B. Tech.

(Computer Science)

AS PER

AICTE MODEL CURRICULUM

NDER

Faculty of Technology

Bachelor of Technology (Computer Science)

B-Tech(CS) 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(CS) 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	Artificial Intelligence for Engineers	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
*TheMiniProjectorinternship(3-4weeks)conductedduringsummerbreakafterIIsemesterandwillbeassessedduringIIIsemester.							

B.Tech(CS) Third Semester							
Subject Code	Subject	L	T/P	Credits	End semester Exam	Internal Marks	Total
BTCS301	Mathematics-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	ComputerOrganization and Architecture	3	1	4	70	30	100
BTCS305	Discrete Structures &TheoryofLogic	3	1	4	70	30	100
BTCS306P	Data Structures UsingC Lab	0	2	1	30	20	50
BTCS307P	ComputerOrganization Lab	0	2	1	30	20	50
BTCS308P	Discrete Structure&Logic Lab	0	2	1	30	20	50
BTCS309P	Mini Project orInternship Assessment*	0	2	2	30	20	50
Total		15	12	24	470	230	700

B.Tech (CS) -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	OperatingSystems	3	0	3	70	30	100
BTCS404	TheoryofAutomataandFormal Languages	3	1	4	70	30	100
BTCS405	Microprocessor	3	1	4	70	30	100
BTCS406P	OperatingSystemsLab	0	2	1	30	20	50
BTCS407P	Microprocessor-Lab	0	2	1	30	20	50
BTCS408P	Python Language ProgrammingLab	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 willbe assessed duringV semester.

B.Tech(CS)-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						
-	**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(CS)-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						
-	**Open Elective-I**	3	0	3	70	30	100
BTCSOE605A	Real Time Systems						

BTCSOE605B	Embedded System						
BTCSOE605C	Introduction To Mems						
BTCSOE605D	Object Oriented Programming						
BTCSOE605E	Numerical Techniques						
BTCSOE605F	GIS & Remote Sensing						
BTCSOE605G	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 willbe assessed duringVII semester.

B-Tech(CS) 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	4	2	30	20	50
Total		**12**	**13**	**19**	**440**	**210**	**650**

B-Tech(CS) 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
BTCSOE803A	Filter Design						
BTCSOE803B	Bioeconomics						
BTCSOE803C	Design Thinking						
BTCSOE803D	Introduction to Women's & Gender Studies						
BTCSOE803E	Quality Management						
BTCSOE803F	Modeling of Field Effects Nano Devices						
BTCSOE803 G	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 OBJECTIVES:

PO1:- Have Understanding of Programming Language Standards, Problem Solving Techniques, IDE and Compilers for C.

PO2:- To have in depth knowledge of Writing, Compiling and Running Programs.

To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, and Functions with C.

PO3:- To understand and Practice basics of arrays, pointers, pre-processor, Structure and Union **PO4:-** To learn difference in procedural and Object oriented programming language withunderstanding and Practice beginner level of Pointers, Pre-processor, Programming.

COURSE OUTCOMES

CO1:-To develop simple algorithms for arithmetic and logical problems.

CO2:- To translate the algorithms to programs & execution (in C language).

CO3:- To implement conditional branching, iteration and recursion.

CO4:- To decompose a problem into functions and synthesize a complete program using divide and Conquer approach.

CO5:- 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, Fromalgorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program,Syntaxand 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 relationaloperators, 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 anddefaultwith switch.

Module – 3 : **(Loops & Functions)**

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of breakandcontinue 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 dimensionalarrays. 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 (noimplementation)

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 Objectives:

PO1:- Have Understanding of Programming Language Standards, Problem Solving Techniques, IDE and Compilers for C.

PO2:- To have in depth knowledge of Writing, Compiling and Running Programs.

To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, and Functions with C.

PO3:- To understand and Practice basics of arrays, pointers, pre-processor, Structure and Union **PO4:-** To learn difference in procedural and Object oriented programming language withunderstanding and Practice beginner level of Pointers, Pre-processor, Programming.

Course Outcomes

PO1:-To write programs for arithmetic and logical problems.

PO2:-To translate the algorithms to programs & execution (in C language).

PO3:-To write programs for conditional branching, iteration and recursion.

PO4:- To write programs using functions and synthesize a complete program using divide AndConquer approach.

PO5:- 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 theresult 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. Maintaina 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)

Programme Objectives:

PO-1: To plan, design, construct, maintain and improve mechanical engineering systems that aretechnically sound, economically feasible and socially acceptable.

PO-2: To apply modern computational, analytical, simulation tools and techniques to address thechallenges faced in mechanical and allied engineering industries.

PO-3: To communicate effectively by using innovative tools, demonstrate leadership qualities, research & entrepreneurial skills, exhibit professionalism, ethical attitude, team spirit along with lifelong learning to achieve career and organizational goals.

Course Outcomes

CO1:- Understanding of the visual aspects of engineering design
CO2:-Understanding of engineering graphics standards and solid modelling
CO3:-Effective communication through graphics
CO4:-Applying modern engineering tools necessary for engineering practice
CO5:-Appling computer-aided geometric design
CO6:-Analysis of Isometric views
CO7:-Creating working drawings

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 projectthe 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:

Module *5*: Demonstration of a simple team design project **[08]**

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 andassembly 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).

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 Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
(Corresponding set of) CAD Software Theory and User Manuals

BASIC ELECTRICAL ENGINEERING

(BTCS102)

Programme Objectives:

PO1: Ability to apply the knowledge of mathematics, science and engineering principles for modeling, analyzing and solving electrical and electronics engineering problems.

PO2: Ability to identify, formulate and analyze real-life electrical and electronics engineering problems.

PO3: Ability to design and develop solutions for real-life electrical and electronics engineering problems.

PO4: Ability to design and develop sophisticated equipment and experimental systems for carrying out detailed investigation to multifaceted electrical and electronics engineering problems.

PO5: Ability to develop and utilize modern tools for modelling, analyzing and solving electrical and electronics engineering problems.

COURSE OUTCOMES

CO1: -Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
CO2: -Analyze the steady state behavior of single phase and three phase AC electrical circuits.

CO3: -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.

CO4: -Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
CO5: -Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

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.

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)

PROGRAMME OBJECTIVES:

PO1:- Design new instruments with practical knowledge.
PO2:- Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
PO3:- Understand measurements technology, usage of new instruments and real time applications in engineering studies.

COURSE OUTCOMES:

CO1:- To solve theclassicalandwave mechanicsproblems
CO2:- To developtheunderstandingoflawsofthermodynamicsandtheir application invarious processes
CO3:- To formulateandsolve the engineering problemsonElectromagnetism &ElectromagneticFieldTheory
CO4:- To aware oflimits ofclassicalphysics&to apply the ideas insolvingthe problems in their parent streams

Module -1 RelativisticMechanics: [8]

Frame ofreference,Inertial&non-inertial frames,Galileantransformations,Michelson- Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein"smass energyrelation, Relativistic relationbetweenenergyand momentum, Massless particle.

Module-2 ElectromagneticField Theory: [8]

Continuityequation forcurrentdensity,Displacementcurrent, Modifyingequationforthe curlofmagneticfieldtosatisfycontinuityequation,Maxwell"sequations invacuumand in nonconductingmedium,Energyinanelectromagnetic field,Poyntingvectorand Poynting theorem, Plane electromagneticwaves invacuumandtheir transversenature.Relation betweenelectricand magneticfieldsofan electromagneticwave,Energyandmomentum carried by electromagneticwaves, Resultant pressure, Skindepth.

Module- 3 Quantum Mechanics: **[8]**

Blackbody radiation, Stefan"slaw,Wien"slaw,Rayleigh-Jeanslawand Planck"slaw,Wave particleduality,Matterwaves,Time-dependent andtime-independent Schrodingerwave equation,Borninterpretationofwavefunction,SolutiontostationarystateSchrodinger wave equation forone-Dimensional particle ina box, Compton effect.

Module-4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extendedsources,Newton"sRingsand itsapplications.Fraunhofferdiffractionatsingle slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power,Resolving powerofgrating,Rayleigh"scriterionofresolution,Resolvingpowerof grating.

Module-5Fibre Optics&Laser: [10]

Fibre Optics: Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency,Classificationoffibre,Attenuationand Dispersioninoptical fibres. Laser:Absorptionofradiation,Spontaneousand stimulatedemissionofradiation,Einstein"s coefficients,Populationinversion,VariouslevelsofLaser,RubyLaser,He-NeLaser,Laser applications.

Reference Books:

1. Conceptsof Modern Physics-AurthurBeiser(Mc-Graw Hill)
2. Introductionto SpecialTheory ofRelativity-Robert Resnick (Wiley)
3. Optics-Brijlal&Subramanian(S. Chand)
4. EngineeringPhysics: Theory andPractical-KatiyarandPandey(Wiley India)
5. Applied Physics forEngineers-NeerajMehta (PHILearning, New)
6. EngineeringPhysics-MalikHKand SinghAK(McGrawHill)

Engineering Physics Lab

(BTCS106P)

List of Experiments

Programme Objectives:

PO1:- Design new instruments with practical knowledge.
PO2:- Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
PO3:- Understand measurements technology, usage of new instruments and real time applications in engineering studies.

Course Outcomes:

CO1: -To determine the wavelength of sodium light by Newton"s ring experiment
CO2: -To determine the wavelength of sodium light with the help of Fresnel"s bi-prism

CO3: -To determine the variation of magnetic field with the distance along the axis of a currentcarrying coil and estimate the radius of the coil.

CO4: -To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

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)

ENGINEERING MATHEMATICS-I

(BTCS104)

PROGRAMME OBJECTIVES:

PO1:-To develop logical understanding of the subject.

PO2:-To develop mathematical skill so that students are able to apply mathematical methods &principals in solving problem from engineering fields.

PO3:-To make aware students about the importance and symbiosis between Mathematics and Engineering.

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.

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, Involutes and Evolutes, 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.

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.

1. Engineering Mathemathics – I. Reena Garg, 2

ENGLISH

BTCS105

PROGRAMME OBJECTIVES:

1. Ability to be comfortable with English in use while reading or listening.

2.Ability to use receptive skills through reading and listening to acquire good exposure to language and literature.

3.Ability to write and speak good English in all situations.

4.Students should develop style in speech and writing and manipulate the tools of language for effective communication.

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 fromforeign 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, NewDelhi.

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

PROGRAMME OBJECTIVES:

2. To understand the basic principles, construction and working of engineering mechanical measurement science.
3. To acquire proficiency in using, calibrating various measurement systems.
4. To understand the problems in measurement system and develop the competency to resolve the problems.
5. To know all the measuring instruments and to measure different parameters in day-todaywork

Course Outcomes

1. Demonstrate a solid understanding of the fundamental principles and concepts in mechanics of solids, including stress, strain, and deformation.
2. Students will gain a comprehensive understanding of internal combustion engines, refrigeration systems, and air-conditioning, including their components, operation, and application in various engineering contexts, preparing them to analyze and work with these technologies effectively.
3. Students will acquire a solid foundation in fluid mechanics, enabling them to understand and apply fundamental principles, equations, and concepts.
4. Students will develop a strong understanding of measurement principles, accuracy, and precision, enabling them to perform various measurements and interpret the results accurately.
5. It will possess a comprehensive understanding of mechatronics, its applications, and the diverse worldof sensors and transducers.

Unit	Topics	Lectures
I	**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 brittlematerials, 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.	8
II	**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	10

	working of window air conditioner.	
III	**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.	7
IV	**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.	8
V	**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, 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.	10

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)

PROGRAMME OBJECTIVES:

Understand the concept of PN Junction and devices, amplifiers, measurement instrument, IoT system and different type of sensor and their uses.

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.	4
	General Model of Wireless Communication: Evolution of mobile radio communication fundamentals, GPRS, GSM, CDMA. Elements of Satellite & Radar Communication,	

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 Vrms, Vdc, 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

PROGRAMME OBJECTIVES:

1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills requiredto become a perfect engineer.

2. To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion it's control to protect the structures.

3. To imbibe the basic concepts of petroleum and its products.

4. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

COURSE OUTCOMES: At the end of this course students will demonstrate the ability to:

1. Understand the concept ofAtomic and Molecular Structure.
2. Understand the concept of Spectroscopic techniques and Applications.
3. Understand the concept of Nernst Equation and application and thermodynamic.
4. Understand the concept of Water Analysis and Fuels.
5. Understand the working concepts of polymer-Blend and Preparation and application of polymers.

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 calorimeterand Dulong'smethos).

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 oforganometallic 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

PROGRAMME OBJECTIVES:

1. To develop logical understanding of the subject.
2. To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
3. To make aware students about the importance and symbiosis between Mathematics and Engineering.

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 & Gama 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, Liouvilles'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)

PROGRAMME OBJECTIVES:

- Analyze the implications of applying AI systems to organizations and future of work.
- Explain how to develop AI systems to meet business, organizational, and technology requirements.
- Implement AI frameworks and platforms to improve business, organizational, and technology outcomes.

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 1.4	What should all engineers know about AI?
1.5	Other emerging technologies
	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 2.5	Data Visualization
2.6	Regression, Prediction & Classification
	Clustering & Recommender Systems
Unit 3	**Natural Language Processing**
3.1	Speech recognition
3.2	Natural language understanding
3.3 3.4	Natural language generation
3.5	Chatbots
	Machine Translation
Unit 4	**Artificial Neural Networks**
4.1	Deep Learning
4.2	Recurrent Neural Networks
4.3	Convolutional Neural Networks

4.4	
4.5	The Universal Approximation Theorem
	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 tostudents.

(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 (I.P.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-guidedlearning 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 ofactivities 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

PROGRAMME OBJECTIVES:

To study layout, safety measures and different engineering materials mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron used in workshop

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	**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.	3 Hours
2	**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.	3 Hours
3	**Fitting shop** 1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.	3 Hours
4	**Carpentry Shop** Study of Carpentry Tools, Equipment and different joints. Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tension Joint	3 Hours
5	**Welding Shop** Introduction to BI standards and reading of welding drawings.	

SEMESTER III

Mathematics-III(PDE,ProbabilityandStatistics)

BTCS-301

PROGRAMME OBJECTIVES:

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 withs tandard concept and tools atan intermediateto superiorlevelthat will provide them well towards undertaking a variety of problems in the discipline.

CourseOutcomes

Thestudentswilllearn:

- Theideaofpartialdifferentiationandtypesofpartialdifferentialequations
- Theideaof classificationofsecondpartialdifferentialequations,wave,heat equation andtransmissionlines
- Thebasicideasofstatisticsincludingmeasuresofcentraltendency, correlation,regressionandtheirproperties.
- Theideas ofprobabilityandrandomvariablesandvariousdiscrete andcontinuousprobabilitydistributionsandtheirproperties.
- Thestatisticalmethodsofstudyingdatasamples,hypothesistestingandstatistical qualitycontrol,controlchartsandtheirproperties.

ModuleI:PartialDifferentialEquations

OriginofPartialDifferentialEquations,LinearandNonLinearPartialEquationsof firstorder, Lagrange'sEquations,Charpit'smethod, Cauchy'smethodofCharacteristics,Solutionof Linear PartialDifferentialEquationof Higherorderwithconstantcoefficients,Equationsreducibleto linearpartialdifferentialequationswithconstantcoefficients.

ModuleII:ApplicationsofPartialDifferentialEquations:

Classification oflinearpartialdifferentialequationofsecondorder,Methodofseparationof variables,Solutionofwaveandheatconductionequationuptotwodimension,Laplaceequation intwodimensions,EquationsofTransmissionlines.

ModuleIII:StatisticalTechniquesI:

Introduction: Measures ofcentraltendency, Moments, Moment generatingfunction(MGF), Skewness,Kurtosis,CurveFitting,Methodof leastsquares,Fittingofstraightlines,Fittingof seconddegreeparabola,Exponentialcurves ,Correlationand Rankcorrelation, Regression Analysis:Regressionlinesofy onxandxony,regressioncoefficients,propertiesofregressions coefficientsandnonlinearregression.

ModuleIV:StatisticalTechniquesII:

Probability andDistribution: Introduction, Addition andmultiplication lawofprobability, Conditionalprobability,Baye'stheorem,Randomvariables(Discreteand ContinuousRandom variable)ProbabilitymassfunctionandProbabilitydensity function,Expectationandvariance,

DiscreteandContinuousProbabilitydistribution:Binomial,PoissionandNormaldistributions.

ModuleV:StatisticalTechniquesIII:

Sampling,TestingofHypothesisandStatisticalQualityControl: Introduction, Sampling Theory(SmallandLarge), Hypothesis,Nullhypothesis,Alternativehypothesis,Testinga Hypothesis,Levelof significance,Confidencelimits,Testof significanceofdifferenceofmeans, T-test,F-testandChi-squaretest,OnewayAnalysisofVariance(ANOVA).StatisticalQuality Control(SQC),ControlCharts,ControlChartsforvariables($\bar{X}$ and$R$Charts),ControlCharts forVariables(p,npandCcharts).

TextBooks

1. ErwinKreyszig,AdvancedEngineeringMathematics,9th Edition,JohnWiley& Sons,2006.
2. P.G.Hoel,S.C.PortandC.J.Stone,IntroductiontoProbabilityTheory, UniversalBookStall,2003(Reprint).
3. S.Ross:AFirstCourseinProbability,6thEd.,PearsonEducationIndia,2002.
4. W.Feller,AnIntroductiontoProbabilityTheoryanditsApplications,Vol.1,3rd Ed.,Wiley,1968.

ReferenceBooks

1. B.S.Grewal,HigherEngineeringMathematics,KhannaPublishers,35thEdition,2000.
2. T.Veerarajan:EngineeringMathematics(forsemesterIII),TataMcGraw-Hill,New Delhi.
3. R.K.JainandS.R.K.Iyenger:AdvanceEngineeringMathematics;NarosaPublishing House,NewDelhi.
4. J.N.Kapur:MathematicalStatistics;S.Chand&SonsCompanyLimited,NewDelhi.
5. D.N.Elhance,V.Elhance&B.M.Aggarwal:FundamentalsofStatistics;KitabMahal Distributers,NewDelhi.

COURSEOUTCOMES

	CourseOutcome(CO)	Bloom's Knowledge Level(KL)
	Attheendofthiscourse,thestudentswillbeableto:	
CO1	Remembertheconceptofpartialdifferentialequationandtosolve partialdifferentialequations	K_1&K_3
CO2	Analyzetheconceptof partialdifferentialequationstoevaluate theproblems concernedwithpartialdifferentialequations	K_4&K_5
CO3	Understandtheconceptofcorrelation,moments,skewnessand kurtosisandcurvefitting	K_2
CO4	Remembertheconceptofprobabilitytoevaluateprobability distributions	K_1&K_5
CO5	Applytheconceptofhypothesistestingandstatisticalquality controltocreatecontrolcharts	K_3&K_6

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

Evaluationmethodologytobefollowed:

Theevaluationandassessmentplanconsistsofthefollowingcomponents:

a. Classattendanceandparticipationinclassdiscussionsetc.
b. Quiz.
c. Tutorialsandassignments.
d. Sessionalexamination.
e. Finalexamination.

AwardofInternal/ExternalMarks:

Assessmentprocedurewillbeasfollows:

1. Thesewillbecomprehensiveexaminationsheldon-campus(Sessionals).
2. Quiz. -a.Quizwillbeoftypemultiplechoices,fill-in-the-blanksormatchthecolumns.
   b.Quizwillbeheldperiodically.
3. Tutorialsandassignments
   a.Theassignments/home-work maybeofmultiplechoicetypeorcomprehensivetypeat leastoneassignmentfromeachModule/Unit.
   b.Thegradesanddetailedsolutionsofassignments(ofbothtypes)willbeaccessibleonlineafterthesubmissiondeadline
4. Finalexaminations.

Technical Communication
(BTCS302)

PROGRAMME OBJECTIVES:

1. To understand the concept, process and importance of Professional Communication
2. To enable students to acquire English Speaking and Writing Skills
3. To enable students to develop Presentation Skills

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for theworkplaceas Engineers.
2. StudentswillutilizethetechnicalwritingforthepurposesofTechnicalCommunication and its exposurein various dimensions.
3. Studentswouldimbibeinputsbypresentationskillstoenhanceconfidenceinfaceof diverseaudience.
4. Technicalcommunicationskillswill**create**avastknow-howoftheapplicationofthe learningto promotetheirtechnical competence.
5. Itwouldenablethemto**evaluate**theirefficacyasfluent&efficientcommunicatorsby learningthevoice-dynamics.

Unit -1 Fundamentals ofTechnical Communication:

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

Dimensions of Communication: Reading&comprehension;Technicalwriting:sentences;Paragraph

Technicalstyle: Definition, types&Methods;TheflowofCommunication:Downward;upward,LateralorHorizontal; Barriers toCommunication.

Unit-II Forms of Technical Communication:

Technical Report: Definition&importance;

Thesis/Projectwriting: structure&importance; synopsiswriting:Methods

TechnicalresearchPaperwriting:Methods& style;Seminar& Conference paperwriting; **Key-NoteSpeech:**Introduction & Summarization; Expert Technical Lecture:Themeclarity;Analysis&Findings;7Csof effective businesswriting:concreteness, completeness, clarity,conciseness,courtesy, correctness, consideration.

Unit-III Technical Presentation: Strategies&Techniques

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

Individualconferencing:essentials:PublicSpeaking:method;Techniques:Clarity ofsubstance; emotion; Humour; Modes of Presentation;

Overcoming Stage Fear: Confident speaking; AudienceAnalysis& retentionof audience interest

MethodsofPresentation:Interpersonal; Impersonal; Audience Participation: Quizzes &Interjections.

Unit-IVTechnical CommunicationSkills:

Interviewskills,GroupDiscussion: Objective &Method;Seminar/ConferencesPresentation

skills: Focus;Content;Style;Argumentationskills;Devices;Analysis; Cohesion& Emphasis; Critical thinking;
Nuances: Exposition narration &Description; effective business communicationcompetence;Grammatical;
Discourse competence:combinationof expression&conclusion;
Socio-linguistic competence: Strategiccompetence:Solutionofcommunication problems with verbal andnonverbal means.

Unit-V Kinesics &VoiceDynamics:
Kinesics: Definitions; importance; Features of BodyLanguage; Voice Modulation:Quality, Pitch;Rhythm;intonation;Pronunciation;Articulation;stress&accent
Linguisticfeaturesof voice control: Vowel& Consonant Sounds.

ReferenceBooks

1. TechnicalCommunication–PrinciplesandPracticesbyMeenakshiRaman&Sangeeta Sharma, OxfordUniv. Press, 2007, New Delhi.
2. BusinessCorrespondenceandReportWritingbyProf.R.C.Sharma&KrishnaMohan, Tata McGrawHill &Co.Ltd., 2001, NewDelhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. PublicationsIndiaLtd.;Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. ATextBookofScientificandTechnicalWritingbyS.D.Sharma;VikasPublication, Delhi.
6. SkillsforEffectiveBusinessCommunicationbyMichaelMurphy,HarwardUniversity, U.S.
7. Business Communication for Managers byPayalMehra, PearsonPublication, Delhi

DATASTRUCTURE(BTCS303)

PROGRAMME OBJECTIVES:

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.
- Introduces sorting and pattern matching algorithms

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO1	Describehowarrays,linkedlists,stacks,queues,trees,andgraphsarerepresentedinmemory, used bythealgorithms andtheircommon applications.	K_1,K_2
CO2	Discuss the computational efficiencyofthesortingand searchingalgorithms.	K
CO3	Implementation ofTreesand Graphsand performvarious operations onthesedatastructure.	K
CO4	Understandingtheconceptofrecursion,applicationofrecursionanditsimplementationand removal of recursion.	K_4
CO5	Identifythealternativeimplementationsofdatastructureswithrespecttoitsperformancetosolve 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,EfficiencyofanAlgorithm,TimeandSpaceComplexity,Asymptoticnotations:Big Oh, BigThetaand Big Omega, Time-Spacetrade-off.AbstractDataTypes (ADT)	08
II	Arrays:Definition,SingleandMultidimensionalArrays,RepresentationofArrays:RowMajorOrder,andColumnMajorOrder,DerivationofIndexFormulaefor1-D,2-D,3-Dandn-DArrayApplication of arrays, SparseMatrices and theirrepresentations.Linked lists:ArrayImplementationandPointerImplementationofSinglyLinkedLists,DoublyLinkedList, Circularly LinkedList,Operationson aLinkedList.Insertion,Deletion, Traversal, PolynomialRepresentationandAdditionSubtraction &MultiplicationsofSinglevariable&Two variables Polynomial.	08
III	Searching:ConceptofSearching,Sequentialsearch,IndexSequentialSearch,BinarySearch.ConceptofHashing&CollisionresolutionTechniquesusedinHashing.Sorting:InsertionSort, Selection, Bubble Sort, QuickSort, MergeSort, HeapSortand RadixSort.	08
IV	Graphs:TerminologyusedwithGraph,DataStructureforGraphRepresentations:AdjacencyMatrices, 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 Dijikstra Algorithm.	08

V	Stacks: Abstract Data Type, Primitive Stack operations: Push &Pop, Array and LinkedImplementationofStack inC,Applicationofstack:Prefix andPostfixExpressions,Evaluationof postfix expression,IterationandRecursion-Principlesofrecursion, Tailrecursion,Removalof recursionProblemsolvingusingiterationandrecursionwithexamplessuch asbinarysearch, Fibonaccinumbers, and Hanoi towers.Tradeoffsbetween iterationandrecursion.Queues: OperationsonQueue:Create,Add,Delete,FullandEmpty,Circularqueues,Arrayand linked implementation ofqueuesinC, Dequeueand PriorityQueue.	08

Textbooks:

1. AaronM.Tenenbaum,YedidyahLangsamandMosheJ.Augenstein,"DataStructuresUsingCandC++", PHI LearningPrivateLimited, Delhi India
2. Horowitz andSahani,"Fundamentalsof DataStructures", Galgotia PublicationsPvtLtd DelhiIndia.
3. Lipschutz, "DataStructures" Schaum's Outline Series,TataMcGraw-hill Education (India)Pvt. Ltd.
4. Thareja,"Data StructureUsingC" Oxford HigherEducation.
5. AK Sharma, "DataStructureUsingC", Pearson Education India.
6. RajeshK.Shukla, "DataStructureUsingCand C++"WileyDreamtech Publication.
7. MichaelT. Goodrich, Roberto Tamassia, DavidM. Mount "DataStructuresand Algorithms inC++", Wiley India.
8. P. S. Deshpandey, "CandData structure", WileyDreamtech Publication.
9. R. Kruseetal, "DataStructuresand ProgramDesign inC", Pearson Education.
10. Berztiss, AT:Datastructures,Theoryand Practice,Academic Press.
11. Jean PaulTrembleyand Paul G. Sorenson, "An Introduction to DataStructures withapplications", McGraw Hill.
12. AdamDrozdek"DataStructures and AlgorithminJava", Cengage Learning

ComputerOrganizationandArchitecture(BTCS304)

PROGRAMME OBJECTIVES:

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO 1	Studyofthe basicstructureand operation ofadigitalcomputer system.	K_1,K_2
CO 2	Analysisofthedesignofarithmetic& logicunitandunderstandingofthefixedpointandfloating-pointarithmetic operations.	K_2,K_4
CO 3	Implementation ofcontrolunittechniquesandtheconceptofPipelining	K_3
CO 4	Understandingthehierarchical memorysystem, cachememories and virtual memory	K_2
CO 5	Understandingthedifferentways ofcommunicatingwith I/O devices andstandardI/O interfaces	K_2,K_4

DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction:Functionalunitsofdigitalsystemandtheirinterconnections,buses,busarchitecture, typesofbusesandbusarbitration.Register,busandmemorytransfer. Processororganization, generalregistersorganization, stackorganization andaddressingmodes.	08
II	Arithmetic and logic unit: Look ahead carries adders. Multiplication: Signed operand multiplication,Boothsalgorithmandarraymultiplier.Divisionandlogicoperations.Floatingpoint arithmeticoperation, Arithmetic& logicunitdesign. IEEE Standardfor FloatingPoint Numbers	08
III	ControlUnit: Instructiontypes,formats,instructioncyclesandsubcycles(fetchandexecuteetc), microoperations,executionofacompleteinstruction.ProgramControl,ReducedInstructionSet Computer, Pipelining. Hardwire and micro programmed control: micro programme sequencing, conceptof horizontal and verticalmicroprogramming.	08
IV	Memory:Basicconceptandhierarchy,semiconductorRAMmemories,2D&21/2Dmemory organization.ROMmemories. Cachememories:conceptand designissues &performance,address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtualmemory:conceptimplementation.	08
V	Input /Output:Peripheraldevices,I/Ointerface,I/Oports,Interrupts:interrupthardware,typesof interruptsandexceptions. ModesofDataTransfer:ProgrammedI/O,interruptinitiatedI/Oand DirectMemory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	08

Textbooks:

1. ComputerSystemArchitecture-M. Mano
2. CarlHamacher, Zvonko Vranesic, Safwat Zaky ComputerOrganization,McGraw-Hill, FifthEdition, Reprint 2012
3.John P. Hayes, Computer Architectureand Organization,TataMcGraw Hill,Third Edition, 1998. Referencebooks
4. WilliamStallings, ComputerOrganization andArchitecture-DesigningforPerformance, Pearson Education, Seventh edition,2006.
5. BehroozParahami, "Computer Architecture", Oxford UniversityPress, EighthImpression, 2011.
6. David A. PattersonandJohn L. Hennessy, "ComputerArchitecture-AQuantitative Approach", Elsevier, adivision of reed IndiaPrivateLimited,Fifth edition,2012
7. StructuredComputerOrganization,Tannenbaum(PHI)

Discrete Structures &Theory ofLogic (BTCS305)

PROGRAMME OBJECTIVES:

- Introduces elementary discrete mathematics for computer science and engineering.

● Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO 1	Writean argumentusinglogical notationand determine iftheargumentisorisnot valid.	K_3,K_4
CO 2	Understandthebasicprinciplesofsets andoperations 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	Demonstratedifferenttraversalmethodsfortreesand graphs.	K_1,K_4
CO 5	Model problems in ComputerScience using graphs andtrees.	K_2,K_6

DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	SetTheory:Introduction,Combinationofsets,Multisets,Orderedpairs.Proofsofsomegeneral identitiesonsets. Relations:Definition,Operationson relations,Properties of relations,Composite Relations, Equalityofrelations, Recursive definition ofrelation, Orderofrelations.Functions:Definition,Classificationoffunctions,Operationsonfunctions,Recursively defined functions. Growth of Functions.NaturalNumbers:Introduction,MathematicalInduction,VariantsofInduction,Inductionwit hNonzero Basecases. ProofMethods, Proofbycounter– example, Proof bycontradiction.	08
II	Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, GroupHomomorphisms, Definition and elementarypropertiesof Rings and Fields.	08
III	Lattices: Definition,Propertiesoflattices–Bounded,Complemented,ModularandComplete lattice. BooleanAlgebra:Introduction,AxiomsandTheoremsof Booleanalgebra,Algebraic manipulation ofBoolean expressions.Simplification ofBoolean Functions, Karnaughmaps,Logic gates, Digitalcircuitsand Boolean algebra.	08
IV	PropositionalLogic: Proposition,wellformedformula,Truthtables,Tautology,Satisfiability, Contradiction, Algebra ofproposition, Theoryof Inference. (8)PredicateLogic: Firstorderpredicate,wellformedformulaofpredicate,quantifiers,Inference theoryof predicatelogic.	08
V	Trees:Definition, Binary tree, Binarytreetraversal, Binarysearchtree.Graphs:Definitionandterminology, Representation ofgraphs,Multigraphs, Bipartitegraphs, Planar graphs, Isomorphismand Homeomorphismof graphs, Eulerand Hamiltonian paths, Graphcoloring, Recurrence Relation &Generatingfunction:Recursivedefinition offunctions, Recursivealgorithms, Method ofsolvingrecurrences.Combinatorics: Introduction,CountingTechniques, PigeonholePrinciple	08

Textbooks:

1.Koshy,DiscreteStructures,ElsevierPub.2008KennethH.Rosen,DiscreteMathematicsandItsApplications,6/e, McGraw-Hill,2006.
2. B. Kolman, R.C.Busby, and S.C. Ross, DiscreteMathematical Structures, 5/e,Prentice Hall, 2004.
3.E.R. Scheinerman, Mathematics: A DiscreteIntroduction,Brooks/Cole, 2000.
4.R.P. Grimaldi,Discreteand CombinatorialMathematics, 5/e, AddisonWesley,2004
5.Liptschutz, Seymour, " DiscreteMathematics", McGrawHill.
6.Trembley, J.P&R.Manohar, "DiscreteMathematicalStructurewithApplicationtoComputerScience",McGrawHill.
4. Deo, 7.Narsingh, "GraphTheoryWith applicationtoEngineeringand Computer.Science.", PHI.
8. Krishnamurthy, V.,"CombinatoricsTheory&Application", East-WestPress Pvt. Ltd., New Delhi

DataStructureusingCLab(BTCS306P)

WriteC Programs toillustratetheconceptofthefollowing:

1. SortingAlgorithms-Non-Recursive.
2. SortingAlgorithms-Recursive.
3. SearchingAlgorithm.
4. Implementation of StackusingArray.
5. Implementation of QueueusingArray.
6. Implementation of CircularQueueusingArray.
7. Implementation of StackusingLinked List.
8. Implementation of QueueusingLinked List.
9. Implementation of CircularQueueusingLinked List.
10. Implementation ofTreeStructures, BinaryTree,TreeTraversal, BinarySearchTree, Insertion and Deletion in BST.
11. Graph Implementation, BFS, DFS, Minimumcostspanningtree, shortest path algorithm.

ComputerOrganizationLab(BTCS307P)

1. ImplementingHALFADDER, FULLADDER usingbasiclogicgates
2. ImplementingBinary-to-Gray, Gray -to-Binarycode conversions.
3. Implementing3-8 lineDECODER.
4. Implementing4x1 and 8x1MULTIPLEXERS.
5. Verifythe excitationtablesofvarious FLIP-FLOPS.
6. Design ofan8-bitInput/ Outputsystemwithfour8-bitInternal Registers.
7. Design ofan8-bitARITHMETICLOGIC UNIT.
8. Design thedata pathof acomputerfromits registertransferlanguage description.
9. Design thecontrol unit ofacomputer usingeitherhardwiringor microprogrammingbased onits register transferlanguage description.
10. Implement asimpleinstructionsetcomputerwith acontrolunit and adata path.

DiscreteStructure&LogicLab(BTCS308P)

1. Introduction to digitalelectronicslab-nomenclatureofdigital ICs, specifications,studyofthedata sheet, Concept ofVccand ground, verificationofthetruth tablesoflogic gates usingTTLICs.
2. Implementation ofthe given Booleanfunctionusinglogic gates in both SOPandPOS forms.
3. Verification ofstatetablesofRS,JK,Tand D flip-flops usingNAND &NOR gates.
4. Implementation and verification ofDecoderusinglogic gates.
5. Implementation and verification ofEncoderusinglogicgates.
6. Implementation of4:1 multiplexerusinglogic gates.
7. Implementation of1:4 demultiplexerusinglogicgates.
8. Implementation of4-bitparalleladderusing7483 IC.
9. Design, and verifythe4-bit synchronous counter.

10. Design, and verifythe4-bitasynchronouscounter.

Mini Project or Internship Assessment
(BTCS309P)

Semester –IV

PYTHONPROGRAMMING (BTCS401)

PROGRAMME OBJECTIVES:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

CourseOutcome (CO)		Bloom'sKnowledge Level(KL)
At theend of course ,thestudentwillbe able to understand		
CO1	Toread and write simple Python programs.	K_1, K_2
CO2	To develop Pythonprograms with conditionals and loops.	K_2, K_4
CO3	To define Pythonfunctionsand to usePython datastructures--lists,tuples, dictionaries	K_3
CO4	To do input/output with files in Python	K_2
CO5	To do searching,sortingand mergingin Python	K_2, K_4

DETAILEDSYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:**TheProgrammingCycleforPython,PythonIDE,InteractingwithPythonPrograms, ElementsofPython,TypeConversion. **Basics:**Expressions,AssignmentStatement,ArithmeticOperators,OperatorPrecedence,Boolean Expression.	08
II	**Conditionals:** Conditional statement in Python (if-else statement, its working and execution), Nested-if statementand Elif statementin Python, Expression Evaluation &Float Representation. **Loops:**Purposeandworkingofloops,Whileloopincludingitsworking,ForLoop,NestedLoops, Breakand Continue.	08
III	**Function:**PartsofAFunction,ExecutionofAFunction,KeywordandDefaultArguments,Scope Rules. **Strings:**LengthofthestringandperformConcatenationandRepeatoperationsinit.Indexingand SlicingofStrings. **Python Data Structure :** Tuples , Unpacking Sequences , Lists , Mutable Sequences , List Comprehension, Sets , Dictionaries **HigherOrderFunctions:**Treatfunctions asfirstclass 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 _init_, _str_, comparison methods and Arithmetic methods etc.) , Class Example , Inheritance , Inheritance and OOP.	08
V	**Iterators&Recursion:**RecursiveFibonacci,TowerOfHanoi **Search:**SimpleSearchand EstimatingSearchTime,BinarySearchandEstimatingBinarySearch Time **Sorting&Merging:**SelectionSort, Merge List,MergeSort, HigherOrderSort	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 Inter-disciplinary 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 ValuesandProfessional EthicsBTCS402

Objectives:

1. Tohelpstudentsdistinguishbetweenvaluesandskills,andunderstandthe need, basicguidelines, content and process ofvalueeducation.
2. Tohelpstudentsinitiateaprocessofdialog withinthemselvestoknow what they'reallywant to be'in theirlifeand profession.
3. Tohelpstudentsunderstandthemeaningofhappinessandprosperityfora human being.
4. Tofacilitatethestudentstounderstandharmonyatallthelevelsofhuman living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existencein theirprofession and leadan ethicallife

CourseOutcome:

On completion ofthiscourse, the students willbeableto

1. Understand the significance of value inputs in a classroom, distinguish between values andskills,understand the need, basicguidelines, contentand processofvalueeducation, explorethemeaningofhappinessandprosperity and do acorrect appraisal ofthe currentscenario in the society.
2. Distinguish between theSelf and the Body, understandthe meaningof Harmonyin theSelftheCo- existenceof Self and Body.
3. Understand thevalueof harmoniousrelationshipbasedontrust, respectand other naturally acceptable feelings in human-human relationships and exploretheirrolein ensuringa harmonious society.
4. Understand the harmony in nature and existence, and work out their mutuallyfulfillingparticipationin thenature.
5. Distinguishbetweenethicalandunethicalpractices,andstartworkingout the strategyto actualizeaharmonious environment wherevertheywork.

UNIT-1

Course Introduction- Need, Basic Guidelines, Content andProcessforValueEducation Understandingtheneed, basicguidelines,contentandprocessfor ValueEducation, Self-Exploration–whatisit?- itscontentandprocess;'NaturalAcceptance'and ExperientialValidation-asthemechanism forselfexploration,Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillmentofaspirations of every humanbeing withtheircorrectpriority, Understanding Happiness and Prosperity correctly- A critical appraisal of the currentscenario,Method to fulfill theabovehuman aspirations:understanding and livingin harmonyat various levels.

UNIT-2

Understanding Harmony in the Human Being- Harmony in Myself Understandinghumanbeingasaco-existenceofthesentient'I'andthematerial 'Body',UnderstandingtheneedsofSelf ('I')and'Body'- SukhandSuvidha, Understanding theBodyasaninstrumentof 'I'(Ibeingthedoer, seerandenjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understandingtheharmony ofIwith theBody:SanyamandSwasthya;correct appraisal ofPhysicalneeds,meaningofProsperityin detail, Programsto ensureSanyamand Swasthya.

UNIT-3

UnderstandingHarmonyintheFamilyandSociety-Harmonyin Human-HumanRelationship UnderstandingharmonyintheFamily- thebasicunitofhuman interaction, Understanding values in human-human relationship; meaning of Nyaya and programforitsfulfillmenttoensureUbhay-tripti;Trust(Vishwas) andRespect (Samman)as thefoundationalvalues ofrelationship, Understanding themeaning of Vishwas; Difference between intention and competence, Understanding the meaningof Samman,Difference betweenrespectanddifferentiation;theother salientvaluesinrelationship,Understandingtheharmonyinthesociety(society beinganextensionoffamily):Samadhan,Samridhi,Abhay, Sah-astitvaas comprehensiveHumanGoals, Visualizing auniversalharmoniousorder insociety-Undivided Society (AkhandSamaj),Universal Order(SarvabhaumVyawastha)- fromfamilyto world family!.

UNIT-4

UnderstandingHarmonyin the Natureand Existence-Whole existenceso-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillmentamongthefourordersofnature-recyclabilityandself-regulationin nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units inall-pervasivespace, Holistic perceptionofharmonyatalllevels ofexistence.

UNIT-5

ImplicationsoftheaboveHolisticUnderstandingofHarmonyon ProfessionalEthics Naturalacceptanceofhumanvalues,DefinitivenessofEthical HumanConduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic UniversalOrder,CompetenceinProfessionalEthics:a)Ability toutilizethe professionalcompetenceforaugmentinguniversalhuman order,b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,technologiesandmanagementmodels,Casestudiesof typical holistic technologies,managementmodels andproductionsystems,Strategy for transitionfromthepresentstateto UniversalHumanOrder:a)Atthelevelof individual:associallyandecologically responsible engineers,technologistsand managers,b)At thelevelofsociety:asmutually enriching institutionsand organizations.

TextBooks:

1. RR Gaur, R Sangal, G PBagaria, 2009, AFoundationCoursein Human Valuesand Professional Ethics.

References:

1. IvanIllich,1974,Energy&Equity,TheTrinityPress,Worcester,and Harper Collins, USA
2. E.F.Schumacher,1973,SmallisBeautiful:astudyofeconomicsasif peoplemattered, Blond &Briggs, Britain.
3. SussanGeorge,1976,HowtheOtherHalfDies,PenguinPress.Reprinted 1986, 1991
4. DonellaH.Meadows,DennisL.Meadows,JorgenRanders,WilliamW. BehrensIII,1972,LimitstoGrowth–ClubofRome'sreport,Universe Books.
5. ANagraj,1998, Jeevan VidyaEkParichay,DivyaPathSansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A NTripathy, 2003, Human Values,New AgeInternational Publishers.
8. SubhasPalekar,2000,How topracticeNaturalFarming,Pracheen(Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer &Robert L. Berry, 2000, Fundamentals of Ethics for Scientists&Engineers , OxfordUniversity Press.
10. MGovindrajran,SNatrajan&V.S.SenthilKumar,EngineeringEthics (includingHuman Values), Eastern EconomyEdition, Prentice Hallof IndiaLtd.
11. BP Banerjee,2005, Foundations ofEthics andManagement, ExcelBooks.
12. BLBajpai,2004,IndianEthosandModernManagement,NewRoyal

BookCo., Lucknow. Reprinted 2008.

Modeof Evaluation:

Assignment/Seminar/Continuous AssessmentTest/SemesterEnd Exam

1. RR Gaur, R Sangal, G PBagaria, 2009, AFoundationCoursein Human Valuesand Professional Ethics.

Operating system**(BTCS403)**		
PROGRAMME OBJECTIVES: 1. To provide an understanding of the design aspects of operating system concepts through simulation Introduce basic Unix commands, system call interface for process management, interprocess 2 communication and I/O in Unix		
CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO 1	Understandthestructureand functions ofOS	K_1,K_2
CO 2	Learnabout Processes,Threadsand Schedulingalgorithms.	K_1,K_2
CO 3	Understandtheprinciples of concurrencyand Deadlocks	K_2
CO 4	Learn variousmemory management scheme	K_2
CO 5	StudyI/Omanagement and Filesystems.	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, MultithreadedSystems, OperatingSystemStructure-Layered structure, SystemComponents,OperatingSystemservices,ReentrantKernels,MonolithicandMicrokernelSystems.	08
II	ConcurrentProcesses:Process Concept, PrincipleofConcurrency, Producer/ Consumer Problem, MutualExclusion,CriticalSectionProblem,Dekker'ssolution,Peterson'ssolution,Semaphores, TestandSetoperation;ClassicalProbleminConcurrency-DiningPhilosopherProblem,Sleeping BarberProblem;Inter Process Communication modelsand Schemes, Process generation.	08
III	CPUScheduling: SchedulingConcepts,PerformanceCriteria,ProcessStates,ProcessTransition Diagram,Schedulers,ProcessControlBlock(PCB),Processaddressspace,Processidentification information,Threadsandtheirmanagement,SchedulingAlgorithms,MultiprocessorScheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recoveryfromdeadlock.	08
IV	Memory Management:Basicbare machine,Residentmonitor,Multiprogrammingwithfixed partitions,Multiprogrammingwithvariablepartitions,Protectionschemes,Paging,Segmentation, Pagedsegmentation,Virtualmemoryconcepts,Demandpaging,Performanceofdemandpaging, Pagereplacement algorithms, Thrashing, Cache memoryorganization, Locality ofreference.	08
V	I/O Managementand DiskScheduling: I/Odevices,andI/Osubsystems,I/Obuffering,Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism,File directories,andFilesharing,Filesystemimplementationissues,File systemprotectionand security.	08

Textbooks:

1. Silberschatz, Galvin andGagne, “OperatingSystemsConcepts”,Wiley
2. Sibsankar Halderand AlexAAravind, “OperatingSystems”, Pearson Education
3. HarveyM Dietel, “ An Introductionto OperatingSystem”, Pearson Education
4. D M Dhamdhere, “OperatingSystems :AConcept based Approach”, 2ndEdition,
5. TMH5. WilliamStallings,“OperatingSystems:Internalsand Design Principles ”,6thEdition, Pearson Education

Theory of Automata and Formal Languages (BTCS404)

PROGRAMME OBJECTIVES:

- Introduce concepts in automata theory and theory of computation
- Identify different formal language classes and their relationships
- Design grammars and recognizers for different formal languages
- Prove or disprove theorems in automata theory using its properties
- Determine the decidability and intractability of computational problems

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO 1	Analyseanddesignfiniteautomata,pushdownautomata,Turingmachines,formallanguages,and grammars	K_4,K_6
CO 2	Analyse anddesign, Turingmachines,formallanguages, and grammars	K_4,K_6
CO 3	Demonstratetheunderstandingofkeynotions,suchasalgorithm,computability,decidability,and complexitythrough problemsolving	K_1,K_5
CO 4	Prove thebasicresults oftheTheoryof Computation.	K_2,K_3
CO 5	Stateandexplain therelevanceoftheChurch-Turingthesis.	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 andComplexity,Alphabet,Symbol,String,FormalLanguages,DeterministicFinite Automaton(DFA)- Definition,Representation,AcceptabilityofaStringandLanguage,Non DeterministicFiniteAutomaton(NFA), EquivalenceofDFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore Machine, Mealy Machine,EquivalenceofMooreand Mealy Machine,MinimizationofFinite Automata, Myhill-NerodeTheorem, Simulation of DFA and NFA	08
II	RegularExpressionsandLanguages:RegularExpressions,TransitionGraph,Kleen'sTheorem, Finite Automata andRegular Expression-Arden'stheorem,Algebraic MethodUsingArden's Theorem,Regularand Non-RegularLanguages-ClosurepropertiesofRegularLanguages, PigeonholePrinciple,PumpingLemma,ApplicationofPumpingLemma,Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation ofTransition Graph and Regularlanguage.	08
III	Regularand Non-RegularGrammars:ContextFreeGrammar(CFG)-Definition,Derivations, Languages,DerivationTreesandAmbiguity,RegularGrammars-RightLinear andLeftLinear grammars,Conversion of FA intoCFGandRegular grammarinto FA,Simplification ofCFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programmingproblems basedonthe properties ofCFGs.	08
IV	PushDownAutomataandPropertiesofContext FreeLanguages: NondeterministicPushdown Automata(NPDA)-Definition,Moves,ALanguageAcceptedby NPDA,DeterministicPushdown Automata(DPDA) and DeterministicContext free Languages(DCFL), PushdownAutomata for ContextFreeLanguages, ContextFreegrammarsforPushdownAutomata, Twostack Pushdown Automata,PumpingLemmaforCFL,ClosurepropertiesofCFL,Decision ProblemsofCFL, Programmingproblems based on the propertiesofCFLs.	08

V	Turing Machines and Recursive Function Theory : Basic Turing Machine Model, RepresentationofTuringMachines,LanguageAcceptabilityofTuringMachines,Techniquesfor TuringMachineConstruction,Modificationsof Turing Machine, Turing MachineasComputerof IntegerFunctions,Universal Turingmachine,LinearBoundedAutomata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post's CorrespondanceProblem,Introductionto RecursiveFunctionTheory.	08

Textbooks:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition,Pearson EducationAsia
2. Introduction to languages and thetheoryofcomputation,JMartin,3rd Edition,Tata McGrawHill
3. ElementsandTheoryof Computation, C Papadimitrouand C. L. Lewis, PHI
4. MathematicalFoundation ofComputerScience, Y.N.Singh, New AgeInternationa

Microprocessor(BTCS405)

PROGRAMME OBJECTIVES (PO):

To provide solid foundation on the fundamentals of microprocessors and applications, interfacing the external devices to the processor according to the user requirements thus, enabling to create novel products and solutions for real time problems

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendof course,thestudent willbeabletounderstand		
CO 1	ApplyabasicconceptofdigitalfundamentalstoMicroprocessorbasedpersonalcomputer system.	K_3,K_4
CO 2	Analyze a detailed s/w &h/w structure oftheMicroprocessor.	K_2,K_4
CO 3	Illustratehow thedifferentperipherals (8085/8086) are interfaced with Microprocessor.	K_3
CO 4	Analyze theproperties ofMicroprocessors(8085/8086)	K_4
CO 5	Evaluatethedata transferinformation through serial&parallel ports.	K_5

DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Microprocessorevolutionandtypes,microprocessorarchitectureandoperationofitscomponents, addressingmodes,interrupts,datatransferschemes,instructionanddataflow,timerandtiming diagram,Interfacingdevices.	08
II	Pindiagramandinternalarchitectureof8085microprocessor,registers,ALU,Control&status, interrupt andmachine cycle.Instruction sets.Addressing modes.InstructionformatsInstruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machinecontroland assemblerdirectives.	08
III	Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memoryaddressing, and memorysegmentation. Operatingmodes. Instructionsets, instruction format,Types ofinstructions. Interrupts:hardware and softwareinterrupts.	08
IV	Assemblylanguageprogrammingbasedonintel8085/8086.Instructions,datatransfer,arithmetic, logic,branchoperations,looping,counting,indexing,programmingtechniques,countersandtime delays, stacks and subroutines, conditionalcallandreturn instructions	08
V	Peripheral Devices:8237 DMAController, 8255programmableperipheralinterface, 8253/8254programmabletimer/counter, 8259 programmableinterruptcontroller,8251 USART and RS232C.	08

Textbooks:

1. Gaonkar, Ramesh S, “MicroprocessorArchitecture, Programmingand Applications with
2. 8085”, PenramInternationalPublishing.
3. RayA K, Bhurchandi K M, “AdvancedMicroprocessors and Peripherals”,TMH
4. HallDV,”MicroprocessorInterfacing’,TMH
5. Liu and,“Introduction toMicroprocessor”,TMH
6. Brey, BarryB, “INTEL Microprocessors”, PHI
7. Renu Sigh &B.P. GibsonG A, “Microcomputer System:The 8086/8088 family’’,PHI
8. AdityaP MathurSigh, “Microprocessor, Interfacingand Applications M Rafiqzzaman, “Microprocessors,Theory and Applications
9. J.L.Antonakos, AnIntroduction tothe Intel FamilyofMicroprocessors, Pearson,1999

OperatingSystemLab(BTCS406P)

1. Studyofhardwareand softwarerequirementsof different operatingsystems(UNIX,LINUX,WINDOWS XP, WINDOWS7/8
2. Execute variousUNIX systemcalls for
   i. Process management
   ii. File management
   iii. Input/outputSystems calls
3. Implement CPU SchedulingPolicies:
   i. SJF
   ii. Priority
   iii. FCFS
   iv. Multi-level Queue
4. Implement file storageallocationtechnique:
   i. Contiguous(usingarray)
   ii. Linked –list(usinglinked-list)
   iii. Indirect allocation (indexing)
5. Implementation ofcontiguous allocationtechniques:
   i. Worst-Fit ii. Best-Fit
   iii. First-Fit
6. Calculationofexternalandinternalfragmentation
   i. Freespacelist ofblocks fromsystem ii. Listprocess file fromthesystem
7. Implementation ofcompaction forthecontinually changing memorylayoutand calculatetotalmovementof data
8. Implementation ofresourceallocation graph RAG)
9. Implementation of Banker"salgorithm
10. Conversionofresourceallocation graph(RAG)to waitforgraph (WFG)foreach type ofmethod usedforstoring graph.
11. Implement the solution for Bounded Buffer(producer-consumer)problemusinginterprocesscommunication techniques-Semaphores
12. Implement the solutionsfor Readers-Writersproblemusinginterprocesscommunicationtechnique -Semaphore

MicroprocessorLab(BTCS407P)

1. Writeaprogramusing8085 Microprocessor forDecimal,Hexadecimal additionand subtractionoftwo Numbers.
2. Writeaprogramusing8085 Microprocessor foraddition and subtraction oftwo BCD numbers.
3. To perform multiplication and division oftwo8 bitnumbers using8085.
4. Tofind the largestandsmallest numberin anarrayofdatausing8085 instructionset.
5. To writeaprogramtoarrange an arrayofdatain ascendingand descendingorder.
6. Toconvert given Hexadecimal numberinto itsequivalent ASCIInumberand vice versa using8085 instruction set.

7. To writeaprogramtoinitiate 8251 andto checkthe transmissionand reception ofcharacter.
8. Tointerface8253programmableintervaltimerto8085 and verifythe operation of8253in six different modes.
9. TointerfaceDACwith8085 to demonstratethegenerationofsquare, sawtoothand triangular wave.
10. Serialcommunication between two8085through RS-232 Cport.

PythonLanguageProgrammingLab(BTCS408P)

1. To writeapython programthattakesincommand linearguments as input and print the numberofarguments.
2. To writeapython programto performMatrixMultiplication.
3. To writeapython programto computethe GCDof twonumbers.
4. To writeapython programto findthemost frequentwordsin atext file.
5. To writeapython programfindthesquareroot ofa number(Newton'smethod).
6. To writeapython programexponentiation(powerofanumber).
7. To writeapython programfindthemaximumof alistofnumbers.
8. To writeapython programlinearsearch.
9. To writeapython program Binarysearch.
10. To writeapython programselectionsort.
11. To writeapython programInsertionsort.
12. To writeapython programmergesort.
13. To writeapython programfirstnprime numbers.
14. To writeapython programsimulatebouncingballin Pygame.

Semester -V

Database Management System
(BTCS501)

PROGRAMME OBJECTIVES (PO):

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

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

Compiler Design
(BTCS502)

PROGRAMME OBJECTIVES (PO):

The main objective of this course is to introduce the major concept areas of language translation and compiler design and to develop an awareness of the function and complexity of modern compilers. This course is a study of the theory and practice required for the design and implementation of interpreters and compilers for programming languages.

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 Louden," Compiler Construction", Cengage Learning.
7. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

Design and Analysis of Algorithm

(BTCS503)

PROGRAMME OBJECTIVES (PO):

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

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 SpanningTrees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman FordAlgorithms. **[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. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)",McGraw Hill
5. Richard E.Neapolitan "Foundations of Algorithms" Jones & Bartlett Learning
6. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
7. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet
8. Examples, Second Edition, Wiley, 2006.

Data Analytics
(BTCS504A)

PROGRAMME OBJECTIVES (PO):

To understand basics of Data analytics and its life cycle along with component analysis and neural networks, fuzzy logic, Mining Data Streams and Introduction to R programming.

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, estimatingmoments, 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)

PROGRAMME OBJECTIVES (PO):

This course will introduce you to the realm of web design. The first and necessary step for that goal is to understand how HTML works, and then we will proceed to more advanced and complicated structures and concepts of web design, such as CSS and layout control. A series of tasks (website evaluation, website development, reflective report, collaborative website development, website self-assessment), as well as several group activities (discussions, online resource sharing, collaborative work) will help you gain practical experience on web development and a thorough understanding of web design issues.

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, Workingwith 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)

PROGRAMME OBJECTIVES (PO):

1. The main objective of the course is to introduce students with fundamental concepts and theory of computer graphics.
2. It presents the important drawing algorithm, polygon fitting, clipping and 2D transformation curves and an introduction to 3D transformation.
3. It provides the basics of OpenGL application programming interface which allows students to develop programming skills in CG.

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 differentalgorithms.
3. Apply the 2D graphics transformations, composite transformation and Clipping concepts .
4. Apply the concepts of and techniques used in 3D computer graphics, including viewingtransformations
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, Bspline 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)

PROGRAMME OBJECTIVES (PO):

- The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing.
- Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
- Provide the mathematical background for carrying out the optimization associated with neural network learning.
- Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.

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 hetro-associative memory. **[08]**

Unit 2

Neural Networks-II (Back propogation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;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, interference in fuzzy logic, fuzzy if- then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, 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. Siman Haykin,"Neural Netowrks"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)

PROGRAMME OBJECTIVES (PO):

- Develop an appreciation for what is involved in Learning models from data
- Understand a wide variety of learning algorithms
- Understand how to evaluate models generated from data
- Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

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 inmachine 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 AlgorithmConvergence, Generalization;

[08]

Unit 3

Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, ComparingLearning 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)

PROGRAMME OBJECTIVES (PO):

- Analyze system requirements and model problem domains.
- Evaluate the quality of an analysis, and be able to explain how to improve it.
- Design and build object-oriented systems.

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 programmingto 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, Designingalgorithms, design optimization, Implementation of control, Adjustment of inheritance, Objectrepresentation, 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 intodata 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. Inlinefunctions, 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++, Pointes 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 UserGuide", 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 Compete Reference C++, Herbert Schlitz, TMH

Augmented & Virtual Reality
(BTCS505C)

PROGRAMME OBJECTIVES (PO):

1. Gain the knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
4. To learn the Evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to have practical knowledge.

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, Deign 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, Gestrual Commands, Tools, Mutimodal System Control Techniques, DesignGuidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolicInput 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 realityapplications, 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: Meging 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)

PROGRAMME OBJECTIVES (PO):

The course introduces students to analysis, design, and evaluation of the interaction between people and information and communication technologies. The aim is to give students an adequate understanding of the concepts of usability, user experience, and user-centered design.

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 appropriatenessof 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 NFA from REGULAR EXPRESSION
4. Construction of DFA from NFA
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

1. Perform Travelling Salesman Problem
2. Find Minimum Spanning Tree using Kruskal's Algorithm
3. Implement N Queen Problem using Backtracking

Software Engineering
(BTCS601)

PROGRAMME OBJECTIVES (PO):

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

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: Halestead'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)

PROGRAMME OBJECTIVES (PO):

1. To comprehend the basics of the internet and web terminologies.
2. To introduce scripting language concepts for developing client-side Applications.
3. To practice server-side programming features.
4. To be familiar with database applications
5. To know the usefulness of web services.

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

Big Data
(BTCS604A)

PROGRAMME OBJECTIVES (PO):

This course gives an overview of Big Data, i.e. storage, retrieval and processing of big data. In addition, it also focuses on the "technologies", i.e., the tools/algorithms that are available for storage, processing of Big Data. It also helps a student to perform a variety of "analytics" on different data sets and to arrive at positive conclusions.

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 applyingHadoop 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 deleing 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, comparisonwith 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: EmergingBusiness 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)

PROGRAMME OBJECTIVES (PO):

1. To learn and understand the digital image processing
2. To learn and understand various image transform used in digital image processing
3. To learn and understand various image enhancement technique used in digital image processing
4. To learn and understand various image restoration technique and methods used in digital image processing
5. To learn and understand various image compression and Segmentation used in digital image processing

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 – asics 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 RM. 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)

PROGRAMME OBJECTIVES (PO):

The goal of this course is to introduce students to the theory and practice of data compression, as well as to make students comfortable processing real-world audio and video signals on a computer.

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: Moveto-front coding, CALIC, JPEG-LS, Multi- resolution Approaches, Facsimile Encoding, Dynamic Markoy 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 aufmann
4. Series 4.Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer
5. Text Compression1st 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 on 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 justifiedmanner

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

Real Time Systems
BTOE-605A

PROGRAMME OBJECTIVES (PO):

1. To study the basic of tasks and scheduling.
2. To understand programming languages and databases
3. To analyze real time communication
4. To analyze evaluation techniques and reliability models for Hardware Redundancy
5. To understand clock synchronization

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 softwarearchitecture.
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, Taskcommunication	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, ꝑC/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.
5. 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 ForceDamping, The Effects of Air Damping on Micro-Dynamics. Squeeze-filmAirDamping: Reynolds' Equations for Squeeze-film Air Damping, Damping ofPerforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film AirDamping, Couette-flow Model, Stokes-flow Model.	8
4	**Electrostatic Actuation:** Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, ElectrostaticDriving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Stepand Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	8
5	**Thermal Effects:** Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermaland temperature sensors. **Applications of MEMS in RF** MEMS Resonator Design Considerations, One-Port Micromechanical ResonatorModelingVertical DisplacementTwo-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:
1. Understand object-oriented programming features by JAVA,
2. Apply these features to program design and implementation,
3. Understand object-oriented concepts and how they are supported by JAVA,
4. Understand implementation issues related to object-oriented techniques,
5. Build good quality software using object-oriented programming technique

Course Outcomes [The students should be able to]:
1. Apply Java in developing Object Oriented code.
2. Apply the knowledge of Multi-threading and Streams in developing Java applications.
3. Design and implement applications using GUI and Networking in Java.
4. Apply the knowledge of Collections and Generics for building Java applications.
5. Design and develop Java based applications for solutions to real world problems.

UNIT- I
Introduction & Fundamentals of JAVA, Background of JAVA, About Java Technology, Java's architecture, Reading console inputs, Arrays, Constructors, Finalize method, final, this method and reference, static members.

UNIT-II
Concrete class, Abstract class, Interface, Inner classes. Aggregation, Composition and Inheritance, super method and reference. Method overloading and overriding. Singleton classes. Package concepts. Exception Handling: Inbuilt, User defined, Checked and Unchecked.

UNIT- III
String class. Wrapper classes (Integer, Boolean, Character, etc.). Multi-threading: Thread concept, Thread class, Runnable interface, Creating customized threads, Thread synchronization, Thread class methods. Java I/O: Use of InputStream, OutputStream, Reader and Writer classes for reading from and writing data into disk files.

UNIT-IV
AWT & SWING: Frame, Panel, Dialog, CheckBox, Choice, List, JComboBox, JFrame, JPanel, JRadioButton, JScrollPane, JTabbedPane, Using Listeners: ActionListener, ContainerListener, FocusListener, ItemListener, KeyListener, MouseListener, TextListener, WindowListener. Applets. JDBC: Type1 to Type4 drivers. Java Networking: ServerSocket, Socket, RMI.

UNIT-V
Collections Frameworks: HashSet, TreeSet, ArrayList, LinkedList, Vector, HashMap, TreeMap, Hashtable classes. Generics in Java: Creating instances of generic classes, generic types, Declaring (and invoking) methods that take generic types. Creating and running executable JAR (Java ARchives).

Text Books:
1. Herbert Schildt: "Java A Beginner's Guide, 7th edition",Oracle Press.
2. Maurice Naftalin, Philip Wadler, "Javas Generics and Collections", O'Reilly Media, Inc.
3. Benjamin J Evans, David Flanagan., "Java in a Nutshell", O'Reilly Media, Inc.

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 Jv(x), Bessel Functions Jv(x) for any v≥0. Gamma Function, Solution J-v(x) of the Bessel Equation, Backbones ofBessel's Theory, Jv(x) with v= ±1/2, ±3/2, ±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 linearequations, 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 Outcome:

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 humanbeing (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 ence (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 inthe self.	8
4	**Understanding Co-existence with other orders:** The need and the process of inner evolution (through self-exploration, selfawareness 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 Networksand 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 ArtificialIntelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of IntelligentAgents. Computer vision, Natural Language Possessing.08

Unit-II

Introduction to Search : Searching for solutions, Uniformed search strategies, Informed searchstrategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games,Alpha - Beta pruning08

Unit-III

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

Unit-IV

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

Unit-V

Pattern Recognition : Introduction, Design principles of pattern recognition system, StatisticalPattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) andLinear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, BayesClassifier, 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 ComputationalScience.

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. lan 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 STORAGELayered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – 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 MachineSecurity – 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 afinancial 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 thekey 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

Natural Language Processing

(BTCS702D)

PROGRAMME OBJECTIVES (PO):

- Apply their knowledge of NLP algorithms like text representation, text pre-processing, feature extraction, statistical text analysis, and AI methods.
- Design, implement, and document appropriate, effective, and efficient software solutions for a varietyof NLP problems.
- Exploit standard Python NLP libraries in the development of these solutions.

Course Outcomes:

1. This course will be able to understand about Natural Language Processing Steps involved and Challengesin NLP.
2. This course will have the ability understand Concepts of words and vectors, Techniques used in NLP.
3. This course will be Processing understand Techniques and disciplines.
4. This course will have the ability to explore research areas and produce outstanding contribution in various areas of NLP.

UNIT I Natural Language Processing

Introduction to Natural Language Processing

Types of NLP systems, how computer understands text, Terminologies used in NLP, Steps Involved in NLP, Steps involved in preprocessing, Pipeline of NLP Problems o Challenges in NLP

UNIT II Words & Vectors

Concepts of words and vectors, Techniques of converting words to numbers, GloVe Word Embeddings, Word2Vec and its types, such as Skip Gram, Model and Continuous BOW o Advanced word vectors, limitations of CBOW and Skip Gram

UNIT III Processing Techniques

Word window classification, Dependency parsing, Constituency parsing o Machine translation, Attention, End to end models for speech processing, Deep learning for speech recognition, Tree recursive neural networks o RNN for language modelling, Dynamic neural network for question answering

UNIT IV: Case Studies

Smart Home Services Provider Uses Natural Language Generation to Create Highly Personalized Website Copy, Online Education Company Improves Customer Support with Autosuggestion of Macros, Using Natural Languag for Health care Summaries, Microsoft Gets the Pulse of Customer Sentiment with Natural Language Processing

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 conceptsof 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 developmentof 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, finement, 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 ssurance – 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

CourseOutCome

- 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 functionto 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 Gupra, 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. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

SoftwareTesting(BTCS703D)

PROGRAMME OBJECTIVES (PO):

1. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies,and methods.
2. To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendofcourse,thestudentwillbeabletounderstand		
CO1	Haveanabilitytoapplysoftwaretestingknowledgeandengineeringmethods.	K2,K3
CO2	Haveanabilitytodesignandconductasoftwaretestprocessforasoftwaretestingproject.	K3,K4
CO3	Haveanabilitytoidentifytheneedsofsoftwaretestautomation,anddefineanddevelopatest tooltosupporttestautomation.	K1,K2
CO4	Haveanabilityunderstandandidentifyvarioussoftwaretestingproblems,andsolvethese problemsbydesigningandselectingsoftwaretestmodels,criteria,strategies,andmethods.	K1,K2
CO5	Havebasicunderstandingandknowledgeofcontemporaryissuesinsoftwaretesting,suchas component-basedsoftwaretestingproblems.	K2
DETAILEDSYLLABUS		3-0-0

Unit	Topic	Proposed Lecture
I	ReviewofSoftwareEngineering:OverviewofSoftwareEvolution,SDLC,TestingProcess, TerminologiesinTesting:Error,Fault,Failure,Verification,Validation,DifferenceBetweenVerificationandValidation,TestCases,TestingSuite,Test,Oracles,ImpracticalityofTestingAllData;ImpracticalityofTestingAllPaths.Verification:VerificationMethods,SRSVerification,SourceCodeReviews,UserDocumentationVerification,Software,ProjectAudit,TailoringSoftwareQualityAssurance ProgrambyReviews,Walkthrough,InspectionandConfigurationAudits	08
II	FunctionalTesting:BoundaryValueAnalysis,EquivalenceClassTesting,DecisionTable BasedTesting,CauseEffectGraphingTechnique.StructuralTesting:ControlFlowTesting,PathTesting,IndependentPaths,GenerationofGraphfromProgram,IdentificationofIndependentPaths,CyclomaticComplexity,DataFlowTesting,MutationTesting	08
III	RegressionTesting:WhatisRegressionTesting?RegressionTestcasesselection,Reducingthe numberoftestcases,Codecoverageprioritizationtechnique.Reducingthenumberoftestcases:Prioritizationguidelines,Prioritycategory,Scheme,RiskAnalysis	08
IV	Software Testing Activities: Levels of Testing, Debugging, Testing techniques and theirapplicability,ExploratoryTestingAutomatedTestDataGeneration:TestData,Approachesto testdatageneration,testdatagenerationusinggeneticalgorithm,TestDataGenerationTools, SoftwareTestingTools,andSoftwaretestPlan.	08
V	ObjectOrientedTesting:Definition,Issues,ClassTesting,ObjectOrientedIntegrationand SystemTesting.TestingWebApplications:WebTesting,UserInterfaceTesting,UsabilityTesting,SecurityTesting,PerformanceTesting,Databasetesting,PostDeploymentTesting	08

Textbooks:

1. Yogesh Singh,"Software Testing", CambridgeUniversityPress, New York,2012
2. K..K. Aggarwal&YogeshSingh,"SoftwareEngineering",New AgeInternationalPublishers,New Delhi,2003.
3. RogerS.Pressman,"SoftwareEngineering–APractitioner'sApproach",FifthEdition,McGraw-HillInternationalEdition, New Delhi,2001.
4. Marc Roper, "Software Testing", McGraw-Hill BookCo.,London,1994.
5. M.C.Trivedi,SoftwareTesting&Audit,KhannaPublishingHouse6.BorisBeizer,"SoftwareSystemTestingandQuality Assurance", VanNostrand Reinhold, NewYork,1984

DIGITAL AND SOCIAL MEDIA MARKETING

(BTCSOE704A)

COURSE OBJECTIVE

- Introduce current and core practices of Digital and Social Media Marketing that will allow learners to analyses, plan, execute and evaluate a digital marketing strategy.
- Introduce core tools currently used in Digital and Social Media Marketing that will allow learners to analyses, 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 inmarketing strategy.
- Use principles of consumer and social psychology to develop social media content and campaigns thatengage consumers.
- Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagatingideas, 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 aredriving shifts from traditional marketing practices to digital marketing practices,the modern digital consumer and new consumer's digital journey. Marketingstrategies for the digital world-latest practices.

UNIT-II

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

UNIT-III

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

UNIT-IV

Designing Organization for Digital Success: Digital transformation, digitalleadership principles, online P.R. and reputation management. ROI of digitalstrategies, 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, digitaltransformation framework; security and privatization issues with digitalmarketing Understanding trends in digital marketing – Indian and globalcontext, online communities and co-creation,

Text books:

1. Moutsy Maiti: Internet Mareting, 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
(BTCSOE704B)

Course Objectives:

- This course can motivate students to have an overall idea how to start and sustain a businessenterprise.
- 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 Managerrole 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 topeople- 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 it's 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 it's sustainability through production, planning and control (PPC)
5. Develop appropriate business model and apply in a better way.

Micro and Smart Systems
(BTCSOE704C)

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,structure 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

(BTCSOE704D)

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 domestics 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 a nd limitations. Wave a n d T i d a l Wa v e : Principle of working, performance and limitations. Waste Recycling Plants.

Text books:

1. Raja etal, “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 RESEARACH

(BTCSOE704E)

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 2x nor mx2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing 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

(BTCSOE704F)

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 foundas 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, Humanhuman 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)

ProjectManagement&Entrepreneurship(BTCS801)

PROGRAMME OBJECTIVES (PO):

To understand comprehensive of entrepreneurship, including its necessity, scope, the key competencies and traits of successful entrepreneurs.

Course Outcomes:

1. Students will have a comprehensive understanding of entrepreneurship, including its necessity, scope, the key competencies and traits of successful entrepreneurs.
2. Students will be equipped with the knowledge and skills to foster innovation, generate entrepreneurial ideas, and identify business opportunities.
3. Students will possess a comprehensive understanding of project management, including its significance and the role of project managers.
4. Students will be proficient in project cost estimation, working capital assessment, fund sourcing, capital budgeting, risk management in project evaluation.
5. Students will have a holistic understanding of social sector perspectives, social entrepreneurship opportunities.

Unit	Topics	Lectures
I	**Entrepreneurship:**Entrepreneurship:need,scope,Entrepreneurialcompetencies&traits,Factorsaffectingentrepreneurialdevelopment,Entrepreneurialmotivation(McClellend'sAchievementmotivationtheory),conceptualmodelofentrepreneurship,entrepreneurvs.intrapreneur;Classificationofentrepreneurs;EntrepreneurialDevelopmentProgrammes	8
II	**EntrepreneurialIdeaandInnovation:**IntroductiontoInnovation,EntrepreneurialIdeaGenerationandIdentifyingBusinessOpportunities,ManagementskillsforEntrepreneursandmanagingforValueCreation,CreatingandSustainingEnterprisingModel&OrganizationalEffectiveness	8
III	**ProjectManagement:**Projectmanagement:meaning,scope&importance,roleofprojectmanager;projectlife-cycleProjectappraisal:PreparationofarealtimeprojectfeasibilityreportcontainingTechnicalappraisal,;Environmentalappraisal,Marketappraisal(including marketsurveyforforecastingfuturedemandandsales) and Managerialappraisal.	8
IV	**Project Financing:**Projectcost estimation&workingcapitalrequirements,sourcesoffunds,capitalbudgeting, Risk&uncertaintyinprojectevaluation,preparationofprojectedfinancialstatementsviz.Projectedbalancesheet,projectedincomestatement,projectedfunds &cashflowstatements,Preparationofdetailedprojectreport,Projectfinance.	8

V	**SocialEntrepreneurship:**SocialSectorPerspectivesandSocialEntrepreneurship,SocialEntrepreneurshipOpportunitiesandSuccessfulModels,SocialInnovationsand Sustainability,Marketing ManagementforSocialVentures,RiskManagementinSocialEnterprises,Legal FrameworkforSocialVentures.	8

TextBook:

1. InnovationandEntrepreneurshipbyDrucker,P.F.;HarperandRow
2. Business,EntrepreneurshipandManagement:Rao,V.S.P.;Vikas
3. Entrepreneurship:RoyRajeev;OUP.
4. TextBookofProjectManagement:Gopalkrishnan,P.andRamamoorthy,V.E.;McMillan
5. ProjectManagementforEngineering,BusinessandTechnology:Nicholas,J.M.,andSteyn,H.;PHI
6. ProjectManagement:TheManagerialProcess:Gray,C.F.,Larson,E.W.andDesai,G.V.;MGH

Deep Learning(BTCS802A)

PROGRAMME OBJECTIVES (PO):

The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various deep learning methods in NLP, Neural Networks etc. Several libraries and datasets publicly available will be used to illustrate the application of these algorithms. This will help students in developing skills required to gain experience of doing independent research and study.

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendofcourse,thestudentwillbeable:		
CO1	To present the mathematical, statistical and computational challenges of building neuralnetworks	K_1,K_2
CO2	Tostudytheconceptsofdeeplearning	K_1,K_2
CO3	Tointroducedimensionalityreductiontechniques	K_2
CO4	Toenablethestudentstoknowdeeplearningtechniquestosupportreal-timeapplications	K_2, K_3
CO5	Toexaminethecasestudiesofdeeplearningtechniques	K_3,K_6

DETAILEDSYLLABUS		3-0-0
Unit	Topic	ProposedLecture
I	INTRODUCTION:Introductiontomachinelearning-Linearmodels(SVMsandPerceptrons, logisticregression)-IntrotoNeuralNets:Whatashallownetworkcomputes-Traininganetwork:lossfunctions,backpropagationandstochasticgradientdescent-Neuralnetworksasuniversalfunctionapproximates	08
II	DEEPNETWORKS:HistoryofDeepLearning-AProbabilisticTheoryofDeepLearning-Backpropagationandregularization,batchnormalization-VCDimensionandNeuralNets-DeepVs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervisedLearning	08
III	DIMENTIONALITYREDUCTION9Linear(PCA,LDA)andmanifolds,metriclearning-Auto encodersanddimensionalityreductioninnetworks-IntroductiontoConvnet-Architectures–AlexNet,VGG,Inception,ResNet-TrainingaConvnet:weightsinitialization,batchnormalization,hyperparameteroptimization	08
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convexoptimizationfordeepnetworks-StochasticOptimizationGeneralizationinneuralnetworks-Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs &Deep Reinforcement Learning - Computational &ArtificialNeuroscience	08
V	CASESTUDYANDAPPLICATIONS:Imagenet-Detection-AudioWaveNet-NaturalLanguage ProcessingWord2Vec-JointDetection-Bioinformatics-FaceRecognition-SceneUnderstanding-GatheringImageCaptions	08

Textbooks:

1. CosmaRohillaShalizi,AdvancedDataAnalysisfromanElementaryPointofView,2015.
2. Deng&Yu,DeepLearning:MethodsandApplications,NowPublishers,2013.
3. IanGoodfellow,YoshuaBengio,AaronCourville,DeepLearning,MITPress,2016.
4. MichaelNielsen,NeuralNetworksandDeepLearning,DeterminationPress,2015.

MappingwithMOOCS:https://onlinecourses.nptel.ac.in/noc18_cs41/preview

Service Oriented Architecture (BTCS802B)

PROGRAMME OBJECTIVES (PO):

SOA encompasses a set of design principles that structure system development and provide means for integrating components into a coherent and decentralized system.

CourseOutcome(CO)		Bloom'sKnowledgeLevel(KL)
Attheendofcourse,thestudentwillbeable:		
CO1	ComprehendtheneedforSOAanditssystematicevolution.	K1,K2
CO2	ApplySOAtechnologiestoenterprisedomain.	K3
CO3	DesignandanalyzevariousSOApatternsandtechniques.	K4
CO4	CompareandevaluatebeststrategiesandpracticesofSOA.	K2
CO5	UnderstandthebusinesscaseforSOA	K1

DETAILEDSYLLABUS		3-0-0
Unit	Topic	ProposedLecture
I	**Introduction:**SOAandMSABasics:ServiceOrientationinDailyLife,EvolutionofSOAand MSA.ServiceorientedArchitectureandMicroservicesarchitecture–DriversforSOA,DimensionsofSOA,ConceptualModelofSOA,StandardsandGuidelinesforSOA,EmergenceofMSA.**Enterprise-Wide SOA:** Considerations for Enterprise-wide SOA, Strawman Architecture forEnterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis andDesign (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process, SOAMethodologyforEnterprise	08
II	**Service-OrientedApplications:**ConsiderationsforService-orientedApplications,Patternsfor SOA,Pattern-basedArchitectureforService-orientedApplications,CompositeApplications,CompositeApplicationProgrammingModel. **Service-OrientedAnalysisandDesign:**NeedforModels,PrinciplesofServiceDesign,NonfunctionalPropertiesforServices,DesignofActivityServices(orBusinessServices),DesignofDataServices,DesignofClientSe	08
III	**Technologies for SOA:** Technologies for Service Enablement, Technologies for ServiceIntegration,TechnologiesforServiceOrchestration. **SOAGovernanceandImplementation:**StrategicArchitectureGovernance,ServiceDesign-timeGovernance,ServiceRun-timeGovernance,ApproachforEnterprise-wideSOAImplementation.	08
IV	**BigDataandSOA:**Concepts,BigDataanditscharacteristics,TechnologiesforBigData, Service-orientationforBigDataSolutions. **BusinessCaseforSOA:**StakeholderObjectives,BenefitsofSOA,CostSavings,ReturnonInvestment(ROI),BuildaCaseforSOA	08
V	**SOABestPractices:**SOAStrategy–BestPractices,SOADevelopment–BestPractices,SOA Governance–BestPractices. **EAandSOAforBusinessandITAlignment:**EnterpriseArchitecture,NeedforBusinessandItAlignment, EAandSOAforBusinessandItAlignment	08

Textbooks:

1. ShankarKambhampaty;Service-OrientedArchitecture&MicroservicesArchitecture:ForEnterprise,Cloud,BigDataand Mobile;Wiley; 3rd Edition;2018;ISBN:9788126564064.
2. IconGroupInternational;The2018-2023WorldOutlookforService-OrientedArchitecture(SOA)SoftwareandServices; ICONGroup International;1st Edition,2017; ASIN: B06WGPN8YD.
3. ThomasErl;ServiceOrientedArchitectureConceptsTechnology&Design;PearsonEducationLimited;2015;ISBN-13: 9788131714904.
4. Guido Schmutz, Peter Welkenbach, Daniel Liebhart; Service Oriented Architecture An Integration Blueprint; Shroff Publishers&Distributors; 2010;ISBN-13:9789350231081

Mobile Computing(BTCS802C)

PROGRAMME OBJECTIVES (PO):

Students taking this course will develop an understanding of the ways that mobile technologies can be used for teaching and learning. They will also consider the impact of mobile computing on the field of education.

	CourseOutcome(CO)	Bloom'sKnowledgeLevel(KL)
	Attheendofcourse,thestudentwillbeabletounderstand	
CO1	Explainanddiscussissuesinmobilecomputingandillustrateoverviewofwirelesstelephonyand channelallocationincellularsystems.	K1,K4
CO2	ExploretheconceptofWirelessNetworkingandWirelessLAN.	K1
CO3	Analyse and comprehend Data management issues like data replication for mobile computers, adaptiveclusteringformobilewirelessnetworksandDisconnectedoperations.	K4
CO4	IdentifyMobilecomputingAgentsandstatetheissuespertainingtosecurityandfaulttolerancein mobilecomputingenvironment.	K1,K2
CO5	Compareandcontrastvariousroutingprotocolsandwillidentifyandinterprettheperformanceof networksystemsusingAdhocnetworks.	K2

DETAILEDSYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	Introduction, issuesinmobilecomputing,overviewofwirelesstelephony:cellularconcept,GSM: air-interface,channelstructure,locationmanagement:HLR-VLR,hierarchical,handoffs,channelallocationincellularsystems,CDMA,GPRS.	08
II	WirelessNetworking,WirelessLANOverview:MACissues,IEEE802.11,BlueTooth,Wireless multipleaccessprotocols,TCPoverwireless,Wirelessapplications,databroadcasting,MobileIP,WAP:Architecture,protocolstack,applicationenvironment,applications.	08
III	Datamanagementissues,datareplicationformobilecomputers,adaptiveclusteringformobile wirelessnetworks,Filesystem,Disconnectedoperations.	08
IV	MobileAgentscomputing,securityandfaulttolerance,transactionprocessinginmobilecomputing environment.	08
V	Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destinationsequenceddistancevectorrouting(DSDV),Dynamicsourcerouting(DSR),AdHocondemanddistancevectorrouting(AODV),Temporaryorderedroutingalgorithm(TORA),QoSinAdHocNetworks,applications.	08

Textbooks:

1. J.Schiller,MobileCommunications,AddisonWesley.
2. A.Mehrotra,GSMSystemEngineering.
3. M.V.D.Heijden,M.Taylor,UnderstandingWAP,ArtechHouse.
4. CharlesPerkins,MobileIP,AddisonWesley.
5. CharlesPerkins,AdhocNetworks,AddisonWesley.

Internet of Things (BTCS802D)

PROGRAMME OBJECTIVES (PO):

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are alsoable to design & develop IOT Devices.

	CourseOutcome(CO)	Bloom'sKnowledgeLevel(KL)
	Attheendofcourse,thestudentwillbeabletounderstand	
CO1	Demonstratebasicconcepts,principlesandchallengesinIoT.	K1,K2
CO2	Illustratefunctioningofhardwaredevicesandsensorsusedfor IoT.	K2
CO3	Analyzenetworkcommunicationaspectsandprotocolsusedin IoT.	K4
CO4	ApplyIoTfordevelopingreallifeapplicationsusingArduniopro gramming.	K3
CP5	TodevelopIoTinfrastructureforpopularapplications	K_2,K_3

DETAILEDSYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technologybehindIoT,SourcesoftheIoT,M2MCommunication,IoTExamples.DesignPrinciples forConnectedDevices:IoT/M2Msystems layers anddesign standardization,communicationtechnologies,dataenrichmentandconsolidation,easeofdesigningandaffordability	08
II	**HardwareforIoT:**Sensors,Digitalsensors,actuators,radiofrequencyidentification(RFID) technology,wirelesssensornetworks,participatorysensingtechnology.EmbeddedPlatformsforIoT:Embeddedcomputingbasics,OverviewofIOTsupportedHardwareplatformssuchasArduino,NetArduino,Raspberrypi,BeagleBone,IntelGalileoboardsandARMcortex.	08
III	**Network&CommunicationaspectsinIoT:**WirelessMediumaccessissues,MACprotocol survey,Surveyroutingprotocols,Sensordeployment&Nodediscovery,Dataaggregation&disseminatio n	08
IV	**ProgrammingtheArdunio:**ArduinioPlatformBoardsAnatomy,ArduinioIDE,coding,using emulator,usinglibraries,additionsinardunio,programmingtheardunioforIoT.	08
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoTApplications:SmartMetering,E-health,CityAutomation,AutomotiveApplications,homeautomation,smartcards,communicatingdatawithH/Wunits,mobiles,tablets,Designingofsmartstreetlightsinsmartcity.	08

Textbooks:

1. OlivierHersent,DavidBoswarthick,OmarElloumi"TheInternetofThingskeyapplicationsandprotocols",wiley
2. JeevaJose,InternetofThings,KhannaPublishingHouse
3. MichaelMiller"TheInternetofThings"byPearson
4. RajKamal"INTERNETOFTHINGS",McGraw-Hill,1STEdition,2016
5. ArshdeepBahga,VijayMadisetti"InternetofThings(Ahandsonapproach)"1STedition,VPIpublications,2014
6. AdrianMcEwen,HakinCassimally"DesigningtheInternetofThings"WileyIndia

Cryptography&NetworkSecurity(BTCS802E)

PROGRAMME OBJECTIVES (PO):

	CourseOutcome(CO)	Bloom'sKnowledgeLevel(KL)
	Attheendofcourse,thestudentwillbeabletounderstand	
CO1	ClassifythesymmetricencryptiontechniquesandIllustratevariousPublickeycryptographic techniques.	K2,K3
CO2	Understandsecurityprotocolsforprotectingdataonnetworksandbeabletodigitallysignemailsan dfiles.	K1,K2
CO3	Understandvulnerabilityassessmentsandtheweaknessofusingpasswordsforauthentication	K4
CO4	Beabletoperformsimplevulnerabilityassessmentsandpasswordaudits	K3
CO5	Summarizetheintrusiondetectionanditssolutionstoovercometheattacks.	K2
	DETAILEDSYLLABUS	**3-0-0**

Unit	Topic	Proposed Lecture
I	Introduction to security attacks, services and mechanism, Classical encryption techniques-substitutionciphersandtranspositionciphers,cryptanalysis,steganography,Streamandblockciphers.ModernBlockCiphers:Blockciphersprinciples,Shannon'stheory ofconfusionanddiffusion,fiestalstructure,Dataencryptionstandard(DES),StrengthofDES,Ideaofdifferentialcryptanalysis,blockciphermodesofoperations,TripleDES	08
II	Introductiontogroup,field,finitefieldoftheformGF(p),modulararithmetic,primeandrelativeprimenumbers,ExtendedEuclideanAlgorithm,AdvancedEncryptionStandard(AES)encryption anddecryptionFermat'sandEuler'stheorem,Primarilytesting,ChineseRemaindertheorem,DiscreteLogarithmicProblem,PrincipalsofpublickeycryptosystemsRSAalgorithm,securityofRSA	08
II I	MessageAuthenticationCodes:Authenticationrequirements,authenticationfunctions,message authenticationcode,hashfunctions,birthdayattacks,securityofhashfunctions,Securehashalgorithm(SHA)DigitalSignatures:DigitalSignatures,ElgamalDigitalSignatureTechniques,Digitalsignaturestandards(DSS),proofofdigitalsignaturealgorithm,	08
IV	KeyManagementanddistribution:Symmetrickeydistribution,Diffie-HellmanKeyExchange,Publickeydistribution,X.509Certificates,PublickeyInfrastructure.AuthenticationApplications:	08
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combiningsecurityassociations,keymanagement.IntroductiontoSecureSocketLayer,Secureelectronic, transaction(SET)SystemSecurity:IntroductoryideaofIntrusion,Intrusiondetection,Virusesandrelatedthreats,firewalls	08

Textbooks:

1. WilliamStallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. BehrouzA.Frouzan: Cryptography and Network Security, McGraw Hill .
3. CKShyamala, NHarini, Dr. T.R.Padmnabhan Cryptographyand Security ,Wiley
4. BruceSchiener, "Applied Cryptography". JohnWiley&Sons
5. Bernard Menezes,"Network Security and Cryptography", Cengage Learning.
6. AtulKahate,"CryptographyandNetworkSecurity", McGrawHill

SubjectCode:BTCSOE803A	FILTERDESIGN	3L:0T:0P	3 Credits

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	Chooseanappropriatetransformforthegivensignal.
CO2	Chooseappropriatedecimationandinterpolationfactorsforhighperformancefilters.
CO3	ModelanddesignanARsystem.
CO4	ImplementfilteralgorithmsonagivenDSPprocessorplatform.

Unit	Topics	Lectures
I	Introduction:Fundamentals,Typesoffiltersanddescriptiveterminology,whyweuseAnalogFilters,Circuitelementsandscaling,Circuitsimulationandmodelling. Operationalamplifiers:Op-ampmodels,Op-ampslewrate,Operationalamplifierswith resistivefeedback:NoninvertingandInverting,AnalysingOp-ampcircuits,Blockdiagramsandfeedback,TheVoltagefollower,Additionandsubtraction,ApplicationofOp-ampresistorcircuits.	8
II	Firstorder filter: Bilinear transfer functions and frequency response – Bilineartransferfunctionanditsparts,realizationofpassiveelements, Bodeplots,Activerealization,TheeffectofA(s),cascadedesign.	8
III	Secondorderlowpassandbandpassfilters:Designparameters,Secondordercircuit,frequencyresponseoflowpassandbandpasscircuits,Integratorsandothersbiquads.	8
IV	Secondorderfilterswitharbitrarytransmissionzeros:Byusingsumming,Byvoltagefeed forward,cascadedesignrevisited. Lowpassfilterswithmaximallyflatmagnitude:theideallowpassfilter,Butterworthresponse,Butterworthpolelocations,lowpassfilterspecifications,arbitrarytransmissionzeros.	8
V	Lowpassfilterwithequalripple(Chebyshev)magnituderesponse:Thechebyshevpolynomial,Thechebyshevmagnituderesponse,Locationofchebyshevpoles,Comparison ofmaximallyflat&equal–rippleresponses,Chebyshevfilterdesign Inversechebyshevandcauerfilters:Inversechebyshevresponse,Fromspecificationstopoleandzerolocations,Cauermagnituderesponse,Chebyshevrationalfunctions,Cauerfilterdesign.	8

Text Book:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, "Analog Filter Design", 2ndIndianEdition, 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.

SubjectCode:BTCSOE803B	BIOECONOMICS	3L:0T:0P	3 Credits

OBJECTIVE:

This course is designed with an objective to provide an understanding of the basic knowledge of bioecomics 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 simulationand 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.

BTCSOE803C

SubjectCode:BTCSOE803C	DesignThinking	3L:0T:0P	3Credits

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

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.

Unit	*Topics*	Lectures
I	Introductiontodesignthinking,traditionalproblemsolvingversusdesignthinking,history ofdesignthinking,wickedproblems.Innovationandcreativity,theroleofinnovationandcreativityinorganizations,creativityinteamsandtheirenvironments,designmindset.Introductiontoelementsandprinciplesofdesign,13MusicalNotesforDesign Mindset, Examples ofGreatDesign,DesignApproachesacrosstheworld	8
II	UnderstandinghumansasacombinationofI(self)andbody,basicphysicalneedsupto actualization,prosperity,thegapbetweendesiresandactualization.Understandingcultureinfamilysociety,institution,startup,socializationprocess.Ethicalbehavior:effectsonself,society,understandingcorevaluesandfeelings,negativesentimentsand howtoovercomethem,definitehumanconduct:universalhumangoal,developinghumanconsciousnessinvalues,policy,andcharacter.Understandstakeholders,techniquestoempathize,identifykeyuserproblems.Empathytools-Interviews,empathymaps,emotionalmapping,immersionandobservations,customerjourneymaps,andbrainstorming,ClassifyinginsightsafterObservations,ClassifyingStakeholders,Do's&Don'tsforBrainstorming,Individualactivity-'Moccasinwalk'	8

III	Definingtheproblemstatement,creatingpersonas,PointofView(POV)statements. Research-identifyingdrivers,information gathering, targetgroups,samples,andfeedbacks.IdeaGeneration-basicdesigndirections,ThemesofThinking,inspirationsandreferences,brainstorming,inclusion,sketchingandpresentingideas,ideaevaluation,doublediamondapproach,analyze–fourW's,5why's,"HowMightWe",DefiningtheproblemusingIce-CreamSticks,Metaphor&RandomAssociationTechnique,Mind-Map,ideationactivitygames-sixthinkinghats,million-dollaridea,introductiontovisualcollaborationandbrainstormingtools-	8
IV	Fundamentalconceptsofcriticalthinking,thedifferencebetweencriticalandordinarythinking,characteristicsofcriticalthinkers,criticalthinkingskills-linkingideas,structuringarguments,recognizingincongruences,fivepillarsofcriticalthinking,argumentationversusrhetoric,cognitivebias,tribalism,andpolitics.Case studyonapplyingcriticalthinkingondifferentscenarios.	8
V	Theargument,claim,andstatement,identifyingpremises and conclusion,truthandlogicconditions,valid/invalidarguments,strong/weakarguments,deductiveargument,argumentdiagrams,logicalreasoning,scientificreasoning,logicalfallacies,propositionallogic,probability,andjudgment,obstaclestocriticalthinking.Groupactivity/roleplaysonevaluatingarguments.	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

BTCSOE803D

SubjectCode:BTCSOE803D	IntroductiontoWomen'sandGenderStudies	3L:0T:0P	3Credits

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

1. To learn about Sex-Gender,Gendershaping and,SexualDivisionofWork.
2. To understand fundamental ofvariousstandsofFeminism.
3. To understand the different Women's Movement.
4. To learn various GenderRolesandPsychologyofSex.
5. To learn various GenderandMassMedia and Representation.

Unit	*Topic*	Lectures
I	**WomenandSociety:**UnderstandingSex-Gender,GendershapingInstitutions,TheoriesofGenderconstructionUnderstandingSexismandAndrocentrism,UnderstandingPatriarchyandTheoriesofPatriarchy,PrivateandPublicdichotomy,SexualDivisionofWork,Patriarchypracticesindifferentinstitutionsand TextBooks.	8
II	**FeministTheory:**RiseofFeminism,IntroductiontovariousstandsofFeminism-LiberalFeminism,RadicalFeminism,MarxistFeminism,SocialistFeminism,CulturalFeminism,Eco-Feminism,PostColonialFeminism,PostModernFeminism.WavesofFeminism.	8
III	**Women'sMovement:**Thesocio-economicconditionsofwomenduringtheageof IndustrialrevolutiontheCallfor Women'sRights1848,Women'srightsmovement1848-1920,HistoricalDevelopmentsofSocialReformMovementsinIndia,Women's groups andorganizations,Women'sMovementMovements forUniformCivilcodeandShahBanocase,Dalitwomenandthequestionofdoublemarginality.	8
IV	**GenderRolesandPsychologyofSex:**DifferenceConceptualizationofgenderrolesandgenderroleattitudes,Gender:Aggression,Achievement,Communication,FriendshipandRomantic,RelationshipsSexDifferencesinMentalHealthTraumarelatingtoRape,Taboo,ChildhoodSexualAbuse,DomesticViolence,Sexual HarassmentatWorkPlace,EducationalInstitutions,EveTeasingetc.	8
V	**GenderandRepresentation:**GenderandMassMedia-PrintMedia,GenderandMassMedia-ElectronicMedia,GenderandFilms,Advertisements,MegaSerials,Stereotypingandbreakingthenormsofwomen'srolesWomen'sRepresentationinLiteraryTexts.	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.

SubjectCode:BT CSOE803E	Quality Management	3L:0T:0P	3Credits

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	QualityConcepts:Evolution ofQuality Control, concept change,TQM Modern concept, Qualityconceptindesign,Reviewofdesign,Evolutionofprototype.ControlonPurchasedProduct:Procurementofvariousproducts,evaluationofsupplies,capacityverification,Developmentofsources,procurementprocedure.ManufacturingQuality:Methodsandtechniquesformanufacture,inspectionandcontrolofproduct,qualityinsalesandservices,guarantee,analysisofclaims.	8
2	QualityManagement:Organizationstructureanddesign,qualityfunction,decentralization, designingandfitting,organizationfordifferenttypeproductsandcompany,economicsofqualityvaluandcontribution,qualitycost,optimizingqualitycost,seductionprogram.Human Factor in quality Attitude of top management, cooperation of groups, operatorsattitude,responsibility,causesofapparatuserrorandcorrectivemethods.	8
3	ControlCharts,Theoryofcontrolcharts,measurementrange,constructionandanalysisofR charts,processcapabilitystudy,useofcontrolcharts.AttributesofControlChart,Defects,constructionandanalysisofcharts,improvementbycontrolchart,variablesample size,constructionandanalysisofCcharts.	8
4	Defects diagnosis and prevention defect study, identification and analysis of defects, correctingmeasure,factorsaffectingreliability,MTTF,calculationofreliability,buildingreliability intheproduct,evaluationofreliability,interpretationoftestresults,reliabilitycontrol,maintainability,zerodefects,qualitycircle.	8
5	ISO-9000anditsconceptofQualityManagement,ISO9000series,Taguchimethod,JITin somedetails.	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

SubjectCode:BTCSOE803F	ModelingofField-EffectNanoDevices	3L:0T:0P	3Credits

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-highkdielectric-copperinterconnects-strainengineering,SOIMOSFET,multigatetransistors–singlegate–doublegate– triplegate–surroundgate,quantumeffects–volumeinversion –mobility–threshold voltage– intersubbandscattering,multigatetechnology–mobility–gatestack	8
2	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics–CMOSTechnology–Ultimatelimits,doublegateMOSsystem–gatevoltageeffect-semiconductorthicknesseffect–asymmetryeffect–oxidethicknesseffect–electrontunnelcurrent–twodimensionalconfinement,scattering –mobility	8
3	Silicon nanowire MOSFETs – Evaluvation of I-V characteristics – The I-V characteristicsfornondegeneratecarrierstatistics–TheI-Vcharacteristicsfordegeneratecarrierstatistics–Carbonnanotube–Bandstructureofcarbonnanotube –Bandstructureofgraphene–Physicalstructureofnanotube–Bandstructureofnanotube–CarbonnanotubeFETs–CarbonnanotubeMOSFETs–SchottkybarriercarbonnanotubeFETs–Electronicconductioninmolecules–Generalmodelforballisticnanotransistors–MOSFETswith0D,1D,and2Dchannels–	8
4	RadiationeffectsinSOIMOSFETs,totalionizingdoseeffects–single-gateSOI–multi-gatedevices, singleeventeffect,scalingeffects	8

5	Digital circuits – impact of device performance on digital circuits – leakage performancetradeoff–multiVTdevicesandcircuits–SRAMdesign, analogcircuitdesign–transconductance-intrinsicgain–flickernoise–selfheating–bandgapvoltagereference–operationalamplifier–comparatordesigns,mixedsignal–successiveapproximationDAC,RFcircuits.	8

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.

SubjectCode:BTCSOE803G	ComputerizedProcessControl	3L:0T:0P	3Credits

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	BasicsofComputer-AidedProcessControl:Roleofcomputersinprocesscontrol, ElementsofacomputeraidedProcesscontrolSystem,ClassificationofaComputer –AidedProcessControlSystemComputerAidedProcess–controlArchitecture:CentralizedControlSystems,DistributedcontrolSystems,HierarchicalComputercontrolSystems.EconomicsofComputer-AidedProcesscontrol.BenefitsofusingComputersinaProcesscontrol.ProcessrelatedInterfaces:AnalogInterfaces,DigitalInterfaces,PulseInterfaces,StandardInterfaces.	8
2	Industrial communication System: Communication Networking, Industrial communicationSystems,DataTransferTechniques,ComputerAidedProcesscontrolsoftware,Typesof ComputercontrolProcessSoftware,RealTimeOperatingSystem	8
3	Process Modelling for computerized Process control: Process model, Physical model,ControlModel,Processmodelling.ModellingProcedure:GoalsDefinition,InformationPreparation,ModelFormulation,SolutionFinding, ResultsAnalysis,ModelValidation	8
4	AdvancedStrategiesForComputerisedProcesscontrol:CascadeControl,Predictive control,AdaptiveControl,Inferentialcontrol,IntelligentControl,Statisticalcontrol.	8

5	Examples ofComputerized Process Control:ElectricOven TemperatureControl, Reheat FurnaceTemperature control,Thickness and Flatness control System formetalRolling,Computer-Aidedcontrol ofElectricPowerGenerationPlant.	8

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

SubjectCode:BTCS804P