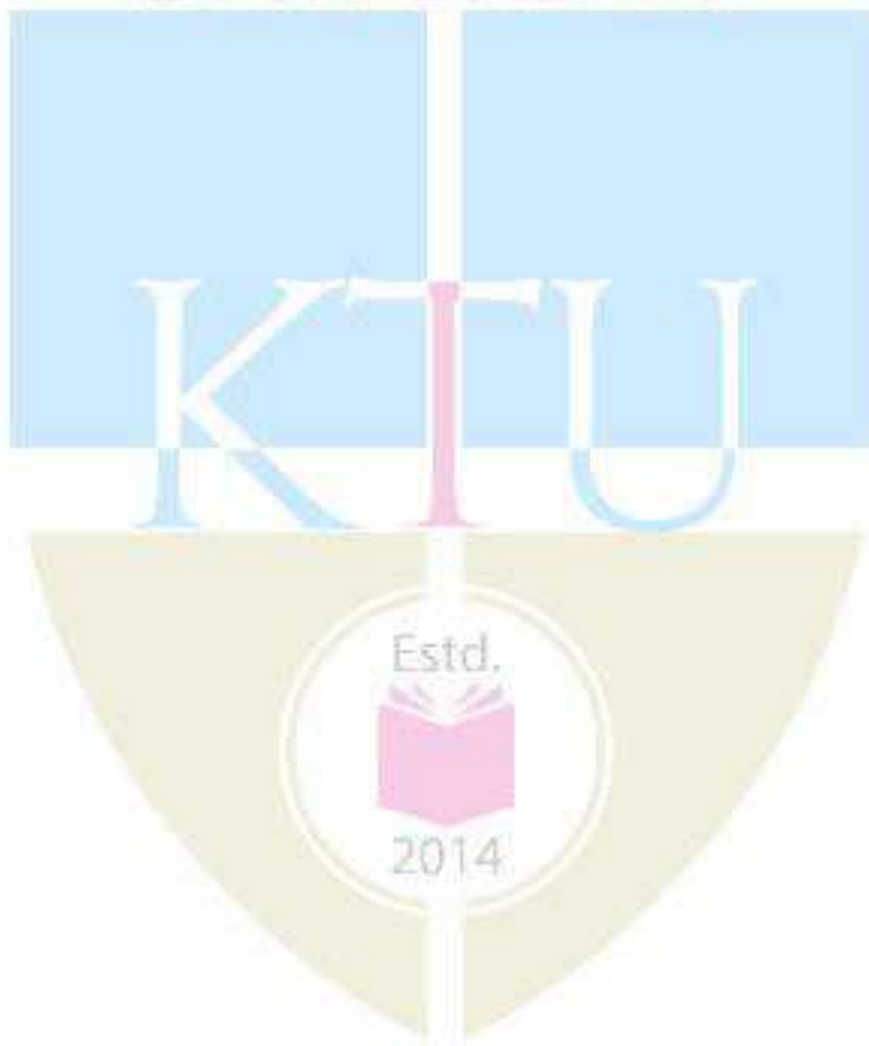
Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – A, B, C, D
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules** (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**).
All the TEN questions have to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question *uniformly* covers **modules I & II**.
 - Any TWO* questions have to be answered.
 - Each question can have *maximum THREE* subparts.
- Part C**
 - Total marks : 18**

- b. **THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
- c. **Any TWO** questions have to be answered.
- d. Each question can have **maximum THREE** subparts.

5. Part D

- a. **Total marks : 24**
 - b. **THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - c. **Any TWO** questions have to be answered.
 - d. Each question can have **maximum THREE** subparts.
6. There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.



Course code	Course Name	L-T-P - Credits	Year of Introduction
CS472	PRINCIPLES OF INFORMATION SECURITY	3-0-0-3	2016

Course Objectives

- To introduce fundamental concepts of security.
- To introduce and discuss the relevance of security in operating system, web services etc.
- To introduce fundamental concepts of secure electronic transactions.

Syllabus

Overview of computer security, Security concepts, Need of Security, Access Control, Access control matrix, Security policies, Software vulnerabilities, Security in current domains - Wireless LAN security, Cell phone security, Secure Electronic transactions, Web Services security

Expected Outcome:

The Student will be able to :

- appreciate the common threats faced today
- interpret the foundational theory behind information security
- design a secure system
- identify the potential vulnerabilities in software
- appreciate the relevance of security in various domains
- develop secure web services and perform secure e-transactions

Text Books:

1. Bernard Menezes, Network security and Cryptography, Cengage Learning India, 2010.
2. M Bishop, Computer Security: Art and Science, Pearson Education, 2003.

References:

1. E Whiteman and J Mattord, Principles of information security 4th edn, Cengage Learning
2. V K Pachghare, Cryptography and information security, PHI
3. Behrousz A Forouzan, D Mukhopadhyay, Cryptography and network Security, McGraw Hill
4. W Mao, Modern Cryptography: Theory & Practice, Pearson Education, 2004.
5. C P. Fleeger and S L Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction: Overview of computer security, Security concepts, Need of Security- Threats- Deliberate software attacks, Deviation in quality of service, Attacks- malicious code, brute force, Timing attack, sniffers Access Control Mechanisms - Access Control, Access control matrix, Access control in OS-Discretionary and Mandatory access control, Role-based access control, case study SELinux	7	15%

II	Security policies and models: confidentiality policies, Bell-LaPadula model, Integrity policies, Biba model, Clark-Wilson models, Chinese wall model, waterfall model	7	15%
FIRST INTERNAL EXAMINATION			
III	Software vulnerabilities: Buffer and stack overflow, Cross-site scripting(XSS) , and vulnerabilities, SQL injection and vulnerabilities , Phishing.	6	15%
IV	Malware: Viruses, Worms and Trojans. Topological worms. Internet propagation models for worms.	6	15%
SECOND INTERNAL EXAMINATION			
V	Security in current domains: Wireless LAN security - WEP details. wireless LAN vulnerabilities – frame spoofing. Cellphone security - GSM and UMTS security. Mobile malware - bluetooth security issues.	8	20%
VI	Secure Electronics transactions: Framework, strength and weakness, Security in current applications : Online banking , Credit Card Payment Systems. Web Services security: XML, SOAP, SAML, RFID	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

- There will be **FOUR** parts in the question paper – **A, B, C, D**
- Part A**
 - Total marks : 40**
 - TEN** questions, each have **4 marks**, covering **all the SIX modules (THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All** questions are to be answered.
- Part B**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question **uniformly** covers **modules I & II**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part C**
 - Total marks : 18**
 - THREE** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question **uniformly** covers **modules III & IV**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- Part D**
 - Total marks : 24**
 - THREE** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question **uniformly** covers **modules V & VI**.
 - Any TWO** questions have to be answered.
 - Each question can have **maximum THREE** subparts.
- There will be **AT LEAST 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction						
**341	DESIGN PROJECT	0-1-2-2	2016						
Prerequisite : Nil									
Course Objectives • To understand the engineering aspects of design with reference to simple products • To foster innovation in design of products, processes or systems • To develop design that add value to products and solve technical problems									
Course Plan Study :Take minimum three simple products, processes or techniques in the area of specialisation, study, analyse and present them. The analysis shall be focused on functionality, strength, material, manufacture/construction, quality, reliability, aesthetics, ergonomics, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques. Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality, design for strength is not expected. <i>Note :</i> The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.									
Expected outcome. The students will be able to i. Think innovatively on the development of components, products, processes or technologies in the engineering field ii. Analyse the problem requirements and arrive workable design solutions									
Reference: Michael Luchs, Scott Swan, Abbie Griffin, 2015. Design Thinking. 405 pages, John Wiley & Sons, Inc									
Evaluation <table><tr><td>First evaluation (Immediately after first internal examination)</td><td>20 marks</td></tr><tr><td>Second evaluation (Immediately after second internal examination)</td><td>20 marks</td></tr><tr><td>Final evaluation (Last week of the semester)</td><td>60 marks</td></tr></table>				First evaluation (Immediately after first internal examination)	20 marks	Second evaluation (Immediately after second internal examination)	20 marks	Final evaluation (Last week of the semester)	60 marks
First evaluation (Immediately after first internal examination)	20 marks								
Second evaluation (Immediately after second internal examination)	20 marks								
Final evaluation (Last week of the semester)	60 marks								
<i>Note:</i> All the three evaluations are mandatory for course completion and for awarding the final grade.									

Course code	Course Name	L-T-P - Credits	Year of Introduction
**352	Comprehensive Examination	0-1-1-2	2016
Prerequisite : Nil			
Course Objectives - To assess the comprehensive knowledge gained in basic courses relevant to the branch of study - To comprehend the questions asked and answer them with confidence.			
Assessment Oral examination – To be conducted by the college (@ three students/hour) covering all the courses up to and including V semester– 50 marks Written examination - To be conducted by the Dept. on the date announced by the University– common to all students of the same branch – objective type (1 hour duration)– 50 multiple choice questions (4 choices) of 1 mark each covering the six common courses of S1&S2 and six branch specific courses listed – questions are set by the University - no negative marks – 50 marks. <i>Note:</i> Both oral and written examinations are mandatory. But separate minimum marks is not insisted for pass. If a students does not complete any of the two assessments, grade I shall be awarded and the final grade shall be given only after the completion of both the assessments. The two hours allotted for the course may be used by the students for discussion, practice and for oral assessment.			
Expected outcome. The students will be confident in discussing the fundamental aspects of any engineering problem/situation and give answers in dealing with them			



Course code	Course Name	L-T-P - Credits	Year of Introduction
**451	Seminar and Project Preliminary	0-1-4-2	2016
Prerequisite : Nil			
Course Objectives - To develop skills in doing literature survey, technical presentation and report preparation. - To enable project identification and execution of preliminary works on final semester project			
Course Plan Seminar: Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class. Project preliminary: Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the assessment board (excluding the external expert) and get it approved by the board. The preliminary work to be completed: (1) Literature survey (2) Formulation of objectives (3) Formulation of hypothesis/design/methodology (4) Formulation of work plan (5) Seeking funds (6) Preparation of preliminary report Note: The same project should be continued in the eighth semester by the same project team.			
Expected outcome. The students will be able to - Analyse a current topic of professional interest and present it before an audience - Identify an engineering problem, analyse it and propose a work plan to solve it.			
Evaluation Seminar : 50 marks (Distribution of marks for the seminar is as follows: i. Presentation : 40% ii. Ability to answer questions : 30% & iii. Report : 30%) Project preliminary : 50 marks (Progress evaluation by the supervisor : 40% and progress evaluation by the assessment board excluding external expert : 60%. Two progress evaluations, mid semester and end semester, are mandatory.) Note: All evaluations are mandatory for course completion and for awarding the final grade.			

Course code	Course Name	Credits	Year of Introduction						
**492	PROJECT	6	2016						
Prerequisite : Nil									
Course Objectives • To apply engineering knowledge in practical problem solving • To foster innovation in design of products, processes or systems • To develop creative thinking in finding viable solutions to engineering problems									
Course Plan In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester Review and finalization of the approach to the problem relating to the assigned topic Preparing a detailed action plan for conducting the investigation, including team work Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed Final development of product/process, testing, results, conclusions and future directions Preparing a paper for Conference presentation/Publication in Journals, if possible Preparing a report in the standard format for being evaluated by the dept. assessment board Final project presentation and viva voce by the assessment board including external expert									
Expected outcome The students will be able to iii. Think innovatively on the development of components, products, processes or technologies in the engineering field iv. Apply knowledge gained in solving real life engineering problems									
Evaluation Maximum Marks : 100 <table><tr><td>(i) Two progress assessments</td><td>20% by the faculty supervisor(s)</td></tr><tr><td>(ii) Final project report</td><td>30% by the assessment board</td></tr><tr><td>(iii) Project presentation and viva voce</td><td>50% by the assessment board</td></tr></table> <i>Note:</i> All the three evaluations are mandatory for course completion and for awarding the final grade.				(i) Two progress assessments	20% by the faculty supervisor(s)	(ii) Final project report	30% by the assessment board	(iii) Project presentation and viva voce	50% by the assessment board
(i) Two progress assessments	20% by the faculty supervisor(s)								
(ii) Final project report	30% by the assessment board								
(iii) Project presentation and viva voce	50% by the assessment board								