COLLEGE OF TECHNOLOGY

B.TECH. (Computer Science and Engineering) Program

GENERAL COURSE STRUCTURE& THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1Hr. Practical(P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech/B.E. in Computer Science and Engineering (CSE) is kept as 164.

C. Structure of UG Program in Computer Science and Engineering (CSE): The structure of UG program in Computer Science and Engineering (CSE) shall have essentially the following categories of courses with the breakup of credits as given:

Department wise distribution of Credit Load

S. No.	Name of Department/Sub-discipline	Credit Hours
1.	Humanities and Social Sciences including Management courses	15
2.	Basic Science courses	23
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	21
4.	Professional core courses	56
5.	Professional Elective courses relevant to chosen specialization/branch	13
6.	Open subjects – Electives from other technical and /or emerging subjects	15
7.	Project work	21
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
	Total	**164**

D. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BS	Basic Science Courses
ES	Engineering Science Courses
HSM	Humanities and Social Sciences including Management courses
TCS	Program core courses
PE	Program Elective courses
OE	Open Elective courses

- **Course level coding scheme:** Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered. Ten's place digit signifies the semester (1 represents the odd semester courses and 2 represents for even semester courses). Digit at one's place signifies the course number in semester e.g.

  111, 112 … etc. for first year (even semester).

  121,122 … etc. for first year (odd semester).

  211,212 ... etc. for second year (even semester).

  221, 222 ... etc. for second year (odd semester).

Category-wise Courses

HUMANITIES & SOCIAL SCIENCES COURSES [HSM]

Number of Humanities & Social Science, including Management Courses: 5

Credits: 15

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	HSM111	Environmental study and disaster management	3
2.	HSM121	Universal Human Values	3
3.	HSM211	English for Technical Writing	3
4.	HSM311	Theory of Computer Ecosystem	3
5.	HSM411	Entrepreneurship development and business Management	3
		Total	**15**

BASIC SCIENCE COURSES

Number of Basic Sciences Courses: 6

Credits: 23

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	BS111	Engineering Mathematics-I	4(3+1+0)
2.	BS112	Engineering Physics	4(3+0+2)
3.	BS122	Engineering Chemistry	4(3+0+2)
4.	BS123	Biology for Engineers	3(3+0+0)
5.	BS121	Engineering Mathematics-II	4(3+1+0)
6.	BS 212	Engineering Mathematics-III	4(3+1+0)
		Total	**23**

ENGINEERING SCIENCE COURSES

Number of Engineering Sciences Courses: 6

Credits: 21

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	ES111	Basic Electrical Engineering	4 (3+0+2)
2.	ES112	Engineering Drawing	3 (1+0+4)
3.	ES113	Engineering Mechanics	4 (3+1+0)
4.	ES121	Programming in Problem Solving	4(2+0+4)
5.	ES122	Basic Electronics Engineering	4(3+0+2)
6.	ES123	Workshop Technology and Practice	2(0+0+4)
		Total	**21**

PROFESSIONAL CORE COURSES

Number of Professional Core Courses: 14

Credits: 56

S. No.	Course Code	Title of the courses	
1.	TCS211	Data Structure	4 (3+0+2)
2.	TCS212	Discrete Mathematics	4 (3+0+2)
3.	TCS213	Computer Organization and Architecture	4 (3+0+2)
4.	TCS221	Object-oriented programming in Java	4 (3+0+2)
5.	TCS 222	Python Programming	4 (3+0+2)
6.	TCS 223	Operating System	4 (3+0+2)
7.	TCS 224	Theory of Computation	4 (3+0+2)

8.	TCS 225	Web Designing	4 (3+0+2)
9.	TCS 311	Web Technology	4 (3+0+2)
10.	TCS 312	Database Management System	4 (3+0+2)
11.	TCS313	Design analysis and algorithm	4 (3+0+2)
12.	TCS 321	Computer Networks	4 (3+0+2)
13.	TCS322	Data Analysis	4 (3+0+2)
14.	TCS114	Computer Networks	4 (3+0+2)
		Total	56

PROFESSIONAL ELECTIVE COURSES

Professional elective courses credit

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	PE	Professional Elective - I	3(3+0+0)
2.	PE	Professional Elective - II	3(3+0+0)
3.	PE	Professional Elective - III	3(3+0+0)
4.	PE	Professional Elective - IV	3(3+0+0)
		Total	**12**

List of Professional Elective Course offered

S. No.	Title of the courses	Credit(L+T+P)
1.	Application of Soft Computing	3(3+0+0)
2.	Software Engineering	3(3+0+0)
3.	Artificial Intelligence	3(3+0+0)
4.	Natural Language Processing	3(3+0+0)
5.	Big Data	3(3+0+0)
6.	Compiler	3(3+0+0)
7.	Statistical Computing	3(3+0+0)
8.	Computer Graphics	3(3+0+0)
9.	Object Oriented System Design	3(3+0+0)
10.	Digital Image Processing	3(3+0+0)
11.	Machine Learning Techniques	3(3+0+0)
12.	Human-Computer Interface	3(3+0+0)
13.	Augmented & Virtual Reality	3(3+0+0)
14.	Data Compression	3(3+0+0)
15.	Image Processing	3(3+0+0)
16.	Blockchain Architecture Design	3(3+0+0)
17.	Internet of Things	3(3+0+0)
18.	High Performance Computing	3(3+0+0)
19.	Mobile Computing	3(3+0+0)
20.	Distributed System	
	Total	

OPEN ELECTIVE COURSES

Open elective courses credit

S. No.	Course Code	Title of the courses	Credit(L+T+P)

5.	OE	Open Elective - I	3(3+0+0)
6.	OE	Open Elective - II	3(3+0+0)
7.	OE	Open Elective - III	3(3+0+0)
8.	OE	Open Elective - IV	3(3+0+0)
9.	OE	Open Elective - V	3(3+0+0)
		Total	**15**

Students can choose course from other departments broadening their educational experience beyond their primary field of study

PROJECT

Credits: 21

S. No.	Course Code	Title of the courses	
1.	TCS 411	Summer Internship	**2**
2.	TCS 412	Seminar	**1**
3.	TCS-P1	Mini Project-1	**3**
4.	TCS P2	Mini Project -2	**3**
5.	TCS-P3	Project	**12**
		Total	**21**

Semester wise distribution of courses

Semester – I

S. No.	Course Code	Title of the courses	Credit(L+T+P)
3 WEEKS COMPULSORY INDUCTION PROGRAM (UHV-I)			
1.	BS111	Engineering Mathematics – I	4(3+1+0)
2.	BS112	Engineering Physics	4(3+0+2)
3.	ES111	Basic Electrical Engineering	4 (3+0+2)
4.	HSM111	Environmental study and disaster management	3(3+0+0)
5.	ES112	Engineering Drawing	3 (1+0+4)
6.	ES113	Engineering Mechanics	4 (3+1+0)
7.		Sports and Yoga or NSS/NCC	(0+0+2)
		Total	22

Semester – II

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	BS121	Mathematics – II	4 (3+1+0)
2.	BS122	Engineering Chemistry	4 (3+0+2)
3.	BS123	Biology for Engineers	3(3+0+0)
4.	ES121	Programming in Problem Solving	4(2+0+4)
5.	ES122	Basic Electronics Engineering	4(3+0+2)

6.	ES123	Workshop Technology and Practice	2(0+0+4)
7.		Sports and Yoga or NSS/NCC	(0+0+2)
		Total	21

Semester – III

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	HSM211	Universal Human Values	4(2+0+4)
2.	BS212	Mathematics-III	4(3+1+0)
3.	HSM211	English technical Writing	3 (2+0+2)
4.	TCS211	Data Structure	4(3+0+2)
5.	TCS-212	Discrete Mathematics	4(3+0+2)
6.	TCS-213	Computer Organization and Architecture	4(3+0+0)
		Total	23

Semester – IV

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	TCS-221	Object-Oriented programming with java	4(3+0+2)
2.	TCS-222	Python programming	4(3+0+2)
3.	TCS-223	Operating System	4(3+0+2)
4.	TCS-224	Theory of Computation	4(3+1+0)
5.	TCS-225	Web designing	4(3+0+2)
6.	TCS-P1	Mini Project-1	2(0+0+4)
		Total	22

Semester – V

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	TCS-311	Web Technology	4(3+0+2)
2.	TCS-312	Database Management System	4(3+0+2)
3.	TCS-313	Data Analysis and Algorithm	4(3+0+2)
4.	OE-314	Open Electives-1	3(3+0+0)
5.	PE-315	Program elective 1	4(3+0+2)
6.		Constitution of India	Non credit
		Total	19

Semester – VI

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	HSM-311	Theory of Computer Ecosystem	3(3+0+0)
2.	TCS-321	Computer Networks	4(3+0+2)

3.	TCS-322	Data Analysis	4(3+0+2)
4.	PE-321	Program Electives-2	3(3+0+0)
5.	OE-321	Open Elective-2	3(3+0+0)
6.	TCS-P2	Mini Project-2	3(0+0+6)
7.	TNC312	Indian Tradition and Culture	Non credit
		Total	20

Semester – VII

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	HS411	Entrepreneurship development and business Management	3(3+0+0)
2.	PE411	Program Elective-3	3(3+0+0)
3.	PE412	Program Elective-4	3(3+0+0)
4.	OE411	Open Elective-3	3(3+0+0)
5.	OE412	Open Elective-4	3(3+0+0)
6.	TCS411	Internship	2(0+0+4)
7.	TCS412	Seminar	1(0+0+2)
		Total	**18**

Note - Minimum 6 weeks Internship after the sixth semester

Semester – VIII

S. No.	Course Code	Title of the courses	Credit(L+T+P)
1.	PE412	Program Elective-5	3(3+0+0)
2.	OE421	Open Elective-5	3(3+0+0)
3.	TCS-P3	Project	12
		Total	18

SEMESTER–I

INDUCTION PROGRAM

Induction program (mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch& Innovations

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Course Code	**:**	**BS-111**
Course Title	**:**	**Engineering Mathematics-I**
Number of Credits	**:**	**4 (L:3,T:1, P:0)**
Course Category	**:**	**Engineering Science Courses**

Matrices:

Elementary transformations**,** Inverse of a matrix, Gauss Jordon method to find inverse of a matrix; Rank of Matrix, Echelon and Normal form of a matrix; System of linear equations and its solutions; rank-nullity theorem; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; and Cayley-Hamilton Theorem.

Differential Calculus

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Curvature, Evolutes and involutes; Limit & continuity of function of two variables; partial derivatives; Homogeneous functions and Euler's theorem; directional derivatives, total derivative; Maxima, minima and saddle points of function of two variables; and Method of Lagrange multipliers

Integral Calculus:

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Vector Calculus:

Scalar and vector point functions, vector differential operator Del, gradient of scalar point function, divergent and curl of vector point function and their physical interpretations, line, surface and volume integrals, Green, Stokes and Gauss Divergence theorem (without proofs).

TEXT/REFERENCS BOOKS:

1. B.V. Ramana. 2008. Engineering Mathematics. Tata McGraw-Hill Book Co., New Delhi.

2. H. K. Dass 2007, Advanced Engineering Mathematics, S. Chand & Company Pvt. Ltd, New Delhi.

3. R.K. Jain, S.R.K. Iyengar 2016 (Fifth Edition). Advanced Engineering Mathematics. Narosa Publishing House, New Delhi.

4. Erwin Kreyszig (Reprint 2023) (Tenth Edition), Advanced Engineering Mathematics. J. Wiley and Sons; Wiley India Pvt. Ltd.

5.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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Course Code	**:**	**ES-111**
Course Title	**:**	**Basic Electrical Engineering**
Number of Credits	**:**	**4 (L:3,T:0, P:2)**

Course Category	:	Engineering Science Courses

Module I: D.C. Circuits covering, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy store d in magnetic fields;

Module II: Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three phase systems, Generation of three phase power, definition of phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method;

Module III: Transformers covering, Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation; Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation;

Module IV: DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;

Module V: Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Module VI: Sources of Electrical Power covering, Introduction toWind, Solar, Fuelcell, Tidal, Geo-thermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation;

TEXT/REFERENCS BOOKS:

1. AICTE's Prescribed Textbook: Basic Electrical Engineering, Khanna Book Publishing.
2. Ritu Sahdev (2022), Basic Electrical Engineering, Khanna Book Publishing.
3. Nagrath I. J. and D. P .Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
4. Haytand Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D. C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India Hughes, E. 2005)

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Course Code	**:**	**HSM-111**
Course Title	**:**	**Environmental Studies and Disaster Management**
Number of Credits	**:**	**3 (L:3,T:0, P:0)**
Course Category	**:**	**Humanities & Social Science including Management Courses**

Introduction to Environment - Environmental studies - Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere.

Natural Resources: Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources.

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystems. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution. h. light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.

Social Issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health.

Disaster management - Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management. Practical Visit to a local area to document environmental assets river/forest/grassland/hill/mountain.

Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and un

polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of E. coli in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem– Visit to pond/river/hills. Visit to areas affected by natural disaster

TEXT/REFERENCS BOOKS:

1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp

2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bengaluru. 36 pp.

3. Erach Bharucha. Text book for Environmental studies. University Grants Commission, New Delhi.

4. Parthiban, K.T. Vennila, S. Prasanthrajan, M. Umesh Kanna, S. 2023. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi.

5. Prasanthrajan, M. and Mahendran, P.P. 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104.

6. Agrotech Publishing Academy, Udaipur 6. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerut, India.

7. Tyler, Miller and Spoolman, Scot. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA

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Course Code	**:**	**ES-112**
Course Title	**:**	**Engineering Drawing**
Number of Credits	**:**	**3(L:1,T:0, P:4)**
Course Category	**:**	**Engineering Science Courses**

Introduction to engineering drawing, practice of different layout drawings; Drawing instruments and their use; Introduction to lines, letterings, single stroke letters and gothic letters; Dimensioning, dimension line, extension line, arrow head, continuous and progressive dimensioning; Introduction of drawing scales, representative fraction; Practice on orthographic projections, references planes, points and lines in space; Drawing for orthographic projection of points by first angle projection method; Third angle methods of projection; Projection of planes; Projections of solids: polyhedra, cylinder, cone; Projections of solids: prisms and pyramids; Development of surfaces of geometrical solids; Drawing the section of solids: cylinder, cone and sphere; Introduction to isometric scale, isometric view and isometric drawing; Isometric

projection of geometrical solids; Preparation of working drawing from models and isometric views; Sectional drawing of simple machine parts; Nomenclature, thread profiles, multi start threads, left and right hand threads; Conventional representation of threads; Forms of screw threads like metric thread, whit worth thread; Square thread: acme thread, knuckle thread, buttress thread; Square headed and hexagonal nuts and bolts; Different types of lock nuts, studs, machine screws, cap screws and wood screws; Processes for producing leak proof joints; Drawing of different types of rivet heads and riveted joints and foundation bolts; Drawing of stud screws, set screws, butt, hexagonal and square; Drawing of keys: taper, rank taper, hollow saddle etc.; Symbols for different types of welded joints

TEXT/REFERENCS BOOKS:

1. Bhatt, N. D. 2010. Elementary Engineering Drawing. Charotar Publishing House Pvt. Ltd., Anand.

2. Bhatt, N. D. and Panchal, V. M. 2013. Machine Drawing. Charotar Publishing House Pvt. Ltd., Anand.

3. Narayana, K. L. and Kannaiah, P. 2010. Machine Drawing. Scitech Publications (India) Pvt. Ltd, Chennai.

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Course Code	**:**	**ES-113**
Course Title	**:**	**Engineering Mechanics**
Number of Credits	**:**	**4(L:3, T:1, P:0)**
Course Category	**:**	**Engineering Science Courses**

Theory Basic concepts of engineering mechanics, statics, dynamics, kinetics, scalar quantities, vector quantities, systems of units. Composition and resolution of forces, analytical method, graphical method. Laws of forces, moments and their application, levers, parallel forces and couples. Equilibrium of forces, free body diagrams. Centre of gravity (CG) of simple geometrical figures, CG by moments, plane figures, axis of references, CG of symmetric sections, unsymmetrical sections, solid bodies and cut sections. Moment of inertia: Methods of finding out M.I., methods of integration, M.I. of different sections, Theorem of perpendicular axes, parallel axes, M.I. of composite sections and cut sections. Frictional forces, static friction, dynamic friction, limiting friction, normal reaction, angle of friction, coefficient of friction, laws of friction, equilibrium of a body lying in horizontal and inclined planes, ladder friction; wedge friction, screw friction, screw jack. Analysis of simple framed structures, methods of sections, force table, methods of

joints, hinged joints, roller support, vertical and inclined loads. Simple stresses and strain, Hooke's law, Poisson's ratio, modulus of elasticity, Strain related problems. Shear force and bending moment, fundamentals of shear force and bending moment, SFD and BMD of cantilever and simply supported and overhanging beams, point of contra-flexture. Torsion of circular shaft, torsional effect, hoop stress, power transmitted by a shaft. Principal stresses and strain, analysis of plane and complex stress, principal planes and principal stresses, Mohr's circle, finding out principal stresses, different analysis

TEXT/REFERENCS BOOKS:

1. Bansal, R. K. 2005. A Text Book of Engineering Mechanics. Laxmi Publishers, New Delhi. 2. Khurmi, R. S. 2006. Strength of Materials. S. Chand Publishing.

3. Khurmi, R. S. 2018. A Text Book of Engineering Mechanics. S. Chand Publishing.

4. Prasad, I. B. 2004. Applied Mechanics and Strength of Materials. Khanna Publishers, New Delhi.

5. Prasad, I. B. 2004. Applied Mechanics. Khanna Publishers, New Delhi.

6. Sundarajan, V. 2002. Engineering Mechanics and Dynamics. Tata McGraw Hill Publishing Co. Ltd, New Delhi.

7. Timoshenko, S. and Young, D. H. 2003. Engineering Mechanics. McGraw Hill Book Co., New Delhi.

PROGRAMMING FOR PROBLEM SOLVING (ES 123)

(3-0-2)

Content	Contact Hours
Unit -1:	8
Introduction to Components of a Computer System: Memory, Processor, I/O Devices, Storage, Operating System, Concept of Assembler, Compiler, Interpreter, Loader and Linker. **Idea of Algorithm:** Representation of Algorithm, Flowchart, Pseudo Code with Examples, From Algorithms to Programs, Source Code. **Programming Basics:** Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C , Fundamental Data types, Variables and Memory Locations, Storage Classes.	
Unit-2:	8

Arithmetic Expressions and Precedence : Operators and Expression Using Numeric and Relational Operators, Mixed Operands, Type Conversion, Logical Operators, Bit Operations, Assignment Operator, Operator precedence and Associatively. **Conditional Branching:** Applying if and Switch Statements, Nesting if and Else and Switch.	
Unit-3:	8
Iteration and Loops: Use of While, do While and for Loops, Multiple Loop Variables, Use of Break , Goto and Continue Statements. **Arrays:** Array Notation and Representation, Manipulating Array Elements, using Multi Dimensional Arrays. Character Arrays and Strings, Structure, union, Enumerated Data types, Array of Structures, Passing Arrays to Functions.	
Unit-4:	8
Functions: Introduction, Types of Functions, Functions with Array, Passing Parameters to Functions, Call by Value, Call by Reference, Recursive Functions. **Basic of searching and Sorting Algorithms:** Searching & Sorting Algorithms (Linear Search , Binary search , Bubble Sort, Insertion and Selection Sort)	
Unit-5:	8
Pointers: Introduction, Declaration, Applications, Introduction to Dynamic Memory Allocation (Malloc, Calloc, Realloc, Free), String and String functions , Use of Pointers in Self-Referential Structures, Notion of Linked List (No Implementation) **File Handling:** File I/O Functions, Standard C Preprocessors, Defining and Calling Macros and Command-Line Arguments.	

Course Outcome:

Course Outcome (CO)		Bloom's Level
At the End of Course , the Student will be Able to Understand		
CO 1	To Develop Simple Algorithms for Arithmetic and Logical Problems.	K_2, K_3
CO 2	To Translate the Algorithms to Programs & Execution (in C Language).	K_3
CO 3	To Implement Conditional Branching, Iteration and Recursion.	K_3
CO 4	To Decompose a Problem into Functions and Synthesize a Complete Program Using Divide and Conquer Approach.	K_4
CO 5	To Use Arrays, Pointers and Structures to Develop Algorithms and Programs.	K_2, K_3

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze , K_5- Evaluate , K_6- Create

Text Books:

1. Schaum's Outline of Programming with C by Byron Gottfried , McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
5. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
6. Let Us C By Yashwant P. Kanetkar.
7. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
8. Programming in C by Kochan Stephen G. Pearson Education – 2015.
9. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
12. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication

PROGRAMMING FOR PROBLEM SOLVING LAB

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained

   by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate

   of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.

8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

    Between 90-100% -- Print 'A'
    80-90%---------- Print 'B'
    60-80%---------- Print 'C'
    Below 60% ---------- Print 'D'

11. WAP that takes two operands and one operator from the user, perform the operation, and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

a. List all the trains (sorted according to train number) that depart from a particular section.

b. List all the trains that depart from a particular station at a particular time.

c. List all he trains that depart from a particular station within the next one hour of a given time.

d. List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

Note:

a) The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner

b) The subject teachers are suggested to use the concept of project based learning. The subject teacher may giver certain use cases/case studies where student is able to apply multiple concepts in one single program

c) It is also suggested that open source tools should be preferred to conduct the lab. Some open source online compiler to conduct the C lab are as follows:

- **https://www.jdoodle.com/c-online-compiler/**
- **https://www.tutorialspoint.com/compile_c_online.php**
- **https://www.programiz.com/c-programming/online-compiler/**
- **https://www.hackerrank.com/**

Mapping with Virtual Lab

Name of the Lab	Name of the Experiment
Problem Solving Lab	Numerical Representation
	Beauty of Numbers
	More on Numbers
	Factorials
	String Operations
	Recursion
	Advanced Arithmatic
	Searching and Sorting
	Permutation
	Sequences

Course Outcomes:

Course Outcome		Bloom's Level
At the end of course , the student will be able to:		
CO 1	Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.	K_3, K_4
CO 2	Demonstrate an understanding of computer programming language concepts.	K_3, K_2
CO 3	Ability to design and develop Computer programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.	K_6, K_4
CO 4	Able to define data types and use them in simple data processing applications he/she must be able to use the concept of array of structures.	K_1, K_5
CO 5	Develop confidence for self-education and ability for life-long learning needed for Computer language.	K_3, K_4

SEMESTER–II

Course Code	**:**	**BS-121**
Course Title	**:**	**Engineering Mathematics-II**
Number of Credits	**:**	**4 (L:3,T:1, P:0)**
Course Category	**:**	**Engineering Science Courses**

Ordinary differential equations:

Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, differential equations of higher orders, methods of finding complementary functions and particular integrals, Cauchy's and Legendre's linear equations, method of variation of parameters, simultaneous linear differential equations with constant coefficients.

Fourier series and Laplace Transformation:

Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series. Laplace Transform: rules for Laplace transform and inverse Laplace transform, applications to find solutions of ordinary differential equations.

Partial differential equations:

Formation of partial differential equations, Lagrange's linear equation, higher order linear partial differential equations with constant coefficients, solution of non-linear partial differential equations, Charpit's method. Classification of second order linear PDEs into elliptic, parabolic and hyperbolic types.

Complex Variable – Differentiation & Integration:

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

TEXT/REFERENCS BOOKS:

1. B.V. Ramana. 2008. Engineering Mathematics. Tata McGraw-Hill Book Co., New Delhi.

2. H. K. Dass 2007, Advanced Engineering Mathematics, S. Chand & Company Pvt. Ltd, New Delhi.

3. R.K. Jain, S.R.K. Iyengar 2016 (Fifth Edition). Advanced Engineering Mathematics. Narosa Publishing House, New Delhi.

4. Erwin Kreyszig (Reprint 2023) (Tenth Edition), Advanced Engineering Mathematics. J. Wiley and Sons; Wiley India Pvt. Ltd.

5.S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

6. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.

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CourseCode	**:**	**BS122**
CourseTitle	**:**	**Engineering Chemistry**
NumberofCredits	**:**	**4 (L:3,T:0, P:2)**
CourseCategory	**:**	**Basic Science Course**

Unit 1: Chemical Kinetics and Catalysis

- Rate equations, reaction order, and reaction mechanisms, First-order and second-order reaction dynamics, Temperature effects on reaction rates (Arrhenius behavior)

- Introduction to heterogeneous catalysis, Physical adsorption vs. chemisorption, Freundlich's and Langmuir adsorption isotherms, Examples of heterogeneously catalyzed reactions

Unit 2: Organic Reaction Mechanisms and Spectroscopy

- Concepts of electrophiles and nucleophiles, SN_1 and SN_2 reaction pathways, Electrophilic aromatic substitution reactions, free radical reactions
- Detailed study of key reactions: Aldol condensation, Beckmann rearrangement, Cannizzaro reaction, Hoffmann rearrangement, Diels-Alder reaction, Friedel-Crafts reactions, (Additional reactions such as Riemer-Tiemann, Skraup synthesis, etc.)

Unit 3: Spectroscopy & Analytical Techniques

- UV-Visible spectroscopy: Principle, Beer-Lambert law, applications.
- Infrared (IR) spectroscopy: Basic principles, applications in material identification.
- NMR spectroscopy: Basic principle and significance.
- Chromatography: Basics of gas chromatography (GC) and high-performance liquid chromatography (HPLC).

Unit 4: Polymer Chemistry

- Types of polymers: thermoplastics vs. thermosetting polymers, Overview of polymerization methods: addition and condensation polymerization,
- **Specific Polymers and Their Applications:** Case studies: PVC, Dacron, Nylon 66, and Bakelite, Elastomers: Natural rubber, Buna-N, Buna-S, and vulcanization
- Advanced topics: Conducting polymers (intrinsic vs. extrinsic), doping, ion exchange resins, and biodegradable polymers

Unit 5: Electrochemistry and Corrosion

- Electrochemical cells: Galvanic and electrolytic cells, EMF, Nernst equation, Conductance: Specific, molar, equivalent conductance. Kohlrausch's Law, Batteries: Lead-acid battery, lithium-ion battery, fuel cells.
- Corrosion: Types of corrosion, electrochemical theory, factors affecting corrosion, Corrosion control: Cathodic protection, coatings, inhibitors.

Unit 6: Water Treatment and Fuels

- Hardness of water: definitions, calculations, and determination using the EDTA method, Sludge and scale formation in boilers; causes and preventive measures (colloidal, phosphate, and Calgon conditioning), Hardness removal techniques: soda lime process, zeolite process, and ion-exchange processes, Alkalinity of water and its determination.
- Definitions and classification of fuels (solid, liquid, gaseous), Determination of calorific value (including Dulong's formula), Analysis of coal: proximate and ultimate analysis, Overview of petroleum: important fractions and their uses, Gaseous fuels: CNG and LPG

TEXT/REFERENCS BOOKS:

1. Engineering Chemistry – Shashi Chawla
2. Applied Chemistry – A Textbook for Engineers and Technologists – H.D. Gesser
3. Physical Chemistry – P.W. Atkins & Julio de Paula
4. Elements of Physical Chemistry – P.W. Atkins & J. de Paula

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BS122	Biology for Engineers	3L:0T:0P	3 credits

Module1.Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Browni anmotion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module2.Classification

Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3-Genetics

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4.-Biomolecules
Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine.
Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Module5. Enzymes
Purpose: To convey that without catalysis life would not have existed on earth.
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions.Enzymeclassification.Mechanismofenzymeaction.Discussatleasttwo examples.
Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6.Information Transfer
Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer.
DNA as a genetic material. Hierarchy of DNA structure-from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. DICOM Image formats, The DNA Technology (Use and Application) Regulation Bill, 2019
Module 7.Macromolecular analysis
Purpose: How to analyses biological processes at the reductionistic level.
Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8.-Metabolism
Purpose: The fundamental principles of energy transactions are the same in physical and biological world.
Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity.ATPasanenergycurrency.ThisshouldincludethebreakdownofglucosetoCO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9.-Microbiology
Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

References:

1) General Biology, Uma Devi Koduru, Khanna Book Publishing Company.
2) Biology: A global approach: Campbell, N.A.; Reece,J.B.; Urry, Lisa; Cain, M,L.; Wasserman, S.A.; Minorsky, P.V.; Jackson, R.B. Pearson Education Ltd
3) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
4) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M.M.W.H .Freeman and Company
5) Molecular Genetics (Second edition), Stent, G.S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
6) Microbiology, Prescott, L.MJ.P. Harley and C.A. Klein 1995. 2nd edition, C. Brown Publishers

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Course Code	**:**	**ES-123**
Course Title	**:**	**Workshop Technology and Practice**
Number of Credits	**:**	**3(L:1,T:0, P:4)**
Course Category	**:**	**Engineering Science Courses**

Introduction about different shops in the workshop; Safety and precautions to be taken in the workshop; Study of different tools used for fitting and different fitting operations; Study of various measuring instruments used for fitting; Exercise in fitting: sawing, filing and right angle fitting of MS flat; Working with complex fitting jobs: operations of drilling, reaming, and threading and with tap dies; Preparation of a paper weight; Study of various carpentry tools, types of wood and their characteristics and working with carpentry tools; Preparation of simple joints in carpentry: cross half lap joint or T-half joint, Mortise and Tenon joint in carpentry; Preparation of dovetail joint in carpentry; Study of welding, types of welding, oxyacetylene gas welding, types of flames, welding techniques and equipment used for gas welding, working with welding equipment; Working with electric arc welding; Equipment and tools, safety and precautions taken in arc welding; Preparation of Butt joint and lap joint with ARC welding; Preparation of Lap and butt joints using gas welding; Working on a lathe machine and study of different tools used in lathe machine; Exercise on simple turning, step turning in lathe machine; Preparation of job on taper turning, drilling, knurling and threading in lathe machine; Working with different machines in machine shop such as shaper, milling machine, etc. and with different tools used in machine shop; Exercise on bending, shaping etc.; Exercise on Drawing, Punching, Riveting; Making different types of sheet metal joints using G.I. sheets; Practice job on shaper; changing a round MS rod into square section with a shaper; Exercise on a milling machine such as making a slot, gear tooth forming and indexing.

Suggested Readings

1. Chapman W A J. 2018. Workshop Technology (Vol. I and II). Arnold Publishers (India) Pvt. Ltd., AB/9, Safdarjung Enclave, New Delhi.

2. Hajra Choudhury S K, Roy N, Hajra Choudhury A K. 2017. Elements of Workshop Technology (Vol. I and II). Media Promoters and Publishers Pvt. Ltd, Mumbai.

3. Khurmi R S and Gupta J K. 2018. A Text Book of Workshop Technology. S. Chand & Company Ltd, New Delhi.
4. Raghuwansi B S. 2016. A Course in Workshop Technology (Vol. I and II). Dhanpat Rai and Sons, 1682, Nai Sarak, New Delhi.

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Course Code	**:**	**ES121**
Course Title	**:**	**Programming for Problem Solving**
Number of Credits	**:**	**4(L:2,T:0, P:4)**
Course Category	**:**	**Engineering Science Courses**

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

Module II: Arithmetic expressions and precedence.
Module III: Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.
Module IV: Arrays, Arrays (1-D, 2-D), Character arrays and Strings
Module V: Basic Algorithms, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)
Module VI: Function, Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference
Module VII: Recursion, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.
Module VIII: Structures, Defining structures and Array of Structures
Module IX: Pointers, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
Module X: File handling (only if time is available, otherwise should be done as part of the lab).

TEXT/REFERENCE BOOKS:

1. AICTE's Prescribed Textbook: Programming for Problem Solving, Khanna Book Publishing Co.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

PRACTICALS:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations
7. Simple functions
8. Programming for solving Numerical methods problems
9. Recursive functions
10. Pointers and structures 11. File operations

SEMESTER–III

Course Code	**:**	**HSM211**
Course Title	**:**	**Universal Human Values**
Number of Credits	**:**	**3 (L:3,T:0, P:0)**
Course Category	**:**	**Humanities & Social Science including Management Courses**

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 01-hourduration.Tutorialsessionsaretobeusedtoexploreandpracticewhathasbeenproposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

The syllabus for the lectures and practice sessions is given below:

Module1–Introduction to Value Education (6 lectures and 3tutorials fo rpractice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: **Practice Session PS1** Sharing about Oneself

Lecture 3: Self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity– the Basic Human Aspirations

Tutorial 2: Practice SessionPS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity– Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

Expected outcome:

The students start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course. The students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of most of the present-day problems; and a sustained solution could emerge only through understanding of value-based living. Any solution brought out through fear, temptation of dogma will not be sustainable. The students are able to see that verification on the basic of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to overcome this disharmony. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facility in most of the cases, while they have given higher priority to earning of physical facility in their life giving less value to or even ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

Module2– Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the Self and the Body **Lecture 8:** Distinguishing between the Needs of the Self and the Body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body

Lecture 9: The Body as an Instrument of the Self

Lecture 10: Understanding Harmony in the Self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self

Lecture11: Harmony of the Self with the Body

Lecture12: Programme to ensure self-regulation and Health

Tutorial6: Practice Session PS6 Exploring Harmony of Self with the Body

Expected outcome:

The students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and Body are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too. The students are able to see that all physical facility they are required for a limited time in a limited quantity. Also, they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment. The students are able to see that activities like understanding, desire, though and selection are the activities of 'I' only the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

Module 3–Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture13: Harmony in the Family– the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust **Lecture 15:** 'Respect' – as the Right Evaluation

Tutorial8: Practice Session PS8 Exploring the Feeling of Respect
Lecture16: Other Feelings, Justice in Human-to-Human Relationship **Lecture 17:** Understanding Harmony in the Society
Lecture18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

Expected outcome:

The students are able to note that the natural acceptance (intention) is always for living in harmony, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person. The students are able to see that respect is right evaluation, and only right evaluation leads to fulfilment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for them and for others through he may have different body, physical facility or beliefs. The students are able to use their creativity for education children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

Module 4–Harmony in the Nature/Existence (4 lectures and 2tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture20: Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

Expected outcome:

The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human being s are not fulfilling to other orders today and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature. The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also, they are

able to make out how these courses can be made appropriate and holistic.

Module 5–Implications of the Holistic Understanding– a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: PracticeSessionPS12 ExploringEthicalHumanConduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Expected outcome:

The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them. The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment. E.g. mutually enriching production system with rest of nature. The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for the happy and prosperous family and society.

Text Book and Teachers Manual

a. The Textbook – A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
ISBN978-93-87034-47-1

b. The Teacher's Manual-Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books

1. JeevanVidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. HumanValues, A.N. Tripathi, NewAge Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth –by Mohandas Karamchand Gandhi

5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence- J C Kumarappa
8. Bharat Mein Angreji Raj– Pandit Sunder lal
9. Rediscovering India- by Dharampal
10. Hind Swaraj or Indian Home Rule- by Mohandas K. Gandhi
11. India Wins Freedom – Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland (English)
13. Gandhi- Romain Rolland (English)

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Course Code	**:**	**BS212**
Course Title	**:**	**Engineering Mathematics-III**
Number of Credits	**:**	**4 (L:3,T:1, P:0)**
Course Category	**:**	**Engineering Science Courses**

Roots of algebraic and transcendental equations:

To find the guess values for iteration, Fixed point Iterative method, Bisection Method. Method of False position, Newton-Raphson method. Secant method.

Interpolation:

Introduction to Finite differences (in brief), Newton forward and backward interpolation formulae, Gauss interpolation formula, Stirling, Bessel and Everett's central difference formulae, Lagrange interpolation formula.

Numerical differentiation and integration:

Numerical differentiation using the Newton forward and backward interpolation formula, Gauss interpolation formula, Stirling, Bessel and Everett's central difference formulae. Numerical integration using Trapezoidal rule, Simpson 1/3 and 3/8 rules.

Numerical solution of ODE:

Taylor’s series method, Picard's method, Euler's method, Modified Euler's method, Runge-Kutta second-order and fourth-order formulae.

Solution of simultaneous algebraic equations:

Direct methods, Iterative methods, Gauss elimination method, Gauss Jordan method, Pivoting, LU decomposition method, Jacobi method and Gauss-Seidel method.

Text/Reference Books:

1. S.S. Sastry, Introductory methods of Numerical Analysis, Fifth Edition, PHI Publication.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods Problems and Solutions, New Age Publication
3. R.K. Jain, S.R.K. Iyengar 2016 (Fifth Edition). Advanced Engineering Mathematics. Narosa Publishing House, New Delhi.
4. Erwin Kreyszig (Reprint 2023) (Tenth Edition), Advanced Engineering Mathematics. J. Wiley and Sons; Wiley India Pvt. Ltd.

TCS 211	**DATA STRUCTURE**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications.	**K_1, K_2**
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	**K_2**
CO 3	Implementation of Trees and Graphs and perform various operations on these data structures.	**K_3**
CO 4	Understanding the concept of recursion, application of recursion and its implementation, and removal of recursion.	**K_4**
CO 5	Identify the alternative implementations of data structures concerning their performance to solve a real-world problem.	**K_5, K_6**
DETAILED SYLLABUS		**3-1-0**

Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Basic Terminology, Elementary Data Organization, Built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT) **Arrays**: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.	08

II	**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	08
III	**Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.	08
IV	Trees: Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree , Complete Binary Tree. Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertation , Deletion, Searching & Modification of data in Binary Search . Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree, B Tree, & Binary Heaps	08
V	**Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshall Algorithm and Dijkstra Algorithm.	08

Textbooks:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India.
2. Gilberg , Forouzan, Data Structures: A Pseudocode Approach with C 3rd edition , Cengage Learning publication.
3. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
4. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.
5. Thareja, "Data Structure Using C" Oxford Higher Education.
6. AK Sharma, "Data Structure Using C", Pearson Education India.
7. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.
8. Michael T. Goodrich, Roberto Tamassia, David M. Mount "Data Structures and Algorithms in C++", Wiley India.
9. P. S. Deshpandey, "C and Data structure", Wiley Dreamtech Publication.
10. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education.
11. Berztiss, AT: Data structures, Theory and Practice, Academic Press.
12. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.
13. Adam Drozdek "Data Structures and Algorithm in Java", Cengage Learning

TCS 213	COMPUTER ORGANIZATION AND ARCHITECTURE	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Study of the basic structure and operation of a digital computer system.	K_1, K_2
CO 2	Analysis of the design of the arithmetic & logic unit and understanding of the fixed point and floating-point arithmetic operations.	K_2, K_4
CO 3	Implementation of control unit techniques and the concept of Pipelining	K_3
CO 4	Understanding the hierarchical memory system, cache memories and virtual memory	K_2
CO 5	Understanding the different ways of communicating with I/O devices and standard I/O interfaces	K_2, K_4

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus, and memory transfer. Processor organization, general registers organization, stack organization, and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute, etc.), microoperations, and execution of complete instructions. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro programme sequencing, concept of horizontal and vertical microprogramming.	**08**
IV	**Memory:** Basic concept and hierarchy, semiconductor RAMs, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output**: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Text books:

1. Computer System Architecture - M. Mano

2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky Computer Organization, McGraw-Hill, Fifth Edition, Reprint 2012

3. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 1998. Reference books

4. William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education, Seventh edition, 2006.

5. Behrooz Parahami, "Computer Architecture", Oxford University Press, Eighth Impression, 2011.

6. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier, a division of reed India Private Limited, Fifth edition, 2012

7. Structured Computer Organization, Tannenbaum(PHI)

TCS 212	Discrete Mathematics	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Acquire Knowledge of sets and relations for solving the problems of POSET and lattices.	K_3, K_4
CO 2	Apply fundamental concepts of functions and Boolean algebra for solving the problems of logical abilities.	K_1, K_2
CO 3	Employ the rules of propositions and predicate logic to solve the complex and logical problems.	K_3
CO 4	Explore the concepts of group theory and their applications for solving the advance technological problems.	K_1, K_4
CO 5	Illustrate the principles and concepts of graph theory for solving problems related to computer science.	K_2, K_6

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Set Theory& Relations**: Introduction, Combination of sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. **POSET & Lattices**: Hasse Diagram, POSET, Definition & Properties of lattices – Bounded, Complemented, Distributed, Modular and Complete lattice.	**08**
II	**Functions**: Definition, Classification of functions, Operations on functions. Growth of Functions. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps.	**08**
III	**Theory of Logics**: Proposition, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference. Predicate Logic: First order predicate, well- formed formula of predicate, quantifiers, Inference theory of predicate logic.	**08**
IV	**Algebraic Structures**: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms, Definition and elementary properties of Rings and Fields.	**08**
V	**Graphs**: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring. **Combinatorics**: Introduction, Counting Techniques, Pigeonhole Principle	**08**

Textbooks:

1. Koshy, Discrete Structures, Elsevier Pub. 2008 Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6/e, McGraw-Hill, 2006.
2. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 5/e, Prentice Hall, 2004.
3. E.R. Scheinerman, Mathematics: A Discrete Introduction, Brooks/Cole, 2000.
4. R.P. Grimaldi, Discrete and Combinatorial Mathematics, 5/e, Addison
Wesley, 2004 5.Liptschutz, Seymour, " Discrete Mathematics", McGraw
Hill.
6.Trembley, J.P & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw Hill. 4. Deo, 7.Narsingh, "Graph Theory With application to Engineering and Computer.Science.", PHI.
8. Krishnamurthy, V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi

BCS351- Data Structure Lab

List of Experiments (Indicative & not limited to)

1. **Implementing Sorting Techniques:** Bubble Sort, Insertion Sort, Selection Sort, Shell , Sort, Radix Sort, Quick sort
2. **Implementing Searching and Hashing Techniques:** Linear search, Binary search, Methods for Hashing: Modulo Division, Digit Extraction, Fold shift, Fold Boundary, Linear Probe for Collision Resolution. Direct and Subtraction hashing
3. **Implementing Stacks:** Array implementation, Linked List implementation, Evaluation of postfix expression and balancing of parenthesis , Conversion of infix notation to postfix notation
4. **Implementing Queue:** Linked List implementation of ordinary queue, Array implementation of circular queue, Linked List implementation of priority queue, Double ended queue
5. **Implementing Linked List:** Singly Linked Lists, Circular Linked List, Doubly Linked Lists: Insert, Display, Delete, Search, Count, Reverse(SLL), Polynomial , Addition , Comparative study of arrays and linked list
6. **Implementing Trees:** Binary search tree : Create, Recursive traversal: preorder, post order, in order, Search Largest , Node, Smallest Node, Count number of nodes, Heap: Min Heap, Max Heap: reheap Up, reheap Down, Delete , Expression Tree, Heapsort
7. **Implementing Graphs**: Represent a graph using the Adjacency Matrix, BFS, Find the minimum spanning tree (using any method Kruskal's Algorithm or Prim's Algorithm) Self Learning Topics : Shortest Path Algorithm

BCS352- Computer Organization Lab

List of Experiments (Indicative & not limited to)

1. Implementing HALF ADDER, FULL ADDER using basic logic gates
2. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
3. Implementing 3-8 line DECODER.
4. Implementing 4x1 and 8x1 MULTIPLEXERS.

5. Verify the excitation tables of various FLIP-FLOPS.
6. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
7. Design of an 8-bit ARITHMETIC LOGIC UNIT.
8. Design the data path of a computer from its register transfer language description.
9. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
10. Implement a simple instruction set computer with a control unit and a data path.

FOURTH SEMESTER (DETAILED SYLLABUS)

TCS 223	**Operating system**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Understand the structure and functions of OS	K_1, K_2
CO 2	Learn about Processes, Threads and Scheduling algorithms.	K_1, K_2
CO 3	Understand the principles of concurrency and Deadlocks	K_2
CO 4	Learn various memory management scheme	K_2
CO 5	Study I/O management and File systems.	K_2,K_4
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction** : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocess Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	**08**
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication models and Schemes, Process generation.	**08**
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	**08**

IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	**08**
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	**08**

Text books:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
3. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
4. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition,
5. TMH 5. William Stallings, "Operating Systems: Internals and Design Principles ", 6th Edition, Pearson Education

TCS 224	Theory of Computation	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars	$K_{4,}$ K_6
CO 2	Analyse and design, Turing machines, formal languages, and grammars	$K_{4,}$ K_6
CO 3	Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving	$K_{1,}$ K_5
CO 4	Prove the basic results of the Theory of Computation.	K_2,K_3
CO 5	State and explain the relevance of the Church-Turing thesis.	$K_{1,}$ K_5
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Basic Concepts and Automata Theory:** Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata.	**08**
II	**Regular Expressions and Languages:** Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages	**08**
III	**Regular and Non-Regular Grammars**: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programming problems based on the properties of CFGs.	**08**
IV	**Push Down Automata and Properties of Context Free Languages**: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL), Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	**08**

V	**Turing Machines and Recursive Function Theory** : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post's Correspondance Problem, Introduction to Recursive Function Theory.	**08**

Text books:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia
2. Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill
3. Elements and Theory of Computation, C Papadimitrou and C. L. Lewis, PHI
4. Mathematical Foundation of Computer Science, Y.N.Singh, New Age Internationa

TCS 221 **Object Oriented Programming with Java**

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Develop the object-oriented programming concepts using Java	$K_{3,}$ K_4
CO 2	Implement exception handling, file handling, and multi-threading in Java	$K_{2,}K_4$
CO 3	Apply new java features to build java programs.	K_3
CO 4	Analyse java programs with Collection Framework	K_4
CO 5	Test web and RESTful Web Services with Spring Boot using Spring Framework concepts	K_5

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**

I	**Introduction:** Why Java, History of Java, JVM, JRE, Java Environment, Java Source File Structure, and Compilation. Fundamental, **Programming Structures in Java:** Defining Classes in Java, Constructors, Methods, Access Specifies, Static Members, Final Members, Comments, Data types, Variables, Operators, Control Flow, Arrays & String. **Object Oriented Programming**: Class, Object, Inheritance Super Class, Sub Class, Overriding, Overloading, Encapsulation, Polymorphism, Abstraction, Interfaces, and Abstract Class. **Packages:** Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import Naming Convention For Packages	**08**
II	**Exception Handling**: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, JVM Reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling, In-built and User Defined Exceptions, Checked and Un-Checked Exceptions. **Input /Output Basics**: Byte Streams and Character Streams, Reading and Writing File in Java. **Multithreading:** Thread, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing Threads, Inter-thread Communication.	**08**
III	**Java New Features:** Functional Interfaces, Lambda Expression, Method References, Stream API, Default Methods, Static Method, Base64 Encode and Decode, ForEach Method, Try-with-resources, Type Annotations, Repeating Annotations, Java Module System, Diamond Syntax with Inner Anonymous Class, Local Variable Type Inference, Switch Expressions, Yield Keyword, Text Blocks, Records, Sealed Classes	**08**
IV	**Java Collections Framework:** Collection in Java, Collection Framework in Java, Hierarchy of Collection Framework, Iterator Interface, Collection Interface, List Interface, ArrayList, LinkedList, Vector, Stack, Queue Interface, Set Interface, HashSet, LinkedHashSet, SortedSet Interface, TreeSet, Map Interface, HashMap Class, LinkedHashMap Class, TreeMap Class, Hashtable Class, Sorting, Comparable Interface, Comparator Interface, Properties Class in Java.	**08**

V	**Spring Framework:** Spring Core Basics-Spring Dependency Injection concepts, Spring Inversion of Control, AOP, Bean Scopes- Singleton, Prototype, Request, Session, Application, Web Socket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles **Spring Boot:** Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications	**08**

Text Books

1. Herbert Schildt, "Java The complete reference", McGraw Hill Education
2. Craig Walls, "Spring Boot in Action" Manning Publication
1. Steven Holzner, "Java Black Book", Dreamtech.
2. Balagurusamy E, "Programming in Java", McGraw Hill
3. Java: A Beginner's Guide by Herbert Schildt, Oracle Press
4. Greg L. Turnquist "Learning Spring Boot 2.0 - Second Edition", Packt Publication
5. AJ Henley Jr (Author), Dave Wolf, "Introduction to Java Spring Boot: Learning by Coding", Independently Published

Operating System Lab

List of Experiments (Indicative & not limited to)

1. Study of hardware and software requirements of different operating systems (UNIX,LINUX,WINDOWS XP, WINDOWS7/8
2. Execute various UNIX system calls for
    i. Process management
    ii. File management
    iii. Input/output Systems calls
3. Implement CPU Scheduling Policies:
    i. SJF
    ii. Priority
    iii. FCFS
    iv. Multi-level Queue
4. Implement file storage allocation technique:
    i. Contiguous(using array)Linked –list(using linked-list)
    ii. Indirect allocation (indexing)
5. Implementation of contiguous allocation techniques:
    i. Worst-Fit
    ii. Best- Fit
    iii. First- Fit
6. Calculation of external and internal fragmentation
    i. Free space list of blocks from system
    ii. List process file from the system

7. Implementation of compaction for the continually changing memory layout and calculate total movement of data
8. Implementation of resource allocation graph RAG)
9. Implementation of Banker‟s algorithm
10. Conversion of resource allocation graph (RAG) to wait for graph (WFG) for each type of method used for storing graph.
11. Implement the solution for Bounded Buffer (producer-consumer)problem using inter process communication techniques-Semaphores
12. Implement the solutions for Readers-Writers problem using inter process communication technique - Semaphore

Object Oriented Programming with Java

List of Experiments (Indicative & not limited to)

1. Use Java compiler and eclipse platform to write and execute java program.
2. Creating simple java programs using command line arguments
3. Understand OOP concepts and basics of Java programming.
4. Create Java programs using inheritance and polymorphism.
5. Implement error-handling techniques using exception handling and multithreading.
6. Create java program with the use of java packages.
7. Construct java program using Java I/O package.
8. Create industry oriented application using Spring Framework.
9. Test RESTful web services using Spring Boot.
10. Test Frontend web application with Spring Boot

B.TECH. FIFTH SEMESTER (DETAILED SYLLABUS)

Database Management System (TCS 312)		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Apply knowledge of database for real life applications.	K_3
CO 2	Apply query processing techniques to automate the real time problems of databases.	K_3, K_4
CO 3	Identify and solve the redundancy problem in database tables using normalization.	K_2, K_3
CO 4	Understand the concepts of transactions, their processing so they will familiar with broad range of database management issues including data integrity, security and recovery.	K_2, K_4
CO 5	Design, develop and implement a small database project using database tools.	K_3, K_6
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**

I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	**08**
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQl Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	**08**
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	**08**
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	**08**
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	**08**

Text books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
2. Date C J, "An Introduction to Database Systems", Addision Wesley
3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
4. O'Neil, Databases, Elsevier Pub.
5. RAMAKRISHNAN"Database Management Systems",McGraw Hill
6. Leon & Leon,"Database Management Systems", Vikas Publishing House
7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
8. Majumdar & Bhattacharya, "Database Management System", TMH

Web Technology (TCS 311)

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to:		
CO 1	Apply the knowledge of the internet and related internet concepts that are vital in understanding web application development. Then, analyze the insights of internet programming to implement complete application over the web.	K_3, K_6
CO 2	Understand, analyze and apply the role of markup languages like HTML, DHTML, and XML in the workings of the web and web applications.	K_2, K_3
CO 3	Use web application development software tools i.e. XML, Apache Tomcat etc. and identifies the environments currently available on the market to design web sites.	K_3, K_6
CO 4	Understand, analyze, and build dynamic web pages using client side programming JavaScript and also develop the web application using servlet and JSP.	K_2, K_4, K_6
CO 5	Understand the impact of web designing by database connectivity with JDBC in the current market, where everyone prefers electronic medium for shopping, commerce, fund transfer, and even social life also.	K_2, K_3, K_4
DETAILED SYLLABUS		**3-0-2**

Unit	Topic	Proposed Lecture
I	**Introduction:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, Writing Web Projects, Connecting to Internet, Introduction to Internet services and tools, Introduction to client-server computing. Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to AWT, AWT controls, Layout managers	**08**
II	**Web Page Designing:** HTML: List, Table, Images, Frames, forms, CSS, Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: DOM and SAX, Dynamic HTML	**08**
III	**Scripting:** Java script: Introduction, documents, forms, statements, functions, objects; introduction to AJAX, **Networking :** Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagram.	**08**
IV	**Enterprise Java Bean:** Preparing a Class to be a JavaBeans, Creating a JavaBeans, JavaBeans Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean **Java Database Connectivity (JDBC):** Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.	**08**
V	**Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session **Java Server Pages (JSP):** Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries..	**08**

Text books:

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, " Web Technology and Design" , New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
4. Bhave, "Programming with Java", Pearson Education
5. Herbert Schieldt, "The Complete Reference:Java", TMH.
6. Hans Bergsten, "Java Server Pages", SPD O'Reilly
7. Margaret Levine Young, "The Complete Reference Internet", TMH
8. Naughton, Schildt, "The Complete Reference JAVA2", TMH
9. Balagurusamy E, "Programming in JAVA", TMH

Design and Analysis of Algorithm (TCS 313)

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K_4, K_6
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K_5, K_6
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	K_2, K_5
CO 4	Apply classical sorting, searching, optimization and graph algorithms.	K_2, K_4
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K_2, K_3
DETAILED SYLLABUS		**3-1-0**

Unit	Topic	Proposed Lecture
I	**Introduction:** Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics - Shell Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.	**08**
II	**Advanced Data Structures:** Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	**08**
III	**Divide and Conquer** with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. **Greedy Methods** with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.	**08**
IV	**Dynamic Programming** with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	**08**
V	**Selected Topics:** Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms	**08**

Text books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)",McGraw Hill
5. Richard E.Neapolitan "Foundations of Algorithms" Jones & Bartlett Learning
6. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
7. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
8. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997
9. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.
10. Harsh Bhasin,"Algorithm Design and Analysis",First Edition,Oxford University Press.
11. Gilles Brassard and Paul Bratley,Algorithmics:Theory and Practice,Prentice Hall,1995.

B.TEC(CSE) SIXTH SEMESTER (DETAILED SYLLABUS)

Software Engineer		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Explain various software characteristics and analyze different software Development Models	K_1, K_2
CO 2	Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards	K_1, K_2
CO 3	Compare and contrast various methods for software design.	K_2, K_3

CO 4	Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing	K_3
CO 5	Manage software development process independently as well as in teams and make use of Various software management tools for development, maintenance and analysis.	K_5

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	**08**
II	**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	**08**
III	**Software Design:** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	**08**
IV	**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, TopDown and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.	**08**
V	**Software Maintenance and Software Project Management:** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	**08**

Text books:

1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. Kassem Saleh, “Software Engineering”, Cengage Learning.

Data Analytics		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Discuss various concepts of data analytics pipeline	K_1, K_2
CO 2	Apply classification and regression techniques	K_3
CO 3	Explain and apply mining techniques on streaming data	K_2, K_3
CO 4	Compare different clustering and frequent pattern mining algorithms	K_4
CO 5	Describe the concept of R programming and implement analytics on Big data using R.	K_2,K_3
DETAILED SYLLABUS		**3-0-0**

Unit	Topic	Proposed Lecture
I	**Introduction to Data Analytics:** Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle:** Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.	**08**
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	**08**
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.	**08**
IV	**Frequent Itemsets and Clustering:** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	**08**
V	**Frame Works and Visualization:** MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. **Introduction to R** - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	**08**

Text books and References:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. John Garrett,Data Analytics for IT Networks : Developing Innovative Use Cases, Pearson Education

4. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons.
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
6. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley
7. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series
8. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier
9. Michael Berthold, David J. Hand,” Intelligent Data Analysis”, Springer
10. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill
11. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer
12. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication
13. Pete Warden, Big Data Glossary, O’Reilly
14. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
15. Pete Warden, Big Data Glossary, O’Reilly.
16. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press
17. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier

Computer Network		
Course Outcome (CO)		**Bloom’s Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission	K_1,K_2
CO 2	Apply channel allocation, framing, error and flow control techniques.	K_3
CO 3	Describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism.	K_2,K_3
CO 4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.	K_2,K_3
CO 5	Explain the functions offered by session and presentation layer and their Implementation.	K_2,K_3
CO 6	Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET and VPN.	K_2
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introductory Concepts**: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. **Physical Layer:** Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	**08**

II	**Link layer:** Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	**08**
III	**Network Layer:** Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	**08**
IV	**Transport Layer:** Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	**08**
V	**Application Layer:** Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts.	**08**

Text books and References:

1. Behrouz Forouzan, “Data Communication and Networking”, McGraw Hill
2. Andrew Tanenbaum “Computer Networks”, Prentice Hall.
3. William Stallings, “Data and Computer Communication”, Pearson.
4. Kurose and Ross, “Computer Networking- A Top-Down Approach”, Pearson.
5. Peterson and Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann
6. W. A. Shay, “Understanding Communications and Networks”, Cengage Learning.
7. D. Comer, “Computer Networks and Internets”, Pearson.
8. Behrouz Forouzan, “TCP/IP Protocol Suite”, McGraw Hill.