

**KALINGA UNIVERSITY, NAYA RAIPUR,
CHHATTISGARH**



Evaluation Scheme & Syllabus for

B. Tech.

(Computer Science Engineering)

AS PER

AICTE MODEL CURRICULUM

NDER

**Faculty of Engineering
w.e.f. Session 2021-22**

KALINGA UNIVERSITY NAYA RAIPUR
Bachelor of Technology (Computer Science)
w.e.f Academic Session 2021-22

B-Tech(CSE) 1st Semester							
Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS101	Programming for Problem Solving	3	0	3	70	30	100
BTCS102	Basic Electrical Engineering	3	0	3	70	30	100
BTCS103	Engineering Physics	3	1	4	70	30	100
BTCS104	Engineering Mathematics- I	3	1	4	70	30	100
BTCS105	English	2	0	2	70	30	100
BTCS106-P	Engineering Physics-Lab	0	2	1	30	20	50
BTCS107-P	Basic Electrical Engineering-Lab	0	2	1	30	20	50
BTCS108-P	Programming for Problem Solving-Lab	0	2	1	30	20	50
BTCS109-P	Engineering Graphics & Design-Lab	0	2	1	30	20	50
Total		14	10	20	470	230	700

B-Tech(CSE) 2nd Semester							
Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS201	Fundamentals of Mechanical Engineering & Mechatronics	3	0	3	70	30	100
BTCS202	Emerging Domain in Electronics Engineering	3	0	3	70	30	100
BTCS203	Engineering Chemistry	3	1	4	70	30	100
BTCS204	Engineering Mathematics- II	3	1	4	70	30	100
BTCS205	AI For Engineering	2	0	2	70	30	100
BTCS206P	Engineering Chemistry-Lab	0	2	1	30	20	50
BTCS207P	Emerging Domain in Electronics Engineering-Lab	0	2	1	30	20	50
BTCS208P	English Language-Lab	0	2	1	30	20	50
BTCS209P	Mechanical Workshop Lab	0	2	1	30	20	50
Total		14	10	20	470	230	700

*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

B.Tech(CSE) Third Semester							
Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS301	Maths-III	3	1	4	70	30	100
BTCS302	Technical Communication	3	0	3	70	30	100
BTCS303	Data Structure	3	1	4	70	30	100
BTCS304	Computer Organization and Architecture	3	1	4	70	30	100
BTCS305	Discrete Structures & Theory of Logic	3	1	4	70	30	100
BTCS306P	Data Structures Using C Lab	0	2	1	30	20	50
BTCS307P	Computer Organization Lab	0	2	1	30	20	50
BTCS308P	Discrete Structure & Logic Lab	0	2	1	30	20	50
BTCS309P	Mini Project or Internship Assessment*	0	2	2	30	20	50
Total		15	12	24	470	230	700

B.Tech (CSE) -Fourth Semester							
Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS401	Python Programming	3	1	4	70	30	100
BTCS402	Universal Human Values	3	0	3	70	30	100
BTCS403	Operating Systems	3	0	3	70	30	100
BTCS404	Theory of Automata and Formal Languages	3	1	4	70	30	100
BTCS405	Microprocessor	3	1	4	70	30	100
BTCS406P	Operating Systems Lab	0	2	1	30	20	50
BTCS407P	Microprocessor-Lab	0	2	1	30	20	50
BTCS408P	Python Language Programming Lab	0	2	1	30	20	50
Total		15	9	21	440	210	650
*The internship (6 weeks) conducted during summer break after IV semester and will be assessed during V semester.							

B.Tech(CSE)-Fifth Semester

Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS501	Database Management System	3	1	4	70	30	100
BTCS502	Compiler Design	3	1	4	70	30	100
BTCS503	Design and Analysis of Algorithm	3	1	4	70	30	100
BTCS504	Departmental Elective-I	3	0	3	70	30	100
BTCS504A	Data Analytics						
BTCS504B	Web Designing						
BTCS504C	Computer Graphics						
BTCS504D	Application of Soft Computing						
BTCS505	Departmental Elective-II	3	0	3	70	30	100
BTCS505A	Machine Learning Techniques						
BTCS505B	Object Oriented System Design						
BTCS505C	Augmented & Virtual Reality						
BTCS505D	Human Computer Interface						
BTCS506P	Database Management System Lab	0	2	1	30	20	50
BTCS507P	Compiler Design Lab	0	2	1	30	20	50
BTCS508P	Design and Analysis of Algorithm Lab	0	2	1	30	20	50
BTCS509P	Mini Project or Internship Assessment*	0	2	2	30	20	50
Total		15	11	23	470	230	700

B.Tech(CSE)-Sixth Semester

Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS601	Software Engineering	3	1	4	70	30	100
BTCS602	Web Technology	3	1	4	70	30	100
BTCS603	Computer Networks	3	1	4	70	30	100
BTCS604	Departmental Elective-III	3	0	3	70	30	100
BTCS604A	Big Data						
BTCS604B	Image Processing						
BTCS604C	Data Compression						
BTOE605	Open Elective-I	3	0	3	70	30	100
BTOE605A	Real Time Systems						
BTOE605B	Embedded System						
BTOE605C	Introduction To Memos						
BTOE605D	Object Oriented Programming						
BTOE605E	Numerical Techniques						
BTOE605F	GIS & Remote Sensing						
BTOE605G	Understanding The Human Being Comprehensively- Human Aspirations And Its Fulfillment						
BTCS606P	Software Engineering Lab	0	2	1	30	20	50
BTCS607P	Web Technology Lab	0	2	1	30	20	50
BTCS608P	Computer Networks Lab	0	2	1	30	20	50
Total		15	9	21	440	210	650
*The internship (6 weeks) conducted during summer break after VI semester and will be assessed during VII semester.							

B-Tech(CSE) 7th Semester							
Subject Code	Subject	L	T/P	Credits	End Semester Exam	Internal Marks	Total
BTCS701	Artificial Intelligence	3	1	4	70	30	100
	Departmental Elective-IV	3	0	3	70	30	100
BTCS702A	High Performance Computing						
BTCS702B	Cloud Computing						
BTCS702C	Blockchain Architecture Design						
BTCS702D	Natural Language Processing						
	Departmental Elective-V	3	0	3	70	30	100
BTCS703A	Agile Software Development						
BTCS703B	Parallel and Distributed Computing						
BTCS703C	Quantum Computing						
BTCS703D	Software Testing						
	Open Elective-II	3	0	3	70	30	100
BTCSOE704A	Digital & Social Media Marketing						
BTCSOE704B	Idea to Business Model						
BTCSOE704C	Micro and Smart Systems						
BTCSOE704D	Renewable Energy Resources						
BTCSOE704E	Operation Research						
BTCSOE704F	Value Relationship & Ethical Human Conduct –For A Happy & Harmonious Society						
BTCS705P	Artificial Intelligence-Lab	0	2	1	30	20	50
BTCS706P	Minor Project	0	6	3	100	50	150
BTCS707P	Internship Assessment*	0	2	2	30	20	50
Total		12	11	19	440	210	650

B-Tech(CSE) 8th Semester							
Subject Code	Subject	L	T/P	Credits	End Semester Exam	Internal Marks	Total
BTCS801	Project Management & Entrepreneurship	3	0	3	70	30	100
	Departmental Elective-VI	3	0	3	70	30	100
BTCS802A	Deep Learning						
BTCS802B	Service Oriented Architecture						
BTCS802C	Mobile Computing						
BTCS802D	Internet of Things						
BTCS802E	Cryptography & Network Security						
	Open Elective-III	3	0	3	70	30	100
BTC SOE803A	Filter Design						
BTC SOE803B	Bioeconomics						
BTC SOE803C	Design Thinking						
BTC SOE803D	Introduction to Women's & Gender Studies						
BTC SOE803E	Quality Management						
BTC SOE803F	Modeling of Field Effects Nano Devices						
BTC SOE803G	Computerized Process Control						
BTCS804P	Project	0	18	9	200	100	300
Total		9	18	18	410	190	600

SEMESTER I

Programming for Problem Solving

BTCS101 Programming for Problem Solving

Course Outcomes

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Module – 1: (Introduction to Programming)

[08]

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.

Module – 2 : (Arithmetic expressions & Conditional Branching)

[08]

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 associativity.

Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

Module – 3 : (Loops & Functions)

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Module – 4 : (Arrays & Basic Algorithms)

[08]

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.

Basic Algorithms: Searching & Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

Module – 5 :(Pointer & File Handling)

[08]

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), 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, command-line arguments.

Text books:

1. Schum'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, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz
7. A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning – 2007.
8. Let Us C By Yashwant P. Kanetkar.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson.
10. Programming in C by Kochan Stephen G. Pearson Education – 2015.
11. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication.
12. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

Programming for Problem Solving Lab

BTCS108P

Course Outcomes

1. To write programs for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To write programs for conditional branching, iteration and recursion.
4. To write programs using functions and synthesize a complete program using divide and conquer approach.
5. write programs using arrays, pointers and structures.

Other Reference: - Use C Open Source Software referring Spoken Tutorial MOOC

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“
Between 80-90%----- Print „B“
Between 60-80%----- Print „C“
Between Below 60%----- Print „D“
11. WAP that takes two operands and one operator from the user and 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:
 - (i) List all the trains (sorted according to train number) that depart from a particular section.
 - (ii) List all the trains that depart from a particular station at a particular time.
 - (iii) List all he trains that depart from a particular station within the next one hour of a given time.
 - (iv) 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.

Engineering Graphics and Design-Lab

(BTCS109P)

Module 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales

Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

Module 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.

Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

Module 3: Isometric Projections [08]

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conversions.

Module 4: Computer Graphics [08]

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects: Isometric Views of lines, Planes, Simple and compound Solids];

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to pater using the print command: orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling:

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Course Outcomes

- 1: Understanding of the visual aspects of engineering design
- 2: Understanding of engineering graphics standards and solid modelling
- 3: Effective communication through graphics
- 4: Applying modern engineering tools necessary for engineering practice
- 5: Applying computer-aided geometric design
- 6: Analysis of Isometric views
- 7: Creating working drawings

Suggested Text/ Reference Books:

- (i) Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
 - (ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
 - (iii) Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
 - (iv) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House
 - (v) Narayana, K.L. & P Kanniah (2008), Text book on Engineering Drawing, Scitech Publishers.
- (Corresponding set of) CAD Software Theory and User Manuals

BASIC ELECTRICAL ENGINEERING

(BTCS102)

Module - 1: DC Circuits **[08]**

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

Module - 2: Steady- State Analysis of Single Phase AC Circuits **[10]**

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor.

Three phase balanced circuits, voltage and current relations in star and delta connections.

Module - 3 : Transformers **[08]**

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

Module –4 : Electrical machines **[08]**

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Module –5 : Electrical Installations **[06]**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption and savings, battery backup.

COURSE OUTCOMES

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (<http://spoken-tutorial.org>)

Text Books:

1. Ritu Sahdev, “Basic Electrical Engineering”, Khanna Publishing House.
2. S. Singh, P.V. Prasad, “Electrical Engineering: Concepts and Applications” Cengage.
3. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill.
4. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill.

Reference Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Pearson India.

BAISC ELECTRICAL ENGINEERING LAB

BTCS107P

LIST OF EXPERIMENTS

Note: A minimum of 8 experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single-phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer.
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

COURSE OUTCOMES

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

ENGINEERING PHYSICS
(BTCS103)

Module - 1 Relativistic Mechanics: [8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson- Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Module- 2 Electromagnetic Field Theory: [8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell's equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

Module- 3 Quantum Mechanics: [8]

Black body radiation, Stefan's law, Wien's law, Rayleigh-Jeans law and Planck's law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Module- 4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications. Fraunhofer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh's criterion of resolution, Resolving power of grating.

Module- 5 Fibre Optics & Laser: [10]

Fibre Optics: Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres. Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Course Outcomes:

1. To solve the classical and wave mechanics problems
2. To develop the understanding of laws of thermodynamics and their application in various processes
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams

Reference Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal & Subramanian (S. Chand)

4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

Engineering Physics Lab

(BTCS106P)

List of Experiments

Any ten experiments

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To measure attenuation in an optical fiber.
4. To determine the wavelength of He-Ne laser light using single slit diffraction.
5. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
6. To determine the coefficient of viscosity of a given liquid.
7. To determine the value of acceleration due to gravity (g) using compound pendulum.
8. To determine the energy band gap of a given semiconductor material.
9. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
10. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
11. To study the resonance condition of a series LCR circuit.
12. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (KrishnaPrakashan Meerut)

Course Outcomes:

1. To determine the wavelength of sodium light by Newton's ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel's bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

ENGINEERING MATHEMATICS-I

(BTCS104)

Module 1: Matrices

[08]

Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix,

Module 2: Differential Calculus- I

[08]

Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (n^{th} order derivatives), Leibnitz theorem and its application, Envelope, Involutives and Evolutives, Curve tracing: Cartesian and Polar co-ordinates

Module 3: Differential Calculus-II

[08]

Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

Module 4: Multivariable Calculus-I

[08]

Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities),

Module 5: Vector Calculus

[08]

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.

COURSE OUTCOMES

1. Remember the concept of matrices and apply for solving linear simultaneous equations.
2. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .
3. Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.

4. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
5. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
9. Engineering Mathematics – I. Reena Garg, 2

ENGLISH

BTCS105

Course Outcomes

1. Students will be enabled to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
2. Students would be able to create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will apply it at their work place for writing purposes such as Presentation/official drafting / administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to evaluate the correct & error-free writing by being well-versed in rules of English grammar & cultivate relevant technical style of communication & presentation at their work place & also for academic uses.
5. Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence.

Module 1- Basics of Technical English

[08]

Technical English: Definition; Extent & Coverage; Dimensions; Reading; Skimming; Scanning Churning & Assimilation; Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc; Technical Communication; Approaches: Brevity; Objectivity; Simplicity; Utility & Clarity.

Listening: Active; Passive; Thinking strategies: Positive & Logical thinking; **Speaking:** Essentials Nuances & Modes of Speech Delivery.

Module 2- Components of Technical Writing

[08]

Vocabulary Building: Select words; Concept of word formation; Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Synonyms; Antonyms; Abbreviations. Homophones. One word substitutes; Requisites of Sentences.

Module 3- Basic Technical Writing Skills

[08]

Forms: Business writing: Principle; Purchase & Sales Letters; Drafts; Official Writing: Official Letter; D.O. Letter; Notices; Agenda; Minutes of Meeting; Sentence Structure; Phrases & Clauses in sentences; Coherence; Unity; Emphasis in Writing; Devices; Use of Writing methods in Documents; Techniques of writing.

Module 4- Common Grammatical Errors & Technical Style

[08]

Subject-verb agreement; Correct usage: Noun; Pronoun; Agreement; Modifiers; Articles; Prepositions; Cliches; Redundancies; Technical Style: Features; Choice of words; Sentences: Descriptive; Narrative; Expository; Defining & Classifying; Length of paragraph; Writing of Introduction & Conclusion.

Module 5- Presentation Strategies & Oral Communications

[08]

Analysis of locale; Audience; Modulating Style & Content; Speaking with confidence; Kinesics; Paralinguistic features of Voice-Dynamics: Pitch; Intonation; Stress & Rhythm; Conversation & dialogues; Communication at work-place; etc.

Text Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
4. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd., New Delhi.
5. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
6. English Grammar & Composition by Wren & Martin, S.Chand& Co. Ltd., New Delhi.
7. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
8. Personality Development, Harold R. Wallace &L. Ann Masters, Cengage Learning, New Delhi
9. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.
10. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
11. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
12. Spoken English- A manual of Speech and Phonetics by R.K.Bansal&J.B.Harrison, Orient Blackswan, 2013, New Delhi.
13. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

SEMESTER II
FUNDAMENTAL OF MECHANICAL
ENGINEERING AND MECHATRONICS
BTCS201

Unit	Topics	Lectures
I	<p>Unit I: Introduction to Mechanics of Solid: Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems. Types of beams under various loads, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment. Basic Numerical problems.</p>	8
II	<p>Introduction to IC Engines and RAC: IC Engine: Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. Refrigeration: Its meaning and application, unit of refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. Formula based numerical problems on cooling load. Air-Conditioning: Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.</p>	10
III	<p>Introduction to Fluid Mechanics and Applications: Introduction: Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law, Continuity Equation, Bernaulli's Equation and its applications, Basic Numerical problems. Working principles of hydraulic turbines & pumps and their classifications, hydraulic accumulators, hydraulic lift and their applications.</p>	7
IV	<p>Measurements and Control System: Concept of Measurement, Error in measurements, Calibration, measurements of pressure, temperature, mass flow rate, strain, force and torques; Concept of accuracy, precision and resolution, Basic Numerical problems. System of Geometric Limit, Fit, Tolerance and gauges, Basic Numerical problems. Control System Concepts: Introduction to Control Systems, Elements of control system, Basic of open and closed loop control with example.</p>	8
V	<p>Introduction to Mechatronics: Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics. Overview of Mechanical Actuation System – Kinematic Chains, Cam,</p>	10

Train Ratchet Mechanism, Gears and its type, Belt, Bearing, Hydraulic and Pneumatic Actuation Systems: Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.

Reference Books:

- 1 Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
- 2 Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
- 3 Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
- 4 Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
- 5 Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
- 6 Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

EMERGING DOMAIN IN ELECTRONICS ENGINEERING

(BTCS202)

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

1. Understand the concept of PN Junction and devices.
2. Understand the concept of BJT, FET and MOFET.
3. Understand the concept of Operational amplifier
4. Understand the concept of measurement instrument.
5. Understand the working principle of different type of sensor and their uses.
6. Understand the concept of IoT system & Understand the component of IoT system

Unit	Topics	Lectures
I	Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche)	3
	Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits	3
	Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes, Liquid-Crystal Displays.	2
II	Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration	4
	Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer	4
III	Operational Amplifiers: Introduction, Op-Amp Basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator). Differential and Common-Mode Operation, Comparators.	4
	Introduction of IoT System, Components of IoT system: Microprocessor and Microcontroller, Bluetooth Technology, Wi-Fi Technology, Concept of Networking, Sensor Nodes, concept of cloud.	4
IV	Digital Electronics: Number system & representation. Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization upto 6 Variable.	6
	Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits.	2
V	Fundamentals of Communication Engineering: Basics of signal representation and analysis, Electromagnetic spectrum Elements of a Communication System, Need of modulation and typical applications, Fundamentals of amplitude modulation and demodulation techniques.	4
	Introduction to Data Communications: Goals and applications of Networks. General Model of Wireless Communication: Evolution of mobile radio communication fundamentals, GPRS, GSM, CDMA. Elements of Satellite & Radar Communication,	4

Text Books:

1. Robert L. Boylestand / Louis Nashelsky “Electronic Devices and Circuit Theory”, Pearson Education.
2. H S Kalsi, “Electronic Instrumentation”, McGraw Publication
3. George Kennedy, “Electronic Communication Systems”, McGraw Publication
4. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press.
5. Jacob Millman, C.C. Halkias, Staya brataJit, “Electronic Devices and Circuits”, McGraw Hill
6. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India

EMERGING DOMAIN IN ELECTRONICS ENGINEERING-Lab

(BTCS207P)

Suggestive List of Experiments:

Part A

1. Study of various types of Active & Passive Components based on their ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
3. PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB
4. Winding shop: Step down transformer winding of less than 5VA.
5. Soldering shop: Soldering and disordering of Resistor in PCB. Soldering and disordering of IC in PCB. Soldering and disordering of Capacitor in PCB

Part B

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of V_{rms} , V_{dc} , and ripple factor.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
5. Characteristic of BJT: BJT in CE configuration.
6. To study Operational Amplifier as Adder and Subtractor
7. Verification of Truth Table of Various Logic Gate.
8. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

(C)

Part A	PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB	This practical is not possible by virtual lab. It will be conducted only in physical mode
Part B	Study of Lab Equipment's and Components: CRO, Multimeter, Function Generator, Power supply- Active, Passive Components and Bread Board.	NA, These test equipment can be Demonstrated on line from any lab of ECE department or physical mode is only option.

P-N Junction on diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.	http://vlabs.iitkgp.ernet.in/be/exp5/index.html
Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.	http://vlabs.iitkgp.ernet.in/be/exp6/index.html http://vlabs.iitkgp.ernet.in/be/exp7/index.html
Characteristics of Zener diode: V-I characteristics of Zener diode, Graphical measurement of forward and reverse resistance.	http://vlabs.iitkgp.ernet.in/be/exp10/index.html
Characteristic of BJT: BJT in CE configuration.	http://vlabs.iitkgp.ernet.in/be/exp11/index.html
To study Operational Amplifier as Adder and Subtractor	http://vlabs.iitkgp.ernet.in/be/exp17/index.html http://vlabs.iitkgp.ernet.in/be/exp18/index.html
Verification of Truth Table of Various Logic Gate	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/truth-table-gates/
Implementation of the given Boolean function using logic gates in both SOP and POS forms.	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/realization-of-logic-functions/

ENGINEERING CHEMISTRY

BTCS203

Module-1

[08]

Atomic and Molecular Structure:

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

Module-2

[08]

Spectroscopic techniques and Applications:

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

Module-3

[08]

Electrochemistry

Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH , ΔF and ΔS). Lead storage battery. Corrosion; causes, effects and its prevention. Phase Rule and its application to water system.

Module-4

[08]

Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method). Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeter and Dulong's method).

Module-5

[08]

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene) . General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

Reference Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry ByFre W., Billmeyer
7. Engineering ChemistryBy Satya Prakash

ENGINEERING CHEMISTRY- PRACTICAL

BTCS206P

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

NOTE: Choice of any 8 experiments from the above.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

Engineering Mathematics-II
BTCS204

Course Outcomes

1. Understand the concept of differentiation and apply for solving differential equations.
2. Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3. Understand the concept of convergence of sequence and series. Also evaluate Fourier series
4. Illustrate the working methods of complex functions and apply for finding analytic functions.
5. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals

Module 1: Ordinary Differential Equation of Higher Order [10] Linear differential equation of n^{th} order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

Module 2: Multivariable Calculus-II [08] Improper integrals, Beta & Gamma function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

Module 3: Sequences and Series [08] Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

Module 4: Complex Variable – Differentiation [08] Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

Module -5 Complex Variables – Integration [08] Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouville's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integral of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger , Advance Engineering Mathematics , Narosa Publishing -House, 2002.

Reference Books:-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition- Tata McGraw-Hill
6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi

**Artificial Intelligence for Engineers
(BTCS205)**

Course Outcomes

1. Understand the evolution and various approaches of AI
2. Understand data storage, processing, visualization, and its use in regression, clustering etc.
3. Understand natural language processing and chatbots
4. Understand the concepts of neural networks.
5. Understand the concepts of face, object, speech recognition and robots.

Course	Topics
Unit 1	An overview to AI
1.1	The evolution of AI to the present
1.2	Various approaches to AI
1.3	What should all engineers know about AI?
1.4	Other emerging technologies
1.5	AI and ethical concerns
Unit 2	Data & Algorithms
2.1	History Of Data
2.2	Data Storage And Importance of Data and its Acquisition
2.3	The Stages of data processing
2.4	Data Visualization
2.5	Regression, Prediction & Classification
2.6	Clustering & Recommender Systems
Unit 3	Natural Language Processing
3.1	Speech recognition
3.2	Natural language understanding
3.3	Natural language generation
3.4	Chatbots
3.5	Machine Translation
Unit 4	Artificial Neural Networks
4.1	Deep Learning
4.2	Recurrent Neural Networks
4.3	Convolutional Neural Networks
4.4	The Universal Approximation Theorem
4.5	Generative Adversarial Networks
Unit 5	Applications
5.1	Image and face recognition
5.2	Object recognition
5.3	Speech Recognition besides Computer Vision
5.4	Robots
5.5	Applications

Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Prentice Hall
2. Artificial Intelligence by Kevin Knight, Elaine Rich, Shivashankar B. Nair, Publisher : McGraw Hill
3. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Jian Pei, Publisher: Elsevier Science.
4. Speech & Language Processing by Dan Jurafsky, Publisher : Pearson Education
5. Neural Networks and Deep Learning A Textbook by Charu C. Aggarwal, Publisher: Springer International Publishing
6. Introduction to Artificial Intelligence By Rajendra Akerkar, Publisher : PHI Learning

English Language Lab
BTCE208P

Course Objectives:

- (i) To facilitate software based learning to provide the required English Language proficiency to students.
- (ii) To acquaint students with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
- (iii) To train students to use the correct and error-free writing by being well versed in rules of English grammar.
- (iv) To cultivate relevant technical style of communication and presentation at their work place and also for academic uses.
- (v) To enable students to apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics.

SYLLABUS: PROFESSIONAL COMMUNICATION LAB SHALL HAVE TWO PARTS:

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (LP.A.)

List of Practicals

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
 2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
 3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic /Kinesics.
 4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
 5. Official/Public Speaking based on suitable Rhythmic Patterns.
 6. Theme Presentation/ Keynote Presentation based on correct methodologies argumentation.
 7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
 8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
 9. Comprehension Skills based on Reading and Listening Practical's on a model Audio.
-
1. **Computer assisted software based Language Learning:** Software based self-guided learning to provide the required English language proficiency to students from an employability and career readiness standpoint. The software should align to Common European Framework of Reference for Languages (CEFR) and deliver a CEFR level – B2 upon completion.
 2. **Interactive Communication Skills:** Students should practice the language with variety of activities and exercises based on employability skills as startup presentations, GD, Mock interview, Video portfolio, Extempore, Role play, Just A Minute (JAM) etc.

Suggested software:

- **Oxford Achiever** by Oxford University Press.
- **Cambridge English Empower** by Cambridge University Press.
- **MePro.** by Pearson India Education Services Pvt. Ltd.

- **New Interactions** by McGraw-Hill India.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. A Course in Phonetics and Spoken English, Sethi & Dhamija:, Prentice Hall
4. English Pronouncing Dictionary, Joans Daniel, Cambridge University Press, 2007.
5. English Grammar and Usage by R. P. Sinha, Oxford University Press, 2005, New Delhi.
6. English Grammar, Composition and Usage by N.K. Agrawal & F.T. Wood, Macmillan India Ltd., New Delhi.
7. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
8. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.
9. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
10. Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi
11. Personality Development & Soft Skills, Barun K. Mitra, Oxford University Press, 2012 New Delhi.

Mechanical Workshop Lab
BTCS209P

Course Outcomes

- a. Use various engineering materials, tools, machines and measuring equipments.
- b. Perform machine operations in lathe and CNC machine.
- c. Perform manufacturing operations on components in fitting and carpentry shop.
- d. Perform operations in welding, moulding, casting and gas cutting.
- e. Fabricate a job by 3D printing manufacturing technique

S. No.	Mechanical Workshop	Duration
1	<p>Introduction to Mechanical workshop material, tools and machines To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section. To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.</p>	3 Hours
2	<p>Machine shop Demonstration of working, construction and accessories for Lathe machine Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.</p>	3 Hours
3	<p>Fitting shop 1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.</p>	3 Hours
4	<p>Carpentry Shop Study of Carpentry Tools, Equipment and different joints. Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tension Joint</p>	3 Hours
5	<p>Welding Shop Introduction to BI standards and reading of welding drawings.</p>	

SEMESTER III

Mathematics-III(PDE,ProbabilityandStatistics)

BTCS-301

Course Outcomes

The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

The students will learn:

- The idea of partial differentiation and types of partial differential equations
- The idea of classification of second partial differential equations, wave , heat equation and transmission lines
- The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The statistical methods of studying data samples, hypothesis testing and statistical quality control, control charts and their properties.

Module I: Partial Differential Equations

Origin of Partial Differential Equations, Linear and Non Linear Partial Equations of first order, Lagrange's Equations, Charpit's method, Cauchy's method of Characteristics, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations:

Classification of linear partial differential equation of second order, Method of separation of variables, Solution of wave and heat conduction equation up to two dimension, Laplace equation in two dimensions, Equations of Transmission lines.

Module III: Statistical Techniques I:

Introduction: Measures of central tendency, Moments, Moment generating function (MGF) , Skewness, Kurtosis, Curve Fitting , Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves ,Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non linear regression.

Module IV: Statistical Techniques II:

Probability and Distribution: Introduction, Addition and multiplication law of probability, Conditional probability, Baye's theorem, Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Module V: Statistical Techniques III:

Sampling, Testing of Hypothesis and Statistical Quality Control: Introduction , Sampling Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA).Statistical Quality Control (SQC) , Control Charts , Control Charts for variables (\bar{X} and R Charts), Control Charts for Variables (p, np and C charts).

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
3. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2. T. Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
3. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.
4. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
5. D.N. Elhance, V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

COURSEOUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of this course, the students will be able to:		
CO 1	Remember the concept of partial differential equation and to solve partial differential equations	K ₁ & K ₃
CO 2	Analyze the concept of partial differential equations to evaluate the problems concerned with partial differential equations	K ₄ & K ₅
CO 3	Understand the concept of correlation, moments, skewness and kurtosis and curve fitting	K ₂
CO 4	Remember the concept of probability to evaluate probability distributions	K ₁ & K ₅
CO 5	Apply the concept of hypothesis testing and statistical quality control to create control charts	K ₃ & K ₆

K₁ – Remember, K₂ – Understand, K₃ – Apply, K₄ – Analyze, K₅ – Evaluate, K₆ – Create

Evaluation methodology to be followed:

The evaluation and assessment plan consists of the following components:

- a. Class attendance and participation in class discussions etc.
- b. Quiz.
- c. Tutorials and assignments.
- d. Sessional examination.
- e. Final examination.

Award of Internal/External Marks:

Assessment procedure will be as follows:

1. These will be comprehensive examinations held on-campus (Sessionals).
2. Quiz. -a. Quiz will be of type multiple choices, fill-in-the-blanks or match the columns.
b. Quiz will be held periodically.
3. Tutorials and assignments
 - a. The assignments/home-work may be of multiple choice type or comprehensive type at least one assignment from each Module/Unit.
 - b. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
4. Final examinations.

Technical Communication (BTCS302)

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Unit -1 Fundamentals of Technical Communication:

Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication

Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph

Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit - II Forms of Technical Communication:

Technical Report: Definition & importance;

Thesis/Project writing: structure & importance; synopsis writing: Methods

Technical research Paper writing: Methods & style; Seminar & Conference paper writing; **Key-Note**

Speech: Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit - III Technical Presentation: Strategies & Techniques

Presentation: Forms; interpersonal Communication; Class room presentation; style; method;

Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation;

Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest

Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - IV Technical Communication Skills:

Interview skills, Group Discussion: Objective & Method; Seminar/Conferences Presentation

skills: Focus; Content; Style; Argumentation skills; Devices; Analysis; Cohesion & Emphasis; Critical thinking;

Nuances: Exposition narration & Description; effective business communication competence; Grammatical;

Discourse competence: combination of expression & conclusion;

Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.

Unit - V Kinesics & Voice Dynamics:

Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent

Linguistic features of voice control: Vowel & Consonant Sounds.

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprenice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi

DATA STRUCTURE (BTCS303)		
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,	K ₁ , K ₂
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	K ₃
CO 3	Implementation of Trees and Graphs and perform various operations on these data structure.	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 with respect to its performance to solve a real worldproblem.	K ₅ , K ₆
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed
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	08
II	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
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	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: Warshal Algorithm and Dijkstra Algorithm.	08
V	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

Text books:

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

Computer Organization and Architecture (BTCS304)		
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 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, Booths 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), micro operations, execution of a complete instruction. 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 RAM memories, 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:		
<ol style="list-style-type: none"> 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) 		

Discrete Structures & Theory of Logic (BTCS305)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Write an argument using logical notation and determine if the argument is or is not valid.	K ₃ , K ₄
CO 2	Understand the basic principles of sets and operations in sets.	K ₁ , K ₂
CO 3	Demonstrate an understanding of relations and functions and be able to determine their properties.	K ₃
CO 4	Demonstrate different traversal methods for trees and graphs.	K ₁ , K ₄
CO 5	Model problems in Computer Science using graphs and trees.	K ₂ , K ₆
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs. Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions, Growth of Functions. Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases. Proof Methods, Proof by counter – example, Proof by contradiction.	08
II	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
III	Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.	08
IV	Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference. (8) Predicate Logic: First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.	08
V	Trees: Definition, Binary tree, Binary tree traversal, Binary search tree. Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring, Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences. Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle	08

Text books:

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. Liptschütz, 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

Data Structure using C Lab (BTCS306P)

Write C Programs to illustrate the concept of the following:

1. Sorting Algorithms-Non-Recursive.
2. Sorting Algorithms-Recursive.
3. Searching Algorithm.
4. Implementation of Stack using Array.
5. Implementation of Queue using Array.
6. Implementation of Circular Queue using Array.
7. Implementation of Stack using Linked List.
8. Implementation of Queue using Linked List.
9. Implementation of Circular Queue using Linked List.
10. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
11. Graph Implementation, BFS, DFS, Minimum cost spanning tree, shortest path algorithm.

Computer Organization Lab (BTCS307P)

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.

Discrete Structure & Logic Lab (BTCS308P)

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder using logic gates.
5. Implementation and verification of Encoder using logic gates.
6. Implementation of 4:1 multiplexer using logic gates.
7. Implementation of 1:4 demultiplexer using logic gates.
8. Implementation of 4-bit parallel adder using 7483 IC.
9. Design, and verify the 4-bit synchronous counter.

10. Design, and verify the 4-bit asynchronous counter.

**Mini Project or Internship Assessment
(BTCS309P)**

Semester –IV

PYTHON PROGRAMMING (BTCS401)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To read and write simple Python programs.	K ₁ , K ₂
CO 2	To develop Python programs with conditionals and loops.	K ₂ , K ₄
CO 3	To define Python functions and to use Python data structures -- lists, tuples, dictionaries	K ₃
CO 4	To do input/output with files in Python	K ₂
CO 5	To do searching ,sorting and merging in Python	K ₂ , K ₄
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: The Programming Cycle for Python , Python IDE, Interacting with Python Programs , Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.	08
II	Conditionals: Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation. Loops: Purpose and working of loops , While loop including its working, For Loop , Nested Loops , Break and Continue.	08
III	Function: Parts of A Function , Execution of A Function , Keyword and Default Arguments ,Scope Rules. Strings : Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings. Python Data Structure : Tuples , Unpacking Sequences , Lists , Mutable Sequences , List Comprehension , Sets , Dictionaries Higher Order Functions: Treat functions as first class Objects , Lambda Expressions	08
IV	Sieve of Eratosthenes: generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes. File I/O : File input and output operations in Python Programming Exceptions and Assertions Modules : Introduction , Importing Modules , Abstract Data Types : Abstract data types and ADT interface in Python Programming. Classes : Class definition and other operations in the classes , Special Methods (such as <code>_init_</code> , <code>_str_</code> , comparison methods and Arithmetic methods etc.) , Class Example , Inheritance , Inheritance and OOP.	08
V	Iterators & Recursion: Recursive Fibonacci , Tower Of Hanoi Search : Simple Search and Estimating Search Time , Binary Search and Estimating Binary Search Time Sorting & Merging: Selection Sort , Merge List , Merge Sort , Higher Order Sort	08

Text books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, —Introduction to Computation and Programming Using Python``, Revised and expanded Edition, MIT Press , 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015. 6.Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
7. Charles Dierbach, —Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.
8. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.1

Universal Human Values and Professional Ethics

BTCS402

Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcome:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT-1

Course Introduction- Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2

Understanding Harmony in the Human Being- Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4

Understanding Harmony in the Nature and Existence- Whole existence so-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation:

Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Operating system (BTCS403)		
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

Theory of Automata and Formal Languages (BTCS404)		
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, Myhill-Nerode Theorem, Simulation of DFA and NFA	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, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	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

Microprocessor (BTCS405)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system.	K ₃ , K ₄
CO 2	Analyze a detailed s/w & h/w structure of the Microprocessor.	K ₂ ,K ₄
CO 3	Illustrate how the different peripherals (8085/8086) are interfaced with Microprocessor.	K ₃
CO 4	Analyze the properties of Microprocessors(8085/8086)	K ₄
CO 5	Evaluate the data transfer information through serial & parallel ports.	K ₅
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Microprocessor evolution and types, microprocessor architecture and operation of its components, addressing modes, interrupts, data transfer schemes, instruction and data flow, timer and timing diagram, Interfacing devices.	08
II	Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, Control & status, interrupt and machine cycle. Instruction sets. Addressing modes. Instruction formats Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control and assembler directives.	08
III	Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, and memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.	08
IV	Assembly language programming based on intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions	08
V	Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.	08
Text books:		
<ol style="list-style-type: none"> 1. Gaonkar, Ramesh S , “Microprocessor Architecture, Programming and Applications with 8085”, Penram International Publishing. 2. Ray A K , Bhurchandi K M , “Advanced Microprocessors and Peripherals”, TMH 3. Hall D V ,”Microprocessor Interfacing’, TMH 4. Liu and, “ Introduction to Microprocessor”, TMH 5. Brey, Barry B, “INTEL Microprocessors”, PHI 6. Renu Sigh & B.P. Gibson G A , “ Microcomputer System: The 8086/8088 family” ,PHI 7. Aditya P Mathur Sigh, “Microprocessor, Interfacing and Applications M Rafiqzaman, “Microprocessors, Theory and Applications 8. J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999 		

Operating System Lab (BTCS406P)

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)
 - ii. Linked –list(using linked-list)
 - iii. 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

Microprocessor Lab (BTCS407P)

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.

5. To write a program to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port.

Python Language Programming Lab (BTCS408P)

1. To write a python program that takes in command line arguments as input and print the number of arguments.
2. To write a python program to perform Matrix Multiplication.
3. To write a python program to compute the GCD of two numbers.
4. To write a python program to find the most frequent words in a text file.
5. To write a python program find the square root of a number (Newton's method).
6. To write a python program exponentiation (power of a number).
7. To write a python program find the maximum of a list of numbers.
8. To write a python program linear search.
9. To write a python program Binary search.
10. To write a python program selection sort.
11. To write a python program Insertion sort.
12. To write a python program merge sort.
13. To write a python program first n prime numbers.
14. To write a python program simulate bouncing ball in Pygame.

Semester -V

Database Management System (BTCS501)

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

1. Apply knowledge of database for real life applications.
2. Apply query processing techniques to automate the real time problems of databases.
3. Identify and solve the redundancy problem in database tables using normalization.
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.
5. Design, develop and implement a small database project using database tools.

Unit 1

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. [8]

Unit 2

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 [8]

Unit 3

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 [8]

Unit 4

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. [8]

Unit 5

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. [8]

Text & References Books

1. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
2. Date C J, "An Introduction to Database Systems", Addison Wesley
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addison 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", Gargotia Publications
8. Majumdar & Bhattacharya, "Database Management System", TMH

Compiler Design (BTCS502)

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

1. Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.
2. Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
3. Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
4. Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.
5. Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.

Unit 1

Introduction to Compiler: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG. [08]

Unit 2

Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables. [08]

Unit 3

Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax- directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements. [08]

Unit 4

Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors. [08]

Unit 5

Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis. [08]

Text & References Books

1. K. Muneeswaran, Compiler Design, First Edition, Oxford University Press.
2. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003.
3. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
4. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
5. .V Raghvan, "Principles of Compiler Design", TMH
6. Kenneth Loudon, "Compiler Construction", Cengage Learning.
7. Charles Fischer and Ricard LeBlanc, "Crafting a Compiler with C", Pearson Education

Design and Analysis of Algorithm (BTCS503)

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

1. Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.
2. Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).
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.
4. Apply classical sorting, searching, optimization and graph algorithms.
5. Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.

Unit 1

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]

Unit 2

Advanced Data Structures: Red-Black Trees, B-Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List [08]

Unit 3

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]

Unit 4

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]

Unit 5

Selected Topics: Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms [08]

Text & References Books

1. Thomas H. Cormen, 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
8. Examples, Second Edition, Wiley, 2006.

Data Analytics (BTCS504A)

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

1. Describe the life cycle phases of Data Analytics through discovery, planning and building.
2. Learn various Data Analysis Techniques.
3. Implement various Data streams.
4. Understand item sets, Clustering, frame works & Visualizations.
5. Apply R tool for developing real time applications..

Unit 1

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]

Unit 2

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 generalization, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods. [08]

Unit 3

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]

Unit 4

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]

Unit 5

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 & References Books

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. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with dvanced Analytics, John Wiley & Sons.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
5. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley

6. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series
7. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier
8. Michael Berthold, David J. Hand, ” Intelligent Data Analysis”, Springer
9. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill
10. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer
11. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication
12. Pete Warden, Big Data Glossary, O’Reilly
13. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
14. Pete Warden, Big Data Glossary, O’Reilly.
15. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press
16. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier

Web Designing (BTCS504B)

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

1. Understand principle of Web page design and about types of websites
2. Visualize and Recognize the basic concept of HTML and application in web designing.
3. Recognize and apply the elements of Creating Style Sheet (CSS).
4. Understanding the basic concept of Java Script and its application.
5. Introduce basics concept of Web Hosting and apply the concept of SEO

Unit 1

Introduction : Basic principles involved in developing a web site, Planning process , Domains and Hosting, Responsive Web Designing , Types of Websites (Static and Dynamic Websites), Web Standards and W3C recommendations,

Introduction to HTML: What is HTML , HTML Documents, Basic structure of an HTML document , Creating an HTML document , Mark up Tags , Heading-Paragraphs , Line Breaks **[08]**

Unit 2

Elements of HTML: HTML Tags., Working with Text , Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls **[08]**

Unit 3

Concept of CSS: Creating Style Sheet, CSS Properties , CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects , Working with Lists and Tables , CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs. **[08]**

Unit 4

Introduction to Client Side Scripting , Introduction to Java Script , Javascript Types , Variables in JS, Operators in JS , Conditions Statements , Java Script Loops, JS Popup Boxes , JS Events , JS Arrays, Working with Arrays, JS Objects ,JS Functions , Using Java Script in Real time , Validation of Forms, Related Examples **[08]**

Unit 5

Web Hosting: Web Hosting Basics , Types of Hosting Packages, Registering domains , Defining Name Servers , Using Control Panel, Creating Emails in Cpanel , Using FTP Client, Maintaining a Website.

Concepts of SEO : Basics of SEO, Importance of SEO, Onpage Optimization Basics **[08]**

Text & References Books

1. Steven M. Schafer, “HTML, XHTML, and CSS Bible, 5ed”, Wiley India
2. Ian Pouncey, Richard York, “Beginning CSS: Cascading Style Sheets for Web Design”, Wiley India

Computer Graphics (BTCS504C)

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

1. Understand the graphics hardware used in field of computer graphics.
2. Understand the concept of graphics primitives like lines and circle based on different algorithms.
3. Apply the 2D graphics transformations, composite transformation and Clipping concepts .
4. Apply the concepts of and techniques used in 3D computer graphics, including viewing transformations
5. Perform the concept of projections, curve and hidden surfaces in real life.

Unit 1

Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms. [08]

Unit 2

Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing.

Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping [08]

Unit 3

Three Dimensional: 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3- D viewing, projections, 3-D Clipping. [08]

Unit 4

Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, B-spline and Bezier curves and surfaces. [08]

Unit 5

Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows. [08]

Text & References Books

1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education
2. Foley, Vandam, Feiner, Hughes – “Computer Graphics principle”, Pearson Education.
3. Rogers, “ Procedural Elements of Computer Graphics”, McGraw Hill
4. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – Tata MCGraw Hill.
5. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, Tata MCGraw Hill.
6. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication.
7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited.
8. Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education

Application of Soft Computing (BTCS504D)

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

1. Recognize the feasibility of applying a soft computing methodology for a particular problem
2. Know the concepts and techniques of soft computing and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.
3. Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem.
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
5. Apply genetic algorithms to combinatorial optimization problems

Unit 1

Neural Networks-I (Introduction & Architecture) : Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetero-associative memory. [08]

Unit 2

Neural Networks-II (Back propagation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule coefficient; back propagation algorithm, factors affecting backpropagation training, applications. [08]

Unit 3

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. [08]

Unit 4

Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, inference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfication & Defuzzification, Fuzzy Controller, Industrial applications [08]

Unit 5

Genetic Algorithm(GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications. [08]

Text & References Books

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.
2. N.P. Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press. Reference Books:
3. Simon Haykin, "Neural Networks" Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

Machine Learning Techniques (BTCS505A)

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

1. To understand the need for machine learning for various problem solving
2. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
3. To understand the latest trends in machine learning
4. To design appropriate machine learning algorithms for problem solving
5. To understand the need for machine learning for various problem solving

Unit 1

INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; **THE CONCEPT LEARNING TASK** - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias **[08]**

Unit 2

DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning;

ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation Algorithm Convergence, Generalization; **[08]**

Unit 3

Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms;

Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm; **[08]**

Unit 4

Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning **[08]**

Unit 5

Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms- General to specific beam search-FOIL; **REINFORCEMENT LEARNING** - The Learning Task, Q Learning. **[08]**

Text & References Books

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

Object Oriented System Design (BTCS505B)

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

1. To Understand the application development and analyze the insights of object oriented programming to implement application
2. To Understand, analyze and apply the role of overall modeling concepts (i.e. System, structural)
3. To Understand, analyze and apply oops concepts (i.e. abstraction, inheritance)
4. To learn concepts of C++ for understanding the implementation of object oriented concepts
5. To learn the programming concepts to implement object oriented modeling.

Unit 1

Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture. [08]

Unit 2

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams.

Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages.

Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine, Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. [08]

Unit 3

Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations.

Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation.

Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation. [08]

Unit 4

C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures

C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions [08]

Unit 5

Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class

Polymorphism : Pointers in C++, Pointers and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism [08]

Text & References Books

1. James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education

3. Object Oriented Programming With C++, E Balagurusamy, TMH
4. C++ Programming, Black Book, Steven Holzner, dreamtech
5. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
6. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson
7. The Complete Reference C++, Herbert Schilitz, TMH

Augmented & Virtual Reality (BTCS505C)

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

1. To make students know the basic concept and framework of virtual reality.
2. To teach students the principles and multidisciplinary features of virtual reality.
3. To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
4. To teach students the technology for managing large scale VR environment in real time.
5. To provide students with an introduction to the AR system framework and development tools.

Unit 1

VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. **HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES:** Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces. **[08]**

Unit 2

3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces. **[08]**

Unit 3

SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market **[08]**

Unit 4

3D INTERACTION TECHNIQUES: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry. **[08]**

Unit 5

DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and Developing Guidelines and Evaluation.

VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training. ugmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational 08 augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

[08]

Text & References Books

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
2. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
4. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Merging Real and Virtual Worlds”, 2005.
5. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.
6. John Vince, “Virtual Reality Systems”, Addison Wesley, 1995.
7. Howard Rheingold, “Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society”, Simon and Schuster, 1991.
8. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002
9. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

Human Computer Interface (BTCS505D)

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

1. Critically discuss common methods in the user-centered design process and the appropriateness of individual methods for a given problem.
2. Use, adapt and extend classic design standards, guidelines, and patterns.
3. Employ selected design methods and evaluation methods at a basic level of competence.
4. Build prototypes at varying levels of fidelity, from paper prototypes to functional, interactive prototypes.
5. Demonstrate sufficient theory of human computer interaction, experimental methodology and inferential statistics to engage with the contemporary research literature in interface technology and design.

Unit 1

Introduction : Importance of user Interface–definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics-Principles of user interface [08]

Unit 2

Design process: Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions. III Screen Designing :Design goals – Scre [08]

Unit 3

Screen Designing : Design goals–Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design. [08]

Unit 4

Windows : New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors [08]

Unit 5

Software tools : Specification methods, interface–Building Tools. 8 Interaction Devices– Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers. [08]

Text & References Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer Interaction, Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

Database Management Systems Lab

(BTCS-506P)

1. Installing oracle/ MYSQL
2. Creating Entity-Relationship Diagram using case tools.
3. Writing SQL statements Using ORACLE /MYSQL:
 - a) Writing basic SQL SELECT statements.
 - b) Restricting and sorting data.
 - c) Displaying data from multiple tables.
 - d) Aggregating data using group function.
 - e) Manipulating data.
 - f) Creating and managing tables.
 1. Normalization
 2. Creating cursor Creating procedure and functions
 3. Creating packages and triggers
 4. Design and implementation of payroll processing system
 5. Design and implementation of Library Information System
 6. Design and implementation of Student Information System
 7. Automatic Backup of Files and Recovery of Files

COMPILER DESIGN LAB

(BTCS-507P)

1. Implementation of LEXICAL ANALYZER for IF STATEMENT
2. Implementation of LEXICAL ANALYZER for ARITHMETIC EXPRESSION
3. Construction of DFA from REGULAR EXPRESSION
4. Construction of NFA from REGULAR EXPRESSION
5. Implementation of SHIFT REDUCE PARSING ALGORITHM
6. Implementation of OPERATOR PRECEDENCE PARSER
7. Implementation of RECURSIVE DESCENT PARSER
8. Implementation of CODE OPTIMIZATION TECHNIQUES
9. Implementation of CODE GENERATOR

Design and Analysis of Algorithm Lab

(BTCS-508P)

- Program for Recursive Binary & Linear Search.
- Program for Heap Sort.
Program for Merge Sort.
 - Program for Selection Sort.
 - Program for Insertion Sort.
 - Program for Quick Sort.
- Knapsack Problem using Greedy Solution**
 6. Perform Travelling Salesman Problem
 7. Find Minimum Spanning Tree using Kruskal's Algorithm
 8. Implement N Queen Problem using Backtracking

Software Engineering (BTCS601)

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

1. To learn about generic models of software development process.
2. To understand fundamental concepts of requirements engineering and Analysis Modeling.
3. To understand the different design techniques and their implementation.
4. To learn various testing measures.
5. To learn various maintenance and project management techniques.

Unit 1

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]**

Unit 2

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]**

Unit 3

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: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs. **[08]**

Unit 4

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]**

Unit 5

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 & References 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.
8. P fleeger, Software Engineering, Macmillan Publication

Web Technology

(BTCS602)

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

1. Apply the knowledge of the internet and related internet concepts that are vital in understanding web application development and analyze the insights of internet programming to implement complete application over the web.
2. Understand, analyze and apply the role of mark up languages like HTML, DHTML, and XML in the workings of the web and web applications.
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.
4. Understand, analyze and build dynamic web pages using client side programming JavaScript and also develop the web application using servlet and JSP.
5. Understand the impact of web designing by database connectivity with JDBC in the current market place where everyone use to prefer electronic medium for shopping, commerce, fund transfer and even social life also.

Unit 1

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]

Unit 2

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]

Unit 3

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]

Unit 4

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]

Unit 5

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 xample, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries. [08]

Text & References 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. Balaguru

Computer Networks (BTCS603)

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

1. Build an understanding of the fundamental concepts and Layered Architecture of computer networking.
2. Understand the basic concepts of link layer properties to detect error and develop the solution for error control and flow control.
3. Design, calculate, and apply subnet masks and addresses to fulfil networking requirements and calculate distance among routers in subnet.
4. Understanding the duties of transport layer, session layer and presentation layer and also focus on network security issues to secure communication towards society.
5. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Unit 1

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]

Unit 2

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]

Unit 3

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]

Unit 4

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]

Unit 5

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 & References Books

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.

Big Data (BTCS604A)

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

1. Identify Big Data and its business implications.
2. Use various techniques for mining data stream
3. List the components of Hadoop and Hadoop Eco-System.
4. Apply Map Reduce programming model to access and process data on Distributed File System.
5. Manage job execution in Hadoop environment and develop Big Data solutions by applying Hadoop Eco System components

Unit 1

Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools. [08]

Unit 2

Hadoop: History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System.

Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce [08]

Unit 3

HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures.

Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud [08]

Unit 4

Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features - NameNode high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN.

NoSQL Databases: Introduction to NoSQL

MongoDB: Introduction, data types, creating, updating and deleting documents, querying, introduction to indexing, capped collections **Spark:** Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN

SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance. [08]

Unit 5

Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase **Pig** - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators,

Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries.

HBase –Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL. [08]

Text & References Books

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
2. Big-Data Black Book, DT Editorial Services, Wiley
3. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill.
4. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
5. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons
6. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach", VPT
7. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP
8. Tom White, "Hadoop: The Definitive Guide", O'Reilly.
9. Eric Sammer, "Hadoop Operations", O'Reilly.
10. Chuck Lam, "Hadoop in Action", MANNING Publishers
11. Deepak Vohra, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools", Apress
12. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly
13. Lars George, "HBase: The Definitive Guide", O'Reilly.
14. Alan Gates, "Programming Pig", O'Reilly.
15. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer
16. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons
17. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons
18. Pete Warden, "Big Data Glossary", O'Reilly

Image Processing (BTCS604B)

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

1. To become familiar with digital image fundamentals.
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain
3. To learn concepts of degradation function and restoration techniques
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition method

Unit 1

DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing–Components– Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT. **[08]**

Unit 2

IMAGE ENHANCEMENT : Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. **[08]**

Unit 3

IMAGE RESTORATION : Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **[08]**

Unit 4

IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm. **[08]**

Unit 5

IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching. **[08]**

Text & References Books

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2010
2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D.E. Dudgeon and R.M. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

Data Compression (BTCS604C)

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

1. To gain a fundamental understanding of data compression methods for text, images, and video, and related issues in the storage, access, and use of large data sets
2. To select, giving reasons that are sensitive to the specific application and particular circumstance, most appropriate compression techniques for text, audio, image and video information
3. To illustrate the concept of various algorithms for compressing text, audio, image and video information.
4. To understand various Distortion criterias
5. To illustrate the Advantages of Vector Quantization over Scalar Quantization.

Unit 1

Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes. [08]

Unit 2

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression. [08]

Unit 3

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image. [08]

Unit 4

Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression. [08]

Unit 5

Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization. Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured Vector Quantizers. [08]

Text & References Books

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers
2. Elements of Data Compression, Drozdek, Cengage Learning
3. Introduction to Data Compression, Second Edition, Khalid Sayood, The Morgan Kaufmann
4. Series 4. Data Compression: The Complete Reference 4th Edition by David Salomon, Springer
5. Text Compression 1st Edition by Timothy C. Bell Prentice Hall

Software Engineering Lab (BTCS606P)

For any given case/ problem statement do the following;

1. Prepare a SRS document in line with the IEEE recommended standards.
2. Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case.
3. Draw the activity diagram.
4. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
5. Draw the sequence diagram for any two scenarios.
6. Draw the collaboration diagram.
7. Draw the state chart diagram.
8. Draw the component diagram.
9. Perform forward engineering in java. (Model to code conversion)
10. Perform reverse engineering in java. (Code to Model conversion)
11. Draw the deployment diagram.

Web Technology Lab (BTCS607P)

This lab is based on the Web Technologies. Some examples are as follows:

1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject
2. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
3. Write programs using Java script for Web Page to display browsers information.
4. Write a Java applet to display the Application Program screen i.e. calculator and other.
5. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer.
6. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement a simple servlet book query with the help of JDBC & SQL. Create MS Access Database, Create an ODBC link, Compile & execute JAVA JDVC Socket.
7. Install TOMCAT web server and APACHE. Access the above developed static web pages for books web site, using these servers by putting the web pages developed .
8. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and wd4 respectively. Write a servlet for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
9. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
10. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database
11. Design and implement a simple shopping cart example with session tracking API.

Computer Networks Lab (BTCS608P)

1. To learn handling and configuration of networking hardware like RJ-45 connector, CAT-6 cable, crimping tool, etc.
2. Configuration of router, hub, switch etc. (using real devices or simulators)
3. Running and using services/commands like ping, trace route, nslookup, arp, telnet, ftp, etc.
4. Network packet analysis using tools like Wireshark, tcpdump, etc.
5. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
6. Programming using raw sockets
7. Programming using RPC

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

Open Electives to be offered by the CSE/CS/IT/CSI Branches

Real Time Systems BTOE-605A

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

1. Describe concepts of Real-Time systems and modeling.
2. Recognize the characteristics of a real-time system in context with real time scheduling.
3. Classify various resource sharing mechanisms and their related protocols.
4. Interpret the basics of real time communication by the knowledge of real time models and protocols.
5. Apply the basics of RTOS in interpretation of real time systems.

Unit	Topics	Lectures
I	Introduction Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
II	Real Time Scheduling Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	8
III	Resources Sharing Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.	8
IV	Real Time Communication Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority- Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.	8
V	Real Time Operating Systems and Databases Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.	8

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Embedded System BTOE-605B

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

1. Attain the knowledge of embedded system and its development environment.
2. Gain the knowledge of RTOS based embedded system design and its applications.

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

1. Understand the basics of embedded system and its structural units.
2. Analyze the embedded system specification and develop software programs.
3. Evaluate the requirements of the programming embedded systems, related software architecture.
4. Understand the RTOS based embedded system design.
5. Understand all the applications of the embedded system and designing issues.

Unit	Topic	Lectures
1	Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging. Embedded Networking: Embedded Networking: Introduction, I/O Device Ports &	8
2	Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers. Embedded Firmware Development Environment: Embedded Product Development	8
3	Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model. RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication	8
4	shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux. Embedded System Application Development: Design issues and techniques Case	8
5	Study of Washing Machine- Automotive Application- Smart card System Application.	8

Text Books:

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design” Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.
3. Steve Heath, “Embedded System Design”, Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, “The 8051. Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007.

Introduction to MemS
BTOE-605C

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

1. Understand the Basic concept of MEMS, Mechanics of Beam and Diaphragm Structures, Air Damping and Electrostatic Actuation.
2. Know the knowledge of Thermal Effects and the Applications of MEMS in RF.

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

1. Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.
2. Explain Mechanics of Beam and Diaphragm Structures.
3. Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
4. Know the concept of Electrostatic Actuation.
5. Understand the applications of MEMS in RF

Unit	Topic	Lectures
1	Introduction to MEMS: MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors / Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.	8
2	Mechanics of Beam and Diaphragm Structures: Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.	8
3	Air Damping: Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	8
4	Electrostatic Actuation: Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	8
5	Thermal Effects: Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors. Applications of MEMS in RF MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Micro resonator Modeling, Micromechanical Resonator Limitations.	8

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.
2. S.M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, "Sensors and Transducers", McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, "Micro sensors", IEEE Press.

Object Oriented Programming

BTOE-605D

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

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Know the knowledge of Basic Structural Modeling, Object Oriented Analysis and C++ Basics.

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

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Understand the Basic concept of Basic Structural Modeling.
3. Know the knowledge of Object oriented design, Object design.
4. Know the knowledge of C++ Basics.
5. Understand the Basics of object and class in C++.

Unit	Topic	Lectures
1	hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	8
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine, Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component Deployment, Component diagrams and Deployment diagrams	8
3	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	8
4	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	8
5	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointers and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	8

Text Books:

1. James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education
3. Object Oriented Programming with C++, E Balagurusamy, TMH

Reference Books:

1. R. S. Salaria, Mastering Object Oriented Programming with C++, Khanna Publishing House.
2. C++ Programming, Black Book, Steven Holzner, dreamtech.
3. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia.
4. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson.
5. The Complete Reference C++, Herbert Schlitz, TMH.
6. C++ and Object Oriented Programming Paradigm, PHI.
7. C++ : How to Program, 9th Edition, Deitel and Deitel, PHI.

Numerical Techniques
BTOE-605E

Course Objective: Students undergoing this course are expected to-

1. Understand about the basics of numerical techniques and its applications to Engineering Problems.

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

1. Understand about the basics of Ordinary Differential Equations, Separable equations, Equations made separable by change of variables.
2. Retrieve the information content of Power series method.
3. CO3: Apply problem specific Bessel's equation, Bessel Functions to engineering applications.
4. Understand about the basics of matrix, Eigen values and eigen vectors.
5. Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction.

Unit	Topic	Lectures
1	Ordinary Differential Equations, Separable equations, Equations made separable by change of variables, Homogeneous Equations, Equations with first order and first degree with linear coefficients, Exact equations, Linear equation of first order, Bernoulli's equation, Other degree, Clairaut's equation, Singular solutions, Equations with missing terms, General properties of Linear equations, Linear equations with constant coefficients, Determination of the complementary function, exponential functions, Determination of the particular integral, the Euler equation, Simultaneous Linear Differential equations.	8
2	Power series method, theory of the power series method, Legendre's equation, Legendre's Polynomials, Frobenius Method.	8
3	Bessel's equation, Bessel Functions $J_v(x)$, Bessel Functions $J_v(x)$ for any $v \geq 0$. Gamma Function, Solution $J_{-v}(x)$ of the Bessel Equation, Backbones of Bessel's Theory, $J_v(x)$ with $v = \pm 1/2, \pm 3/2, \pm 5/2$.	8
4	Definition of matrix, Some special definitions and operations involving matrices, Determinants, Theorems on determinants, Inverse of a matrix, Orthogonal and unitary matrix. Orthogonal vectors, System of linear equations, Systems on n equations with n unknowns, Cramer's Rule, Eigen values and eigen vectors.	8
5	Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction, Solution of Difference Equations, Stirred-Tank Reactor System Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.	8

Text & Reference books:

1. Mickley, Reid and Sherwood, "Applied Mathematics in Chemical Engineering", Tata McGraw Hill, New Delhi (1981).
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley and Sons (1999).
3. M. R. Spiegel, "Advanced Mathematics for Engineers and Scientists", Schaum Outline Series, McGraw Hill, (1971).
4. Chandrika Prasad, Reena Garg, "Advanced Engineering Mathematics", Khanna Publishing house

Gis & Remote Sensing
BTOE-605F

Course Objective: Students undergoing this course are expected to-

1. Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

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

1. Understand about the principles of Remote Sensing and its advantages and limitations.
2. Retrieve the information content of remotely sensed data.
3. Apply problem specific remote sensing data for engineering applications.
4. Analyze spatial and attribute data for solving spatial problems.
5. Create GIS and cartographic outputs for presentation

Unit	Topic	Lectures
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	8
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation-interpretation elements;	8
3	Photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	8
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	8
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	8

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.

6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

**Understanding the Human Being Comprehensively – Human Aspirations and its Fulfillment
BTOE-605G**

Course Objectives:

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.
2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.
3. To help the students to develop the understanding of human tradition and its various components.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

Unit	Topic	Lectures
1	Introduction: The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	8
2	Understanding Human being and its expansion: The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – in interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	8
3	Activities of the Self: Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	8
4	Understanding Co-existence with other orders: The need and the process of inner evolution (through self-exploration, self-awareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	8
5	Expansion of harmony from self to entire existence: Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	8

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

Artificial Intelligence (BTCS701)

Course Objective

- Introduce the basic principles of AI towards problem solving, inference, perception, knowledge representation and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural Networks and other machine learning models.
- Experiment with a machine learning model for simulation and analysis.
- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcome

- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems
- Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Demonstrate proficiency in applying scientific method to models of machine learning.

Unit-I

Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Processing.08

Unit-II

Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.08

Unit-III

Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.08

Unit-IV

Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning.08

Unit-V

Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.08

Text books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
3. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education
4. Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India,

**Artificial Intelligence Lab
(BTCS705P)**

The following programs may be developed -

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is belowfreezing.
4. Write a program to solve the Monkey Banana problem.
5. WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
6. WAP to implement factorial, fibonacci of a given number.
7. Write a program to solve 4-Queen problem.
8. Write a program to solve traveling salesman problem.
9. Write a program to solve water jug problem using LISP

High Performance Computing

(BTCS702A)

Course Objective:

1. Understand the role of HPC in science and engineering.
2. Use HPC platforms and parallel programming models.
3. Able to measure, analyse and assess the performance of HPC applications and their supporting hardware.
4. Able to administration, scheduling, code portability and data management in an HPC environment, with particular reference to Grid Computing.
5. Analyse the suitability of different HPC solutions to common problems found in Computational Science.

Course Outcomes:

1. Provide systematic and comprehensive treatment of the hardware and the software high performance techniques involved in current day computing.
2. Introduce the fundamentals of high-performance computing with the graphics processing units and many integrated cores using their architectures and corresponding programming environments.
3. Introduce the learner to fundamental and advanced parallel algorithms through the GPU and MIC programming environments

Unit-I

Overview of Grid Computing Technology, History of Grid Computing, High Performance Computing, Cluster Computing, Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids: Desktop Grids, Cluster Grids, Data Grids, High- Performance Grids, Applications and Architectures of High Performance Grids, High Performance Application Development Environment.08

Unit-II

Open Grid Services Architecture, Introduction, Requirements, Capabilities, Security Considerations, GLOBUS Toolkit. 08

Unit-III

Overview of Cluster Computing, Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems, 08

Unit-IV

Beowulf Cluster: The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM). 08

Unit-V

Overview of Cloud Computing, Types of Cloud, Cyber infrastructure, Service Oriented Architecture Cloud Computing Components: Infrastructure, Storage, Platform, Application, Services, Clients, Cloud Computing Architecture. 08

Text books:

1. Laurence T. Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John iley
2. Ahmar Abbas, “Grid Computing: Practical Guide to Technology & Applications”, Firewall Media, 2004.
3. Joshy Joseph and Craig Fellenstein , “Grid Computing” Pearson Education, 2004.
4. Ian Foster, et al., “The Open Grid Services Architecture”, Version 1.5 (GFD.80). Open Grid Forum, 2006.

6. RajkumarBuyya. High Performance Cluster Computing: Architectures and Systems. PrenticeHall India, 1999.

CLOUD COMPUTING

(BTCS702B)

Course Objective:

1. To analyze the components of cloud computing and its business perspective.
2. To evaluate the various cloud development tools.
3. To collaborate with real time cloud services.
4. To analyze the case studies to derive the best practice model to apply when developing and deploying cloud-based applications.

Course Outcomes:

1. This course gives an introduction to cloud computing and its techniques, issues, and its services that will lead to design and development of a simple cloud service.
2. This course provides the fundamentals and essentials of Cloud Computing, a sound foundation of the Cloud Computing so that it is used for using and adopting Cloud Computing services and tools in the real-life scenarios.
3. This course will be possess skills to design computing systems based on Cloud computing technology and Advancement Hadoop.

Unit-I

INTRODUCTION

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning. 08

Unit-II

CLOUD ENABLING TECHNOLOGIES Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery. 08

Unit-III

CLOUD ARCHITECTURE, SERVICES AND STORAGE Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3. 08

Unit-IV

RESOURCE MANAGEMENT AND SECURITY IN CLOUD Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards. 08

Unit-V

CLOUD TECHNOLOGIES AND ADVANCEMENTS Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation. 08

Text books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O’Reilly, 2009.

Blockchain Architecture Design

(BTCS702C)

Course Objective:

1. Understand the basics of digital money and crypto currencies. And Students are able to understand the fundamental concepts, message passing and functioning of logical clocks in a distributed environment.
2. Design the consensus protocol architecture for blockchain.
3. Design consensus process using open-source tool & platform like umbrella project developing a financial application like Paytm and etc.
4. Design an e-commerce application for end users. Design an application which could satisfy most departmental works like digital record identification, land records & etc.

Course Outcomes:

1. This course will be able to successfully pursue higher education in reputed institutions.
2. This course will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Computer Science and Engineering.
3. This course will be ethically and socially responsible solution providers and entrepreneurs in Computer Science and other engineering disciplines.
4. This course will have the ability to explore research areas and produce outstanding contribution in various areas of Systems Engineering.

Unit-I

Introduction to Blockchain: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms 08

Unit-II

Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains:Design goals, Consensus protocols for Permissioned Blockchains 08

Unit-III

Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool 08

Unit-IV

Use case 1 : Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc 08

Unit-V

Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain 08

Text books:

1. Mstering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>
4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - <https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>

Agile Software Development

(BTCS703A)

Course Objective

- To apply principles of software development and evolution.
- To specify, abstract, verify and validate solutions to large-size problems, to plan, develop and manage large software and learn emerging trends in software engineering.
- Related concepts in software development such as system design. Exploring the new concepts of knowledge management.
- To gain knowledge of software construction fundamentals, managing construction and practical considerations related to the domain of software design and construction.

Course Outcome

- Students should be able to identify the need for engineering approach to software development and various processes of requirements analysis for software engineering problems.
- Analyze various software engineering models and apply methods for design and development of software projects.
- Identify and apply the principles, processes and main knowledge areas for Software Project Management
- Proficiently apply standards, CASE tools and techniques for engineering software projects

Unit-I

AGILE METHODOLOGY Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values 08

Unit-II

AGILE PROCESSES Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices. 08

Unit-III

AGILITY AND KNOWLEDGE MANAGEMENT Agile Information Systems – Agile Decision Making – Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM). 08

Unit-IV

AGILITY AND REQUIREMENTS ENGINEERING Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile

Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation. 08

Unit-V

AGILITY AND QUALITY ASSURANCE Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development. 08

Text books:

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.
3. Craig Larman, "Agile and Iterative Development: A Managers Guide", Addison-Wesley, 2004.
4. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.

Parallel and Distributed Computing

(BTCS703B)

Course Objective

- To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.
- To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet) and their functionalities.
- Elucidate the foundations and issues of distributed systems
- Understand the various synchronization issues and global state for distributed systems.
- Comprehend the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Show the use of agreement protocols and fault tolerance mechanisms in distributed systems. K2 Relate the features of peer-to-peer and distributed shared memory systems K2 C314.6 Interpret the real-time distributed system applications

Course Outcome

- Account for models, limitations and fundamental concepts within parallel computations with communication based both on message passing and shared memory
- Analyse concrete systems and algorithms
- Adapt and develop algorithms for execution on parallel and distributed machines and analyse the algorithms with respect to correctness, reliability, safety and performance.
- Developing skill set in developing a distributed system.

Unit-I

Introduction: Scope , issues, applications and challenges of Parallel and Distributed Computing Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, coprocessing. Principles of Parallel Algorithm Design: Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing. 08

Unit-II

CUDA programming model: Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function. 08

Unit-III

Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time 08

Unit-IV

Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph 08

Unit-V

Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms 08

Text books:

1. A Grama, A Gupta, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.
2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.
3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.
4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

Quantum Computing

(BTCS703C)

Course Objective-

- To understand the building blocks of a quantum computer
- To understand the principles, quantum information and limitation of quantum operations formalizing
- To understand the quantum error and its correction.

Course Outcomes :

- Design of quantum computers using quantum bits (qubits), quantum gates and quantum circuits. Implementation of basic quantum algorithms, including Deutsch's algorithm, Shor's factoring algorithm, and the search algorithm of Grover.
- Understand the quantum Fourier transform and quantum searching.
- Ability to design Quantum search for structured database
- Understand the trends in Quantum Computing such as Optical Photon Computers, Optical Cavity Quantum electrodynamics.

Unit-I

Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. 08

Unit-II

Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured atabase. 08

Unit-III

Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance 08

Unit-IV

Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. 08

Unit-V

Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource . 08

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , “Quantum Computing - A Gentle Introduction” (Scientific and Engineering Computation) Paperback – Import,

3 Oct 2014 3. Computing since Democritus by Scott Aaronson

4. Computer Science: An Introduction by N. David Mermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

DIGITAL AND SOCIAL MEDIA MARKETING

(BTC SOE704A)

COURSE OBJECTIVE

- Introduce current and core practices of Digital and Social Media Marketing that will allow learners to analyse, plan, execute and evaluate a digital marketing strategy.
- Introduce core tools currently used in Digital and Social Media Marketing that will allow learners to analyse, plan, execute and evaluate a digital marketing strategy.
- Develop an understanding of Search Engine Optimization (SEO), Social Media Optimization, Affiliate and other relevant communication channels for engagement of digital communities.

COURSE OUTCOMES

Through successful completion of this course, students will:

- Understand what social media is, the various channels through which it operates, and its role in marketing strategy.
- Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers.
- Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks.
- Measure the impact of a social media campaign in terms of a specific marketing objective

UNIT-I

Introduction to Digital Marketing: The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. Marketing strategies for the digital world-latest practices.

UNIT-II

Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Facebook, Twitter, Google+, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns

UNIT-III

Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing. Marketing gamification, Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO).

UNIT-IV

Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies

UNIT-V

Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation,

Text books:

1. Moutsy Maiti: Internet Marketing, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts

Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).

4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).

5. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

IDEA TO BUSINESS MODEL (BTCOE704B)

Course Objectives:

- This course can motivate students to have an overall idea how to start and sustain a business enterprise.
- The students will learn basics of choosing an idea of a business model.
- The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.

Course Outcome:

- Examine the challenges associated with defining the concepts of entrepreneur and entrepreneurship
- Discuss how the evolution of entrepreneurship thought has influenced how we view the concept of entrepreneurship today
- Discuss how the list of basic questions in entrepreneurship research can be expanded to include research inquiries that are important in today's world
- Discuss how the concepts of entrepreneurial uniqueness, entrepreneurial personality traits, and entrepreneurial cognitions can help society improve its support for entrepreneurship
- Apply the general venturing script to the study of entrepreneurship

Unit-I Introduction

Search for a business idea- How to choose an idea- Product idea- selection of product- The adoption process- Product innovation- Production , planning and development strategy- New product idea. 8

Unit-II Introduction to Entrepreneurship - Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur.- Entrepreneur vs Manager role of entrepreneurship in economic development – Barriers to entrepreneurship. 8

Unit-III The Entrepreneur - types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development prog (EDP)- Evaluation of EDP - Entrepreneur development training. 8

Unit-IV Production system- Design of production system- Types of production system- Production, planning & control (PPC) - Steps of PPC. 8

Unit-V Communication- Importance of communication system - barriers to communication - listening to people- the power of talk - personal selling - risk taking & resilience - negotiation. 8

Text Books:

1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition
2. Production & operations Management- Kanishka Bedi,
3. Marketing Management- Philip Kotler.
4. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock , Gerard George

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

1. Enhance creative knowledge of students regarding selection of a business idea and its implementation process.
2. Acquire knowledge on entrepreneurship development, its Pro's and con's.
3. Acquire basic knowledge on how to become an Entrepreneur.
4. Develop knowledge on Production systems and its sustainability through production, planning and control (PPC)
5. Develop appropriate business model and apply in a better way.

Micro and Smart Systems (BTC SOE704C)

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques.

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

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques.
5. Design application using machine learning techniques.

UNIT-I

Introduction, Why miniaturization?, Microsystems versus MEMS, Why micro fabrication?, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems.

UNIT-II

Micro sensors, actuators, systems and smart materials: Silicon capacitive accelerometer, piezoresistive pressure sensor, conductometric gas sensor, an electrostatic combo-drive, a magnetic microrelay, portable blood analyzer, piezoelectric inkjet print head, micro mirror array for video projection, smart materials and systems.

UNIT-III

Micromachining technologies: silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.

UNIT-IV

Modeling of solids in Microsystems: Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses, Modelling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro mechanics.

UNIT-V

Integration of micro and smart systems: integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.

Text books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.

Renewable Energy Resources

(BTC SOE704D)

Course Objectives:

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestic and industrial application
5. Analyse the environmental aspects of renewable energy resources.

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

1. Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
2. Know the need of renewable energy resources, historical and latest developments.
3. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications
6. Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.
7. Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

UNIT-I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells . Solar cell materials , solar cell array , solar cell power plant , limitations.

UNIT-II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance ; solar thermal power plants , thermal energy storage for solar heating and cooling, limitations.

UNIT-III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion- electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT-V

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text books:

1. Raja et al, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications, 2006.
4. D.S. Chauhan, "Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle, "Renewable Energy Power For A Sustainable Future", Oxford University Press.

OPERATIONS RESEARCH

(BTCOE704E)

Course Objectives:

The course aims at building capabilities in the students for analyzing different situations in the industrial/business scenario involving limited resources and finding the optimal solution within constraints.

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

1. Identify and develop operational research models from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.
4. Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

UNIT-I

Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **[8]**

UNIT-II

Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines. **[8]**

UNIT-III

Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **[8]**

UNIT-IV

Theory of Games : Rectangular games, Minimax theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. **[8]**

UNIT-V

Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time. **[8]**

Text books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

Value Relationship & Ethical Human Conduct –For A Happy & Harmonious Society

(BTC SOE704F)

Course Objectives:

1. To help the students to understand the importance and types of relationship with expressions.
2. To develop the competence to think about the conceptual framework of undivided society as well as universal human order.
3. To help the students to develop the exposure for transition from current state to the undivided society and universal human order.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-a-vis the rest of existence.
 2. It is free from any dogma or set of do's and don'ts related to values.
 3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
 4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
 5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.
- Introduction to the course: Basic aspiration of a Human Being and program for its fulfilment, Need for family and relationship for a Human Being, Human-human relationship and role of behavior in its fulfillment, Human-rest of Nature

UNIT-I

Relationship and role of work in its fulfilment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order, an appraisal of the Current State, Appraisal of Efforts in this Direction in Human History.

UNIT-II

Understanding Human-Human Relationship & its fulfilment: Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfilment, Expression of feelings, Types of relationship and their purpose, mutual evaluation in relationship, Meaning of justice in relationship, Justice leading to culture, civilization and Human Conduct.

UNIT-III

Justice from family to world family order: Undivided Society as continuity and expanse of Justice in behaviour – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order, Universal Human Order as continuity and expanse of order in living: from family order to world family order, a conceptual framework for universal human order.

UNIT-IV

Program for Ensuring Undivided Society and Universal Human Order: Education –Sanskar, Health –Sanyam, Production-work, Exchange – storage, Justice-preservation.

UNIT-V

Human Tradition: Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

Text books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual),
1. R. R. Gaur, R. Asthana, G. P. Bagaria (2010), Excel Books, New Delhi.
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
3. An Appeal by the Dalai Lama to the World: Ethics Are More Important Than Religion, Dalai Lama XIV, 2015.
4. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India.
5. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA.
6. Human Society, Kingsley Davis, 1949.
7. Hind Swaraj or, Indian home rule Mohandas K. Gandhi, 1909.
8. Integral Humanism, Deendayal Upadhyaya, 1965.
9. Lohiya Ke Vichar, Lok Bharti , Rammanohar Lohiya, 2008.
10. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
11. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
12. Samadhanatmak Bhautikvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India
13. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK.
14. Slow is Beautiful, Cecile Andrews (<http://www.newsociety.com/Books/S/Slow-is-Beautiful>)
15. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.
16. Samagra kranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
17. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi
18. Vyavaharvadi Samajshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
19. Vyavahatmak Janvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
20. The Communist Manifesto, Karl Marx, 1848.
21. Toward a True Kinship of Faiths: How the World's Religions Can Come Together Dalai Lama XIV, 2011

Reference Videos.

1. Kin school (30 minutes)
2. Technology (Solar City etc.).
3. Natural Farming.
4. Economics of Happiness (1h 8m).

Mini Project

(BTCS706P)

Students will be asked to work upon minimum one topic during the semester.

They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.

Internship Assessment

(BTCS707P)

Project Management & Entrepreneurship

(BTCS801)

Unit	Topics	Lectures
I	Entrepreneurship: Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clelland's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes	8
II	Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness	8
III	Project Management: Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.	8
IV	Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.	8
V	Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.	8

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Deep Learning (BTCS802A)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To present the mathematical, statistical and computational challenges of building neural networks	K ₁ , K ₂
CO 2	To study the concepts of deep learning	K ₁ , K ₂
CO 3	To introduce dimensionality reduction techniques	K ₂
CO 4	To enable the students to know deep learning techniques to support real-time applications	K ₂ , K ₃
CO 5	To examine the case studies of deep learning techniques	K ₃ , K ₆
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	08
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	08
III	DIMENSIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization	08
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	08
V	CASE STUDY AND APPLICATIONS : Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	08
Text books:		
<ol style="list-style-type: none"> 1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015. 2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013. 3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016. 4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015. 		
Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cs41/preview		

Service Oriented Architecture (BTCS802B)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	Comprehend the need for SOA and its systematic evolution.	K1 , K2
CO 2	Apply SOA technologies to enterprise domain.	K3
CO 3	Design and analyze various SOA patterns and techniques.	K4
CO 4	Compare and evaluate best strategies and practices of SOA.	K2
CO 5	Understand the business case for SOA	K1
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction: SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA. Service oriented Architecture and Microservices architecture – Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards and Guidelines for SOA, Emergence of MSA. Enterprise-Wide SOA: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process, SOA Methodology for Enterprise	08
II	Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model. Service-Oriented Analysis and Design: Need for Models, Principles of Service Design, Nonfunctional Properties for Services, Design of Activity Services (or Business Services), Design of Data Services, Design of Client Services, Design of Business Process Services.	08
III	Technologies for SOA: Technologies for Service Enablement, Technologies for Service Integration, Technologies for Service Orchestration. SOA Governance and Implementation: Strategic Architecture Governance, Service Design-time Governance, Service Run-time Governance, Approach for Enterprise-wide SOA Implementation.	08
IV	Big Data and SOA: Concepts, Big Data and its characteristics, Technologies for Big Data, Service-orientation for Big Data Solutions. Business Case for SOA: Stakeholder Objectives, Benefits of SOA, Cost Savings, Return on Investment (ROI), Build a Case for SOA	08
V	SOA Best Practices: SOA Strategy – Best Practices, SOA Development – Best Practices, SOA Governance – Best Practices. EA and SOA for Business and IT Alignment: Enterprise Architecture, Need for Business and It Alignment, EA and SOA for Business and It Alignment	08
Text books:		
<ol style="list-style-type: none"> Shankar Kambhampaty; Service - Oriented Architecture & Microservices Architecture: For Enterprise, Cloud, Big Data and Mobile; Wiley; 3rd Edition; 2018; ISBN: 9788126564064. Icon Group International; The 2018-2023 World Outlook for Service-Oriented Architecture (SOA) Software and Services; ICON Group International; 1st Edition, 2017; ASIN: B06WGPN8YD. Thomas Erl; Service Oriented Architecture Concepts Technology & Design; Pearson Education Limited; 2015; ISBN-13: 9788131714904. Guido Schmutz, Peter Welkenbach, Daniel Liebhart; Service Oriented Architecture An Integration Blueprint; Shroff Publishers & Distributors; 2010; ISBN-13: 9789350231081 		

Mobile Computing (BTCS802C)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Explain and discuss issues in mobile computing and illustrate overview of wireless telephony and channel allocation in cellular systems.	K1, K4
CO 2	Explore the concept of Wireless Networking and Wireless LAN.	K1
CO 3	Analyse and comprehend Data management issues like data replication for mobile computers, adaptive clustering for mobile wireless networks and Disconnected operations.	K4
CO 4	Identify Mobile computing Agents and state the issues pertaining to security and fault tolerance in mobile computing environment.	K1, K2
CO 5	Compare and contrast various routing protocols and will identify and interpret the performance of network systems using Adhoc networks.	K2
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.	08
II	Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.	08
III	Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	08
IV	Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.	08
V	Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.	08
Text books:		
<ol style="list-style-type: none"> 1. J. Schiller, Mobile Communications, Addison Wesley. 2. A. Mehrotra, GSM System Engineering. 3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House. 4. Charles Perkins, Mobile IP, Addison Wesley. 5. Charles Perkins, Ad hoc Networks, Addison Wesley. 		

Internet of Things (BTCS802D)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	K1,K2
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	K2
CO 3	Analyze network communication aspects and protocols used in IoT.	K4
CO 4	Apply IoT for developing real life applications using Arduinio programming.	K3
CP 5	To develop IoT infrastructure for popular applications	K ₂ , K ₃
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	08
II	Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	08
III	Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	08
IV	Programming the Arduinio: Arduinio Platform Boards Anatomy, Arduinio IDE, coding, using emulator, using libraries, additions in arduinio, programming the arduinio for IoT.	08
V	Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	08
Text books:		
<ol style="list-style-type: none"> 1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", wiley 2. Jeeva Jose, Internet of Things, Khanna Publishing House 3. Michael Miller "The Internet of Things" by Pearson 4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016 5. Arshdeep Bahga, Vijay Madiseti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014 6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India 		

Cryptography & Network Security (BTCS802E)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Classify the symmetric encryption techniques and Illustrate various Public key cryptographic techniques.	K2 , K3
CO 2	Understand security protocols for protecting data on networks and be able to digitally sign emails and files.	K1 , K2
CO 3	Understand vulnerability assessments and the weakness of using passwords for authentication	K4
CO 4	Be able to perform simple vulnerability assessments and password audits	K3
CO 5	Summarize the intrusion detection and its solutions to overcome the attacks.	K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to security attacks, services and mechanism, Classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES	08
II	Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryption Fermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA	08
III	Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,	08
IV	Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.	08
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls	08
Text books:		
<ol style="list-style-type: none"> 1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education. 2. Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill . 3. C K Shyamala, N Harini, Dr. T.R.Padmabhan Cryptography and Security ,Wiley 4. Bruce Schneier, "Applied Cryptography". John Wiley & Sons 5. Bernard Menezes," Network Security and Cryptography", Cengage Learning. 6. AtulKahate, "Cryptography and Network Security", McGraw Hill 		

Subject Code: BTCSOE803A	FILTER DESIGN	3L:0T:0P	3 Credits
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COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand about the characteristics of different filters.
2. Understand the concept of Approximation Theory.
3. Learn about the switched capacitor filter.

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

CO1	Choose an appropriate transform for the given signal.
CO2	Choose appropriate decimation and interpolation factors for high performance filters.
CO3	Model and design an AR system.
CO4	Implement filter algorithms on a given DSP processor platform.

Unit	Topics	Lecture s
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulation and modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	8
II	First order filter: Bilinear transfer functions and frequency response – Bilinear transfer function and its parts, realization of passive elements, Bode plots, Active realization, The effect of A(s), cascade design.	8
III	Second order low pass and band pass filters: Design parameters, Second order circuit, frequency response of low pass and band pass circuits, Integrators and others biquads.	8
IV	Second order filters with arbitrary transmission zeros: By using summing, By voltage feed forward, cascade design revisited. Low pass filters with maximally flat magnitude: the ideal low pass filter, Butterworth response, Butterworth pole locations, low pass filter specifications, arbitrary transmission zeros.	8
V	Low pass filter with equal ripple (Chebyshev) magnitude response: The chebyshev polynomial, The chebyshev magnitude response, Location of chebyshev poles, Comparison of maximally flat & equal-ripple responses, Chebyshev filter design Inverse chebyshev and cauer filters: Inverse chebyshev response, From specifications to pole and zero locations, Cauer magnitude response, Chebyshev rational functions, Cauer filter design.	8

Text Book:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, “Analog Filter Design”, 2nd Indian Edition, Oxford University Press.

Reference Books:

1. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", Second edition, Pearson.
2. T. Deliyannis, Yichuang Sun, J.K. Fidler, "Continuous-Time Active Filter Design", CRC Press.

Subject Code: BTCSOE803B	BIOECONOMICS	3L:0T:0P	3 Credits
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OBJECTIVE:

This course is designed with an objective to provide an understanding of the basic knowledge of bioeconomics to students so that they can explore entrepreneurship opportunities in the bio based industry. This course also serves interdisciplinary innovation in terms of sustainable bioeconomy

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

1. Students will be able to understand basic concept of Bioeconomics, challenges, opportunities & regulations
2. Students will be able to understand development and innovation in terms of bioeconomy towards sustainable development
3. Students will be able to understand Inter- and transdisciplinarity in bioeconomy & research approaches
4. Students will be able to explain biobased resources, value chain, innovative use of biomass and biological knowledge to provide food, feed, industrial products

Unit	Topics	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulation and modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	08
II	Economic Growth, Development, and Innovation in terms of bioeconomy, Environmental Economics and the Role of Government, Modelling and Tools Supporting the Transition to a Bioeconomy, Role of biobased Economy in sustainable development.	08
III	Inter- and transdisciplinarity in Bioeconomy & research approaches, primary production, processing of bio based resources, Markets, Sustainability Management and Entrepreneurship in biobased products.	08
IV	Biobased Resources and Value Chains, Processing of Biobased Resources, Markets, Sustainability Management and Entrepreneurship opportunity in biobased product. Food Security and Healthy Nutrition in the Context of the Bioeconomy, Use of Biomass for the Production of Fuel and Chemicals, The importance of Biotechnology for the Bioeconomy.	08
V	sustainable and innovative use of biomass and biological knowledge to provide food, feed, industrial products, bioenergy and ecological services, importance of bioeconomy- related concepts in public, scientific, and political discourse, Dynamic Management of Fossil Fuel, Biofuel.	08

Text Book:

1. Principles of Bioeconomics by I. Sundar, Vedams eBooks (P) Ltd New Delhi, India
2. Bioeconomy: Shaping the Transition to a Sustainable, Biobased Economy by Iris Lewandowski, Springer.
3. Sociobiology and Bioeconomics by Koslowski, Peter
4. Modeling, Dynamics, Optimization and Bioeconomics I, by Pinto, Alberto Adrego, Zilberman, David, Springer.

Subject Code: BTCSOE803C	Design Thinking	3L:0T:0P	3Credits
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Objective:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real- time problems

Unit	Topics	Lectures
I	Introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world	8
II	Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family society, institution, startup, socialization process. Ethical behavior: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, customer journey maps, and brainstorming, Classifying insights after Observations, Classifying Stakeholders, Do's & Don'ts for Brainstorming, Individual activity- 'Moccasin walk'	8
III	Defining the problem statement, creating personas, Point of View (POV) statements. Research- identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation-basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, JamBoard	8
IV	Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills- linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.	8
V	The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments.	8

Text Book:

1. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
2. BP Banerjee, Foundations of Ethics and Management, 2005, Excel Books
3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA

Course Outcome: After successful completion of the course the students will be able to:

1. Develop a strong understanding of the design process and apply it in a variety of business settings
2. Analyze self, culture, teamwork to work in a multidisciplinary environment and exhibit empathetic behavior
3. Formulate specific problem statements of real time issues and generate innovative ideas using design tools
4. Apply critical thinking skills in order to arrive at the root cause from a set of likely causes
5. Demonstrate an enhanced ability to apply design thinking skills for evaluation of claims and arguments.

Subject Code: BTC SOE803D	Introduction to Women's and Gender Studies	3L:0T:0P	3Credits
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Unit	Topic	Lectures
I	Women and Society: Understanding Sex- Gender, Gender shaping Institutions, Theories of Gender construction Understanding Sexism and Androcentrism, Understanding Patriarchy and Theories of Patriarchy, Private and Public dichotomy, Sexual Division of Work, Patriarchy practices in different institutions and Text Books.	8
II	Feminist Theory: Rise of Feminism, Introduction to various stands of Feminism- Liberal Feminism, Radical Feminism, Marxist Feminism, Socialist Feminism, Cultural Feminism, Eco-Feminism, Post Colonial Feminism, Post Modern Feminism. Waves of Feminism.	8
III	Women's Movement: The socio-economic conditions of women during the age of Industrial revolution the Call for Women's Rights 1848, Women's rights movement 1848-1920, Historical Developments of Social Reform Movements in India , Women's groups and organizations, Women's Movement Movements for Uniform Civil code and ShahBano case, Dalit women and the question of double marginality.	8
IV	Gender Roles and Psychology of Sex: Difference Conceptualization of gender roles and gender role attitudes, Gender: Aggression, Achievement, Communication, Friendship and Romantic, Relationships Sex Differences in Mental Health Trauma relating to Rape , Taboo , Childhood Sexual Abuse , Domestic Violence , Sexual Harassment at Work Place, Educational Institutions, Eve Teasing etc.	8
V	Gender and Representation: Gender and Mass Media- Print Media, Gender and Mass Media-Electronic Media, Gender and Films, Advertisements, Mega Serials, Stereotyping and breaking the norms of women's roles Women's Representation in Literary Texts.	8

Suggested reading:

1. Basab iChakrabarti, Women's Studies: Various Aspects. UrbiPrakashani2014
2. Arvind Narrain. Queer: Despised Sexuality Law and Social Change. Book for Change. 2005
3. Chandra Talpade Mohanty, Feminism without Borders: Decolonizing Theory, Practicing Solidarity. Duke University Press.
4. Flavia Agnes. Law and Gender Inequality: The Politics of Women's Rights in India. Oxford University Press, 2001
5. Sonia Bathla, Women, Democracy and the Media: Cultural and Political Representations in the Indian Press, Sage, New Delhi, 1998.

Subject Code: BTCOE803E	Quality Management	3L:0T:0P	3Credits
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COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Introduce the importance of quality in improving competitiveness.
2. Understand the Implication of Quality on Business.
3. Implement Quality Implementation Programs.
4. Have exposure to challenges in Quality Improvement Programs.

COURSE OUTCOME: After completion of the course student will be able to-

- CO1:** Realize the importance of significance of quality.
CO2: Manage quality improvement teams.
CO3: Identify requirements of quality improvement programs.
CO4: Identify improvement areas based on cost of poor quality.
CO5: Organize for quality and development of quality culture through small group activities.

Unit	Topic	Lectures
1	Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.	8
2	Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.	8
3	Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.	8
4	Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.	8
5	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	8

Text and Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Subject Code: BTCOE803F	Modeling of Field-Effect Nano Devices	3L:0T:0P	3Credits
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COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
2. Introduce the concepts of nanoscale MOS transistor and their performance characteristics.
3. Study the various nano-scaled MOS transistor circuits.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Study the MOS devices used below 10nm and beyond with an eye on the future.

CO2: Understand and study the physics behind the operation of multi-gate systems.

CO3: Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristics.

CO4: Understand and study the physics behind the Radiation effects in SOI MOSFETs.

CO5: Understand the impact of device performance on digital circuits.

Unit	Topic	Lectures
1	MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility – threshold voltage – inter subband scattering, multigate technology – mobility – gate stack	8
2	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics – CMOS Technology – Ultimate limits, double gate MOS system – gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering – mobility	8
3	Silicon nanowire MOSFETs – Evaluation of I-V characteristics – The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube – Band structure of carbon nanotube – Band structure of graphene – Physical structure of nanotube – Band structure of nanotube – Carbon nanotube FETs – Carbon nanotube MOSFETs – Schottky barrier carbon nanotube FETs – Electronic conduction in molecules – General model for ballistic nano transistors – MOSFETs with 0D, 1D, and 2D channels – Molecular transistors – Single electron charging – Single electron transistors.	8
4	Radiation effects in SOI MOSFETs, total ionizing dose effects – single-gate SOI – multi-gate devices, single event effect, scaling effects	8

5	Digital circuits – impact of device performance on digital circuits – leakage performance trade off – multi VT devices and circuits – SRAM design, analog circuit design – transconductance - intrinsic gain – flicker noise – self heating –band gap voltage reference – operational amplifier – comparator designs, mixed signal – successive approximation DAC, RF circuits.	8
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Text and Reference Books:

1. J P Colinge, "FINFETs and other multi-gate transistors", Springer – Series on integrated circuits and systems, 2008
2. Mark Lundstrom, Jing Guo, "Nanoscale Transistors: Device Physics, Modeling and Simulation", Springer, 2006
3. M S Lundstorm, "Fundamentals of Carrier Transport", 2nd Ed., Cambridge University Press, Cambridge UK, 2000.

Subject Code: BTCOE803G	Computerized Process Control	3L:0T:0P	3Credits
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COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Understand Basics of Computer-Aided Process Control.
2. Analyse Industrial communication System.
3. Design Process Modelling for computerized Process control.
4. Design Advanced Strategies For Computerised Process control.
5. Analyse Computerized Process Control.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Understand the Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer.

CO2: Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system.

CO3: Realize Process model, Physical model, Control Model. Modelling Procedure.

CO4: Formulate of Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.

CO5: Design Electric Oven Temperature Control, Reheat Furnace Temperature control.

Unit	Topic	Lectures
1	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer –Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces.	8
2	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System	8
3	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation	8
4	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	8

5	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	8
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Text Books:

1. S. K. Singh, "Computer Aided Process control", PHI.

Reference Books:

1. C. L. Smith, "Digital computer Process Control", Ident Educational Publishers.
2. C. D. Johnson, "Process Control Instrumentation Technology", PHI.
3. Krishan Kant, "Computer Based Industrial Control"
4. Pradeep B. Deshpande & Raymond H. Ash, "Element of Computer Process Control with Advance Control Applications", Instrument Society of America, 1981.
5. C. M. Houpis & G. B. Lamond, "Digital Control System Theory", Tata McGraw Hill.

Project
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