Evaluation Scheme & Syllabus
For
BACHEOLAR OF SCIENCE (CS)
B.Sc.(CS)

Under
Choice Based Credit System

(Effective from the Session: 2019-20)

IIMT UNIVERSITY

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SEMESTER – I

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-111	Principles of Programming with C/C++	Core Theory	4	0	0	30	70	100	4
2	BCS-112	Fundamentals of Computer and IT	Core Theory	4	0	0	30	70	100	4
3	BCS-113	Applied Mathematics-I	Foundation Course	4	0	0	30	70	100	4
4	BCS-114	Fundamentals of Electronics	Foundation Course	4	0	0	30	70	100	4
5	NHU-112	Environment and Ecology	AECC	2	0	0	15	35	50	2
6	BCS-115P	Office Automation Tools Lab	Core Practical	0	0	4	20	30	50	2
7	BCS-116P	Principles of Programming with C/C++ Lab	Core Practical	0	0	4	20	30	50	2
8	NECC-111	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
9	NECC-112	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
10	NECC-113	Spoken Tutorial Certification	Skill Enhancement Course	0	0	2	25	0	25	1
11	NECC-114	MOOCs (Swayam)	skill Enhancement Course	0	0	2	25	0	25	1
12	SPT-111	Sports	Audit Course	1	0	0	50	0	50	0
		Total		19	0	12	225	375	600	24

SEMESTER - II

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-121	Data Structure and Algorithms using C	Core Theory	4	0	0	30	70	100	4
2	BCS-122	Database Management System	Core Theory	4	0	0	30	70	100	4
3	BCS-123	Applied Mathematics-II	Foundation Course	4	0	0	30	70	100	4
4	BCS-124	Switching Theory and Logic Design	Foundation Course	4	0	0	30	70	100	4
5	NHU-121	English Communication	AECC	2	0	0	15	35	50	2
6	BCS-125P	Data Structure and Algorithms using C Lab	Core Practical	0	0	4	20	30	50	2
7	BCS-126P	Database Management System Lab	Core Practical	0	0	4	20	30	50	2
8	NECC-121	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
9	NECC-122	University Social Responsibility	skill Enhancement Course	0	0	0	0	0	25	0
10	NECC-123	Spoken Tutorial Certification	Skill Enhancement Course	0	0	2	25	0	25	1
11	NECC-124	MOOCs (Swayam)	Skill Enhancement Course	0	0	2	25	0	25	1
12	002	Sports	Audit Course	1	0	0	50	0	50	0
		Total		19	0	12	225	375	600	24

SEMESTER - III

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-231	Object Oriented Programming Using Java	Core Theory	4	0	0	30	70	100	4
2	BCS-232	Operating System	Core Theory	4	0	0	30	70	100	4
3	BCS-233E1/2	Choose any one 233E1: Web Technology 233E2 : Discrete Structures	Discipline Specific Elective	4	0	0	30	70	100	4
4	BCS-234E1/2	Choose any one 234E1: Computer Graphics 234E2 : Numerical Methods	Discipline Specific Elective	4	0	0	30	70	100	4
5	BCS-235	Statistical Technique	DSE	2	0	0	15	35	50	2
6	BCS-236P	Object Oriented Programming Using Java Lab	Core Practical	0	0	4	20	30	50	2
7	BCS-237P	Operating System Lab	Core Practical	0	0	4	20	30	50	2
8	NECC-231	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
9	NECC-232	University Social Responsibility	skill Enhancement Course	0	0	0	0	0	25	0
10	NECC-233	Spoken Tutorial Certification	Skill Enhancement Course	0	0	2	25	0	25	1
11	NECC-234	MOOCs (Swayam)	Skill Enhancement Course	0	0	2	25	0	25	1
12		Sports	Audit Course	-	-	-	50	0	50	0
		Total		18	0	12	225	375	600	24

SEMESTER - IV

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-241	Computer Organization and Architecture	Core Theory	4	0	0	30	70	100	4
2	BCS-242	Software Engineering	Core Theory	4	0	0	30	70	100	4
3	BCS-243E1/2	Choose any one 243E1: Python 243E2 : .Net with C#	Discipline Specific Elective	3	0	2	30	70	100	4
4	BCS-244E1/2	Choose any one 244E1: Distributed Systems 244E2: Data Mining	Discipline Specific Elective	4	0	0	30	70	100	4
5	BCS-246P	Computer System Architecture Lab	Core Practical	0	0	4	20	30	50	2
6	BCS-247P	Software Engineering Lab	Core Practical	0	0	4	20	30	50	2
7	NECC-241	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	25	0	25	0
8	NECC-242	University Social Responsibility	skill Enhancement Course	0	0	0	25	0	25	0
9	NECC-243	Spoken Tutorial Certification	Skill Enhancement Course	0	0	2	25	0	25	1
10	NECC-244	MOOCs (Swayam)	Skill Enhancement Course	0	0	2	25	0	25	1
11		Sports	Audit Course	0	0	0	50	0	50	0
		Total		17	0	14	210	340	550	22

SEMESTER - V

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-351	Design and Analysis of Algorithm	Core Theory	4	0	0	30	70	100	3
2	BCS-352	Computer Networks	Core Theory	4	0	0	30	70	100	3
3	BCS-353E1/2/3	Choose any one 353E1: Cloud Computing 353E2: Machine Learning 353E3:Digital Image Processing	Discipline Specific Elective	4	0	0	20	30	50	2
4	BCS-354	Minor Project	Discipline Specific Elective	0	0	2	20	30	50	2
5	Generic Elective30 70 100									4
6	BCS-356P	Design and Analysis of Algorithm Lab	Core Practical	0	0	4	20	30	50	2
7	BCS-357	Seminar and Viva-Voce on Summer Training	Core Practical	0	1	2	20	30	50	2
8		Sports	Audit Course	0	0	0	50	0	50	0
		Total		12	1	8	170	330	500	18

SEMESTER - VI

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal	External	Total	Credits
				L	T	P				
1	BCS-361	Artificial Intelligence	Core Theory	4	0	0	30	70	100	3
2	BCS-362	Theory of Automata and Formal Languages	Core Theory	4	0	0	30	70	100	3
3	BCS-363E1/2/3/	Choose any one 363E1: Cryptography and Network Security 363E2: Android Application Development 363E3: Mobile Computing	Discipline Specific Elective	4	0	0	15	35	50	2
4	BCS-364	Major Project	Discipline Specific Elective	0	0	4	50	0	50	2
5	Generic Elective						30	70	100	4
6	BCS-366P	Artificial Intelligence Lab	Core Practical	0	0	4	20	30	50	2
7	BCS-367	Seminar and Viva-Voce based on Major Project	Core Practical	0	0	2	0	50	50	2
8		Sports	Audit Course	0	0	0	50	0	50	0
		Total		12	0	10	175	325	500	18

Principles Of Programming With C/C++			
Course Code-BCS-111	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program, Declaration, printf(), scanf(), Operators, Expressions, Statements, Arithmetic Expressions.		
UNIT-II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, Ternary Operator, goto Statement, Loops (for, while, do-while) in C, break and continue Statements, Nested Loops.		
UNIT-III	**Functions:**Advantages of Functions, Declaring a Function, Defining a Function, Calling a Function, Argument Passing – Call by Value, Call by Reference, Types of Functions, Recursion. **Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data From Array, Using Arrays with Functions, Multi-Dimensional Arrays. **Pointers:** Basics, Pointerand Function, Array Of Pointers.		
UNIT-IV	**String:** Declaring, Initializing, String Manipulation Functions, String Input and Output Functions, String Pointer, Array of Strings, Passing String to Function. **Structure and Union:** Basic of Structures, Structures and Functions, Array of Structures, Pointer to Structure, Union. **Storage Classes:** Automatic, External, Static & Register.		
UNIT-V	**File Handling:** Introduction, File Types- Text, Binary, The File Pointer, Opening a File, Closing a File, Reading and Writing a File, File Handling Functions: fgetc(), fputc(), fputs(), fgets(), fprintf(), fscanf(), fwrite(), fread(), fseek(), ftell(), feof( ), etc. Command Line Arguments. **Preprocessors:** Introduction to Preprocessors, Preprocessor Directives: #include, #define, Macros With Arguments, Conditional Compilations.		
Text Books	1. E. Balaguruswamy, "*Programming in ANSI C",* Tata McGraw-Hill Education. 2. YashwantKanetkar, *"Let us C",* BPB Publications. 3. E. Balaguruswamy, "*Object Oriented Programming with C++",* Tata McGraw-Hill Education.		
Referential Books	1. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning 2. Ashok N. Kamthane, "*Programming in C*", Pearson Education.		

Fundamentals of Computer and IT			
Course Code-BCS-112	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction to Computers:** Introduction, Characteristics of Computers, Block Diagram of Computer, Generations, Types of Computers and Their Features, Types of Programming Languages, Types of Memory, RAM, ROM, Secondary Storage Devices (FD, CD, HD, Pen drive), Input and Output Devices		
UNIT-II	**Number Systems:** Introduction to Binary, Octal, Decimal, Hexadecimal Number Systems, Conversion, Simple Addition, Subtraction, Multiplication and division. **Algorithm and Flowcharts:** Definition, Characteristics, Advantages and Disadvantages, Symbols of Flow Chart.		
UNIT-III	**Operating System and Services:** Types of Operating System, Features of Operating System, Functions and Services of Operating System. DOS – History, Files and Directories, Internal and External Commands, Batch Files. Windows - History, Icons, Files and Folders, Control Panel, Task Bar, Desktop.		
UNIT-IV	**Internet and its Tools:** Introduction, Usage, Internet Evolution, Basic Internet Terminology, Data over Internet, Modes of Data Transmission, Types of Networks, Types of Topologies, Protocols used in the Internet, Internet Applications , IP address, Getting Connected to Internet Applications, Ethics.		
UNIT-V	**E-Mail:** Creating E-mail Account, Sending E-mail, Reading E-mail. **Emerging Trends in IT:** Introduction, Portal, Blogging, E-Learning and wiki, Social Networking, Electronic Commerce (E-Commerce), Electronic Data Interchange (EDI), Smart Cards, Mobile Communication, Internet Protocol TV		
Text Books	1. P.K. Sinha, "*Fundamental of Computers",*BPB Publications. **2.** V. Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India.		
Referential Books	**1.** Larry Long, "*Computer Fundamental", dreamtech Press.* 2. Ramesh Bangia, "*Computer Fundamentals and Information Technology", Firewall Media.*		

Applied Mathematics-I			
Course Code-BCS-113	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Matrices:** Rank of matrix, Linear transformations, Hermitian and skew–Hermitian forms, Inverse of matrix by elementary operations,Linear dependence, Consistency of linear system of equations and their solution,Diagonalisation of a matrix, Eigen values and Eigen vectors, Caley – Hamilton theorem (without proof).		
UNIT-II	**Differential Calculus – I:** Leibnitz's theorem, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.		
UNIT-III	**Differential Calculus – II:** Taylor's and Maclaurin's Theorems, Expansion of function of several variables, Jacobian, Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).		
UNIT-IV	**Multiple Integrals:** Double and triple integrals, Change of order of integration, Change of variables, Application of integration to lengths, Volumes and Surface areas – Cartesian and Polar coordinates, Beta and Gamma functions, Dirichlet's integral and applications.		
UNIT-V	**Vector Calculus:** Point function, Gradient,Divergence and Curl and their physical interpretations, Vector identities, Directional derivatives;Line,Surface and Volume integrals, Applications of Green's, Stoke's and Gauss divergence theorems (without proofs),		
Text Books	1. E. Kreyszig, "*Advanced Engineering Mathematics*", JohnWiley& Sons 2. B. V. Ramana, "*Higher Engineering Mathematics*", Tata Mc Graw- Hill Publishing Company Ltd 3. R.K.Jain&S.R.K.Iyenger, "*Advance Engineering Mathematics*", Narosa Publishing House.		
Referential Books	1. H. K. Dass, "*Introduction to Engineering Mathematics", S. Chand, New Delhi* 2. R. Wylie, "*Advanced Engineering Mathematics*", McGraw-Hill.		

Fundamentals of Electronics			
Course Code-BCS-114	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Semiconductor Diodes and Applications:** p-n Junction Diode, Characteristics and Parameters, Diode Approximations, DC Load Line Analysis, Half-wave Rectifier, Two-Diode Full-wave Rectifier, Bridge Rectifier, Capacitor filter Circuit (Only Qualitative Approach), Zener Diode Voltage Regulators: Regulator Circuit With No Load, Loaded Regulator, Numerical Examples As Applicable. **Bipolar Junction Transistors:** BJT Operation, BJT Voltages and Currents, BJT Amplification, Common Base, Common Emitter and Common Collector Characteristics, Numerical Examples As Applicable.		
UNIT-II	**BJT Biasing:** DC Load line and Bias Point, Base Bias, Voltage divider Bias, Numerical Examples As Applicable. **Introduction to Operational Amplifiers:** Ideal OPAMP, Inverting and Non Inverting OPAMP circuits, OPAMP Applications: Voltage Follower, Addition, Subtraction, Integration, Differentiation; Numerical Examples As Applicable.		
UNIT-III	**Field Effect Transistors (FET) and Its Biasing**: Junction Field Effect Transistors(JFET), Comparison of BJT and FET, Concept of Pinch Off, JFET Characteristics, CG, CS and CD Configurations, Self-Biasing, Trans-conductance, Amplification and Switching, MOSFETs (D-type and E-type MOSFET), CMOS Introduction, E-MOSFET Amplifier, MOSFET Testing.		
UNIT-IV	**Communication Systems:** Introduction, Elements of Communication Systems, Modulation: Amplitude Modulation, Spectrum Power, AM Detection (Demodulation), Frequency and Phase Modulation, Amplitude and Frequency Modulation: A comparison.		
UNIT-V	**Transducers:** Introduction, Passive Electrical Transducers, Resistive Transducers, Resistance Thermometers, Thermistor, Linear Variable Differential Transformer (LVDT), Active Electrical Transducers, Piezoelectric Transducer, Photoelectric Transducer.		
Text Books	1. Franz Monssen, Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", Prentice Hall. 2. Sanjay Sharma, "*Basic Electronics",* S. K. Kataria& Sons.		
Referential Books	1. David A. Bell, "*Electronic Devices and Circuits*", Oxford University Press. 2. D.P. Kothari, I. J. Nagrath, "*Basic Electronics*", McGraw Hill Education.		

Environment and Ecology			
Course Code-NHU-112	**Theory Course**	**L-T-P-C**	**2-0-0-2**
Course Contents			
UNIT-I	**The Multidisciplinary Nature Of Environmental Studies:** Definition, Scope and Importance, Need for Public Awareness.		
UNIT-II	**Natural Resources:** Renewable And Non-Renewable Resources; **Natural Resources and Associated Problems**: - A) Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies. Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People. B) Water Resources: Use and Over-Utilization of Surface and Groundwater, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems. C) Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies. D) Food Resources: World Food Problems, Changes Caused By Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies. E) Energy Resources: Growing Energy Needs, Renewable and Nonrenewable Energy Sources, Use of Alternate Energy Sources, Case Studies F) Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification. Role of an Individual In Conservation Of Natural Resources; Equitable Use of Resources for Sustainable Lifestyles		
UNIT-III	**Ecosystems:** Concept of an Ecosystem; Structure and Function of an Ecosystem; Producers, Consumers and Decomposers; Energy Flow in the Ecosystem; Ecological Succession; Food Chains, Food Webs and Ecological Pyramids; Introduction, Types, Characteristic Features, Structure And Function of the Following Ecosystem: - A) Forest Ecosystem B) Grassland Ecosystem C) Desert Ecosystem D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)		
UNIT-IV	**Biodiversity and Its Conservation:** Introduction – Definition: Genetic, Species and Ecosystem Diversity;Biogeographically Classification of India; Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, and Aesthetic and Option Values; Biodiversity at Global, National and Local Levels; India as a Mega-Diversity Nation; Hot-Sports of Biodiversity; Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts; Endangered and Endemic Species of India; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.		

UNIT-V	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Pollution; Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes; Role of an Individual in Prevention of Pollution; Pollution Case Studies; Disaster Management: Floods, Earthquake, Cyclone and Landslides.
UNIT-VI	**Social Issues and The Environment:** From Unsustainable to Sustainable Development; Urban Problems Related to Energy; Water Conservation, Rain Water Harvesting, Watershed Management; Resettlement and Rehabilitation of People; Its Problems and Concerns. Case Studies; Environmental Ethics: Issues and Possible Solutions; Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents And Holocaust. Case Studies; Wasteland Reclamation; Consumerism And Waste Products; Environment Protection Act; Air (Prevention and Control Of Pollution) Act; Water (Prevention and Control Of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues Involved in Enforcement of Environmental Legislation; Public Awareness
UNIT-VII	**Human Population and The Environment:** Population Growth, Variation Among Nations; Population Explosion: Family Welfare Programme; Environment and Human Health; Human Rights; Value Education; Women and Child Welfare; Role of Information Technology in Environment and Human Health; Case Studies
UNIT-VIII	**Field Work:** • Visit to a Local Area to Document Environmental Assets-River/ Forest/ Grassland/ Hill/ Mountain. • Visit to a Local Polluted Site – Urban/ Rural/ Industrial/ Agricultural • Study of Common Plants, Insects, Birds. • Study of Simple Ecosystems-Pond, River, Hill Slopes, etc. (Field Work Equal to 5 Lecture Hours).
Text Books	1. A. Basak, "*Environmental Studies",* Pearson Education. 2. Anil Kumar De, "*Environmental Studies*", New Age International
Referential Books	1. J. P. Sharma, "*Environmental Studies*", University Science Press

Office Automation Tools Lab			
Course Code-BCS-115P	**Theory Course**	**L-T-P-C**	**0-0-4-2**
Course Contents			

Practical Work should be based on office automation tools - Word, Excel, and Power Point and will cover the following topics:

Office Tools: Basic Concepts, Uses.

Word: Menu Bar, Menus, Submenus, Tool Bar, Tools, Customizing Toolbar, Hiding Toolbar, Creating and Saving Documents, Working with an Existing Document, Auto Text, Auto Complete and Auto Correct; Formatting a Document, Word Art, Using Tables and Columns-Table Creation and Modification Giving Stress to Auto-Fit, Auto-Format; Object Linking and Embedding, Inserting and Sizing Graphics, Hyperlink, Envelopes & Label Creation, Grammar & Spell Check, Previewing and Printing Documents, Mail Merge.

Excel: Creating a Simple Spreadsheet, Editing a Spreadsheet, Working with Functions and Formula, Formatting Worksheets, Creating Charts, Inserting and Formatting Data in a Worksheet, Working with an Existing Data List, Auto Fill, Fill Series and Auto- complete Options, Formatting Cells; Sorting & Filtering Data, Conditional Formatting, Interlinking Worksheets and Files, Setting Filters and Performing Calculations on Filtered Data etc.

Power Point: Creating and Viewing Presentations, Editing a Presentation, Editing Master Slides, Inserting, Sorting, Hiding and Deleting Slides, Inserting Pictures, Creating Tables, Slide Layouts, Adding Transition and Animation Effect, Hyper Linking Slides & Files.

Data Structure and Algorithms Using C			
Course Code-BCS-121	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.		
UNIT-II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists, Polynomial representation.		
UNIT-III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deques, Priority Queues, Applications of Queue, Array and Linked list representation of Stack and Queue		
UNIT-IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal;Traversal of Binary Trees; Application of Binary Trees; Binary Search Tree (BST), Insertion and Deletion in BST, B-Tree, B+ Tree.		
UNIT-V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Quick Sort, Merge Sort, Heap Sort, Linear Search, Binary Search and Hashing.		
Text Books	1. Tenenbaum**, "***Data Structures Using C***",** Pearson Education. 2. Samir Kumar Bandyopadhyay, K. N. Dey, "*Data Structures Using C",* Pearson Education. 3. Lipschutz (Schaum's Series), "*Data Structure with C",* Tata McGraw Hill Education		
Referential Books	1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education. 2. E. Horowitz, S. Sahni& D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications. 3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.		

Database Management System			
Course Code-BCS-122	**Theory Course**	**L-T-P-C**	**3-0-0-3**
Course Contents			
UNIT-I	**Introduction:**Characteristics of Database Approach, File Management System Vs DBMS, Components of DBMS, DBMS Architecture, Data Abstraction, Data Independence, DBMS Models, Database Languages, Types of Database Users, Role of Database Administrator. **E-R Modeling**: Introduction, Entity Relationship Diagram, Entity, Entity Types, Entity Set, Attributes and Key, Relationships, Relation Types, Roles and Structural Constraints, Concepts of Composite, Derived and Multi-valued Attributes; Super Key, Candidate key, Primary Key, Strong and Weak Entities, Reducing ER Diagram to Tables, Enhanced Entity-Relationship Model (EER Model), Object Modeling, Sub Classes, Super Classes, Inheritance, Generalization and Specialization, Constraints on Specialization and Generalization.		
UNIT-II	**Relational Data Model:**Relational Model Concepts, CODD's Rules, Relational Constraints **Relational Algebra:** Selection and Projection, Set Operations, Renaming, Join, Division. **Data Normalization:** Anomalies, Functional Dependencies, FDs and Keys, Multivalued and Join Dependencies, Normal forms (1NF, 2 NF, 3NF and BCNF, 4NF, 5NF), De-Normalization, Lossless Join and Dependency Preserving Decomposition.		
UNIT-III	**SQL:**Overview, Characteristics of SQL, Advantage of SQL, SQL Data Types and Literals, Types of SQL commands-DDL, DML, DCL, Basic SQL Queries. Constraint Specifications: Primary Key, Not NULL, Unique, Check, Referential key; **Logical Operators-**BETWEEN, IN, AND, OR and NOT, LIKE; Aggregate Operators-The GROUP BY and HAVING Clauses; Nested Queries, Correlated Nested Queries, Set-Comparison Operators, Joins-Inner joins, Outer Joins, Left outer, Right outer, full outer joins; Overview of views and indexes.		
UNIT-IV	**Transaction Processing and Concurrency Control:** Definition Of Transaction, Desirable ACID Properties, Overview of Serializability, Serializable and Non-Serializable Transactions; Definition of Concurrency, Lost Update, Dirty Read And Incorrect Summary Problems Due to Concurrency, Locking, 2PL, Timstamp Ordering.		
UNIT-V	**Database Security and Recovery:** System Failure, Backup and Recovery Techniques, Authorization and Authentication**.** **File Organization:** Sequential Access File, Indexed Sequential Access Files, Direct Access File, Indexing, Multilevel Indexing, B & B+ Trees, Hashing, Hashing Functions, Collision Resolution, Extendible Hashing, and Dynamic Hashing.		
Text Books	1. Abraham Silberschatz, Henry Korth, S.Sudarshan, "Database Systems Concepts", McGraw Hill. 2. Navathe, "Fundamental of database Systems", Pearson Education.		
Referential Books	1. Jim Melton, Alan Simon, "Understanding the new SQL: A complete Guide", Morgan Kaufmann Publishers. 2. A.K.Majumdar, P. Bhattacharya, "Database Management Systems", Tata McGraw Hill. 3. Bipin Desai, "An Introduction to database systems", Galgotia Publications		

Applied Mathematics-II			
Course Code-BCS-123	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Differential Equations:** Linear differential equations of nth order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Normal form, Method of variation of parameters, Applications(without derivation).		
UNIT-II	**Series Solution and Special Functions:** Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.		
UNIT-III	**Laplace Transform:** Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.		
UNIT-IV	**Fourier Series:** Euler's Formulae, Functions having arbitrary periods, Periodic functions, Fourier series of period 2π, Change of interval, Even and odd functions, Half range sine and cosine series		
UNIT-V	**Partial Differential Equations:** Solution of first order partial differential equations by Lagrange's method, Solution of second order linear partial differential equations with constant coefficients, Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.		
Text Books	1. E. Kreyszig, "*Advanced Engineering Mathematics*", JohnWiley& Sons 2. B. V. Ramana, "*Higher Engineering Mathematics*", Tata Mc Graw- Hill Publishing Company Ltd 3. R.K.Jain&S.R.K.Iyenger, "*Advance Engineering Mathematics*", Narosa Publishing House.		
Referential Books	1. H. K. Dass, "*Introduction to Engineering Mathematics", S. Chand, New Delhi* 2. R. Wylie, "*Advanced Engineering Mathematics*", McGraw-Hill.		

Switching Theory and Logic Design			
Course Code-BCS-124	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Data Representation:** Number System: Binary, Octal, Decimal, Hexadecimal; Data Representation for Computation; r's and r-1's Complement, Uses of Complement, Arithmetic Operation on Binary Numbers, Decimal Representation in Computers:BCD, Gray codes and Excess-3 codes; Alphanumeric Representation, Error-Detection and Correction Codes.		
UNIT-II	**Logic Gates and Circuits:** Gates, Boolean Algebra, Laws of Boolean Algebra, Demorgan's Theorems, Minterms, Maxterms, SOP Form and POS Form, Standard and Canonical Form, Conversion of SOP/POS Expression to its Standard SOP/POS Form, Simplifications of Logic Equations Using Laws of Boolean Algebra and Karnaugh Map, Universal Gates, Implementation of Logic Circuit, Logic Circuit Implementation using NAND and NOR Gates.		
UNIT-III	**Combinational Circuits:** Definition,Design of Combinational Circuits,Adder, Subtractor, Comparator, Decoder, Encoder, Code Convertor, Multiplexer, Demultiplexer, Parity Bit Checker and Generators, Parallel Binary Adder/Subtractor, Read Only Memory and Programmable Logic Array.		
UNIT-IV	**Sequential Circuits I:** Definition, Flip-Flops,Latch, Race Around Condition, RS Flip-flop using NAND/NOR Gates, Clocked RS, JK Flip-flop, D Flip-flop, T Flip-flop, Excitation Tables, Master Slave Flip-Flop, Edge Triggered Flip-Flop, Conversion of Flip-Flops, Sequential Circuit Design.		
UNIT-V	**Sequential Circuits II:** Register, Serial and Parallel Shift Registers, Bi-Directional Shift Registers with Parallel Load, Counters,Asynchronous and Synchronous Counters, Up/Down Counters, Modulo-N Counters, BCD Counters, Design of a Simple Counter, Random Access Memory (RAM).		
Text Books	1. Morris Mano, "*Digital Logic and Computer Design*", PHI. 2. Morris Mano, "*Computer Architecture*", PHI.		
Referential Books	1. R.P.Jain, "*Modern Digital Electronics*", Tata McGraw Hill. 2. Malvino and Leach, "*Digital Principles and Application*", Tata McGraw Hill. 3. A. Anand Kumar, "*Switching Theory and Logic Design*", PHI.		

English Communication			
Course Code-NHU-121	**Theory Course**	**L-T-P-C**	**2-0-0-2**
Course Contents			
UNIT-I	**Introduction to Communication** • Nature and Process of Communication • Levels of Communication • Language as a tool of Communication		
UNIT-II	**Language of Communication** • Verbal and Non-Verbal • Spoken and Written • Personal, Social and Business • Barriers to Communication(Intra-personal, Inter-personal and Organizational communication)		
UNIT-III	**Speaking Skills** • Monologue • Dialogue • Group Discussion (Methodology & Guidelines) • Interview (Types & Frequently Asked Questions) • Public Speaking (Dos & Don'ts)		
UNIT-IV	**Reading and Understanding** • Reading Comprehension • Difference between Abstract &Summary • Paraphrasing • Precise Writing		
UNIT-V	**Writing Skills** • Notices, Agenda , Minutes of Meeting • Letter writing (Formal & Informal) • Email Writing • Report Writing (Kinds, Structure)		
Text Books	1. John Seely , "*Oxford Guide to Writing and Speaking*", Oxford University Press. 2. M. Asraf Rizvi, "Effective Technical Communication", Tata McGraw Hill. 3. Fluency in English- Part II, Oxford University Press, 2006. 4. Business English, Pearson, 2008. 5. Language, Literature and Creativity,OrientBlackswan, 2013.		
Referential Books	**1.** Wren & Martin, "English Grammar & Composition", S. Chand Publishing. **2.** Dr.GauriMishra,DrRanjanaKaul, DrBrati Biswas, Language through Literature. **3.** Technical Communication, Meenakshi Raman & Sangeeta Raman		

Object Oriented Programming WithJava			
Course Code-BCS-231	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction to OOPs and Java:** OOPs Concepts, Top-Down Approach and Bottom-Up Approach, Introduction to Java, History of Java, Features of Java,Byte Code, JVM, JRE, JDK,JIT, Java Applications, Character Set, Identifiers, Literals, Comments, Keyword, Data Type, Operators, Conditional Statements, Looping Statements, Array-Declaration, Creation, Initialization, String Handling- Predefined Functions in String, String Methods, Vectors, Command-Line Arguments.		
UNIT-II	**Classes, Objects and Methods:** Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects,Constructors, Types of Constructors, this & static keyword, GarbageCollection, Inheritance, Types of Inheritance, Creating Multilevel Hierarchy,Method Over Loading & Overriding, Dynamic Method Dispatching, finalkeyword, Abstract Class.		
UNIT-III	**Interfaces and Packages:** Defining Interfaces, Extending and ImplementingInterfaces, Defining Packages, Access Protection, Importing Packages, **Exception Handling:** Exception Types, Multiple Catch Clauses, Nested TryStatements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating YourOwn Exception Subclasses. **Multithreaded Programming:** Thread Life Cycle, Creating Threads, ThreadMethods, Thread Priority		
UNIT-IV	**Managing I/O Files:** Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File, Buffering Files, Random Access Files, Interactive I/O. **GUI Programming:**GUIComponents, AWT, Swings, Event Handling.		
UNIT-V	**Introduction to Applet Programming:** Introduction to Applet,AppletArchitecture,Applet Life Cycle, Applet Class, Applet Tag, Applet Methods, Running the Applet. **JDBC:** Accessing Databases With Java Database Connectivity		
Text Books	1. Patrick Naughton and HerbertzSchildt, "Java-2 The Complete Reference", McGraw Hill. 2. Ivor Horton, "Beginning Java-2", Wiley Publishing. 3. Balaguruswamy, "*Programming with Java: A Primer",* Tata McGraw Hill Education.		
Referential Books	1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education. 2. Horetmann Cay and Cornell Gary, "Core JavaTM 2, Volume II – Advanced Features", Pearson Education.		

Operating System			
Course Code-BCS-232	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Basics of Operating Systems**: Definition, Types of Operating Systems, OS Operations, OS Services, System Calls, OS Structures-Layered, Monolithic, Microkernel Operating Systems. **Memory Management:** Background, Logical versus Physical Address space, Swapping, Contiguous Allocation, Paging, Segmentation		
UNIT-II	**Processes:** Definition,Process States, Process State Transitions, Process Control Block, Context Switching, Threads, Concept of Multithreads **Process Scheduling:** Scheduling Objectives, Types of Schedulers, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.		
UNIT-III	**Process Synchronization:** Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of Synchronization- Bounded Buffer Problem, Producer Consumer Problem and Dinning Philosopher Problem. **Deadlock**: Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.		
UNIT-IV	**Virtual Memory:** Basics of Virtual Memory, Hardware and Control Structures, Locality of Reference, Demand Paging, Page Replacement, Page-Replacement Algorithms, Thrashing. **File System**: Concept, Function of File System, Access Methods, Allocation Methods, File System Structure, Directory Structures and Protection, Free-Space Management.		
UNIT-V	**Disk Management:** Disk Structure, Disk Scheduling Algorithm, Swap-Space Management. **I/O Management:** Principles of I/O Hardware-I/O devices, Types of Devices, Device Controllers,Interrupt Handlers, Direct Memory Access, Buffering, Spooling.		
Text Books	1. Silberschatz and Galvin, "*Operating System Concepts*", John Wiley & Sons. 2. Haldar&Aravind, "*Operating System*", Pearson Education.		
Referential Books	1. Madnick& Donovan, "*Operating Systems*", Tata McGraw Hill. 2. Tanenbaum, "*Operating Systems*", PHI.		

Web Technology			
Course Code-BCS-233E1	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Web Page, Website, Web Browser, Internet Address, Uniform Resource Locator(URL), Web Essentials: Clients, Servers, and Communication; Web Servers-Apache, IIS, Proxy Server,HTTP Request Message-Response Message; Web Hosting, TCP/IP Protocol Suite, Installation and Managing Web-Server: IIS/XAMPP/LAMP, Browser Architecture and Web Site Structure		
UNIT-II	**HTML:**Basics of HTML, Formatting and Fonts, Commenting Code, Color, Hyperlink, Lists, Tables, Images, Forms, XHTML, Meta Tags, Character Entities, Frames and Frame Sets,AudioandVideo		
UNIT-III	**Cascading Style Sheets (CSS):** Need for CSS, Introduction to CSS, Basic Syntax and Structure, Using CSS, Background Images, Colors and Properties, Manipulating Texts, Fonts, Borders and Boxes, Margins, Padding, Lists		
UNIT-IV	**XML:** Introduction, Features, XML Document Structure, XML Markups-Element Markup, Attribute Markup, Naming Rules, Components, Comments, Document Type Definitions (DTD)– Internal and External DTD, Developing DTD, Well Formed XML Documents, Valid XML Documents, Validating an XML document using a DTD, XML Schema, Displaying XML Documents, XSL and CSS, XML Namespaces, XML DOM, eXtensible Stylesheet Language Transformations (XSLT).		
UNIT-V	**Java Script**-Introduction, Client-Side JavaScript, Server-Side JavaScript, Data Types, JavaScript Objects, Control Structures, Function, Operators, Statements, Document and Its Associated Objects, Events and Event Handlers, JavaScript Security.		
Text Books	1. AravindShenoy, "*Thinking in HTML*", Packt Publishing. 2. Suehring "*Java Script Step by Step*",Prentice Hall India Learning Private Limited. 3. Behrouz A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill.		
Referential Books	1. A.S.Tanenbaum, "*Computer Networks*", Pearson Education Asia. 2. Uttam Kumar Roy, "*Web Technologies",* Oxford University Press. 3. Raj Kamal, "*Internet and Web Technologies",* Tata McGraw Hill.		

Discrete Structures			
Course Code-BCS-233E2	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Sets**: Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.		
UNIT-II	**Relations and Functions:** Properties of Relations, Equivalence Relation, Partial Order Relation, Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.		
UNIT-III	**Partial Order Relations and Lattices:** Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, Glb, lub, Lattices & Algebraic Systems, Principle of Duality, Basic Properties, Sub lattices, Distributed & Complemented Lattices		
UNIT-IV	**Propositional Logic:** Proposition, First Order Logic, Basic Logical Operation, Truth Tables, Tautologies, Contradictions, Algebra of Proposition, Logical Implications, Logical Equivalence, Predicates, Universal and Existential Quantifiers.		
UNIT-V	**Graphs:** Types and Operations (Bipartite Graph, Subgraph, Distance of a graph, cut-Edges & Cut Vertices, Isomorphic and Homomorphic Graphs), Degree of Graphs, Adjacent and Incidence Matrices, Path, Circuit, Hamiltonian Graph, Graph Colouring.		
Text Books	1. C. L. Liu, "*Elements of Discrete Mathematics*", McGraw Hill Education. 2. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "*Discrete Mathematical Structures*", Prentice Hall 3. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.		
Referential Books	1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "*Discrete Mathematics for Computer Scientists*", Reston Pub. Co. 2. Pundir&Pundir, "*Discrete Mathematics*", PragratiPrakashan. 3. Kenneth H. Rosen, "*Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory*", Tata McGraw Hill Education		

Computer Graphics			
Course Code-BCS-234E1	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Basic of Computer Graphics, Difference Between Manual and Computer Graphics, Uses of Computer Graphics, Image Processing, Visual Display Devices-Refresh CRT, Raster-Scan Displays, Random-Scan Displays, Color-CRT Monitors, DVST, Flat Panel Displays, 3-D Viewing Devices, Stereoscopic and Virtual-Reality Systems; Raster-Scan System, Random Scan System, Graphics Monitors and Workstations, Input Devices, Hard-Copy Devices, Color Models: RGB, YIQ, XYZ, CMY, HLS Color Models.		
UNIT-II	**Output Primitives Algorithms:** Scan Conversion: Point, Line, Circle, Ellipse, Polygon; Filled area algorithms: Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Aliasing, and Introduction to Anti Aliasing.		
UNIT-III	**Geometric Transformations:** 2D Transformations (Translation, Rotation, Scaling, Reflection, Shear, Inverse Transformation, Composite Transformation, Affine Transformation), Homogeneous Coordinates and Matrix Representation, Matrix Representation of 3-D Transformations, Composition of 3-D Transformation.		
UNIT-IV	**Two Dimensional Viewing and Clipping:** Viewing Pipeline, The Window-to-Viewport Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping- Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping, Cyrus-Beck Algorithm, Midpoint Subdivision Algorithm; Polygon Clipping-Sutherland-Hodgeman Polygon Clipping Algorithm.		
UNIT-V	**Three Dimensional Viewing and Clipping:** Viewing Pipeline, Projections, Types of Projections, The Mathematics of Planner Geometric Projections, Parametric Representation of Curves: Bezier Curves, B-Spline Curves; Parametric Representation of Surfaces; Octree, Interpolation method; Clipping, Introduction to Hidden Surface Removal, the Z-Buffer Algorithm, Scan-line Algorithm, Area-Subdivision Algorithm.		
Text Books	1. D. Haran & M. P. Baker, "*Computer Graphics*", Pearson Education. 2. Foley, Van Dam, Feiner, Hughes, "*Computer Graphics: Principles & Practice*", Addison-Wesley Professional.		
Referential Books	1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press. *2.* John Vince, "*Mathematics for Computer Graphics",* Springer.		

Numerical Methods			
Course Code- **BCS-234E2**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Interpolation and Extrapolation:** Finite Differences, Shifting Operator, Factorial Notation, Newton's Forward And Backward Differences, Newton's Dividend Differences Formulae, Lagrange's Interpolation Formula For Unequal Intervals, Gauss's Interpolation Formula, Starling Formula, Bessel's Formula, Laplace-Everett Formula.		
UNIT-II	**Solution of Algebraic and Transcendental Equation:** Graphical Method, Bisections Method, False Position Method, Newton-Raphson Method, Rate Of Convergence Of Newton's Method.		
UNIT-III	**Numerical Differentiation, Numerical Integration:** Introduction, Direct Methods, Maxima and Minima of a Tabulated Function, General Quadratic Formula, Trapezoidal Rule, Simpson's One Third Rule, Simpson's Three-Eight Rule, Weddle's Rule.		
UNIT-IV	**Solution of Differential Equations:** Taylor's Series Method**,** Euler's Method, Milne's Method, Ranga–Kutta Method, Picard's Method.		
UNIT-V	**Solution of Linear Equation and Inverse of the Matrix:** Gauss's Elimination Method, Gauss's Seidel Iterative Method, Jacobi's Method, find Inverse of a Matrix by Matrix Method, Gauss's Elimination Method,		
Text Books	1. Scarboruogh, "*Numerical Mathematical Analysis*", Johns Hopkins Press. 2. Gupta & Bose, "*Introduction to Numerical Analysis*",Academic Publishers.		
Referential Books	1. S.S.Sastry, "*Introductory Methods of Numerical Analysis*", PHI 2. Manish Goyal, "*Computer Based Numerical & Statistical Techniques*", Laxmi Publication 3. Vedamurthy&Iyengar," Numerical Methods", Vikas Publishing House		

Statistical Technique			
Course Code-BCS-235	**Theory Course**	**L-T-P-C**	**2-0-0-2**
Course Contents			
UNIT-I	**Introduction**: Definition, Importance & Limitation of Statistics. Collection of Data and Formation of Frequency Distribution. Graphic Presentation of Frequency Distribution– The Histogram, The Frequency polygon, The frequency Curve, Cumulative frequency curve , Sampling, Methods of Sampling.		
UNIT-II	**Measures of Central Tendency & Dispersion**: Measures of Central Tendency – Mean, Median and Mode, Partition Values – Quartiles, Deciles and Percentiles. Measures of Variation – Range, IQR, Quartile, Deciles and Percentiles, Mean Deviation, Standard Deviation and Variance.		
UNIT-III	**Correlation:** Type of correlation, Degree of correlation**,**Correlation Coefficient, Assumptions of Correlation Analysis, Measurement of Correlation- Karl Person's Methods, Spearman's Rank Correlation.		
UNIT-IV	**Regression Analysis:** Concept of Regression, Types of Regression, Regression Analysis, Regression Lines, Regression line Y on X, Regression line X on Y, Regression Coefficient , Regression calculation in a Bivariate Grouped Frequency Distribution		
Text Books	1. J. K. Sharma,"*Operations Research: Problems & Solutions*", Macmillan India 2. S. P. Gupta, and P. K. Gupta, "*Quantitative Techniques and Operations Research*", Sultan Chand & Sons. 3. N. D. Vohra, "*Quantitative Techniques in Management*", Tata McGraw Hill Education.		
Referential Books	1. S. P. Gupta, "*Statistical Methods*", Sultan Chand &Sons. 2. A. M. Natarajan, P Balasubramani, A. Tamilarasi, "*Operations Research*", Pearson Education. 3. R.L.Rardin, "*Optimization in Operations Research*", Prentice Hall.		

Computer Organization and Architecture			
Course Code-BCS-241	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Basic Computer Organization and Design:** Instructions and Instruction Codes, Computer Registers,Timing and Control, Instruction Cycle, Register Transfer and Micro Operations-Registration Transfer Language, Register Transfer Instructions, Busand Memory Transfer Instructions, Arithmetic and Logic Micro-Operations, Shift Micro-Operations, Arithmetic Logic Shift Unit; Memory-ReferenceInstructions, Input-Output and Interrupts, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.		
UNIT-II	**Central Processing Unit:** General Register Organization,Stacks Organization, Instruction Formats, Addressing Modes, RISC, CISC, Parallel Processing, Pipelining, Instruction and Arithmetic Pipeline, Vector Processing,Matrix Multiplication, Array Processors.		
UNIT-III	**Computer Arithmetic:** Addition, Subtraction Algorithms; Multiplication Algorithms: Shift and Add Algorithms, Booth's Algorithm; Divisor Algorithms, Floating Point Representations, Arithmetic Operations on Floating-Point Numbers, Decimal Arithmetic Operations.		
UNIT-IV	**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupts, Direct Memory Address (DMA), Input/ Output Processor (IOP), Serial Communication.		
UNIT-V	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, AssociativeMemory, Cache Memory, Virtual Memory, Memory Management Hardware		
Text Books	1. Morris Manno, "*Computer System Architecture*", Pearson Education. 2. W. Stallings , "*Computer Organisation And Architecture*", Pearson Education		
Referential Books	1. Rao, "*Prospective in Computer Architecture*" , Prentice Hall of India 2. John P. Hayes, "*Computer Architecture and Organization*", McGraw-Hill		

Software Engineering			
Course Code-BCS-242	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction**: Software- Characteristics and Applications, Software Engineering, Software Engineering Layers, Software Process Framework, CMM, Software Quality Attribute and Metrics, Software Development Life Cycle, Software Process Models- Water Fall Model, Prototyping Model, RAD Model, Spiral Model, Evolutionary Models, Component-based Development Model.		
UNIT-II	**Software Requirements Engineering and Analysis Modeling:** Software Requirements, Requirement Engineering Process, Elicitation Requirements, Analysis and Negotiating Requirements, Requirement Specification, System Modeling, Requirements Validation, Requirement Management, Creating a Software Requirements Specification Document, IEEE Standards for SRS, Feasibility Study, Elements of Analysis Model, Data Modeling- ER Diagram, Information Modeling- DFD, Behavioral Modeling, Control Specification, Process Specification, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.		
UNIT-III	**Software Design and Implementation:** Design Process, Principles, and Design Concepts-Abstraction, Architecture, Refinement, Modularity, Data Structure, Information Hiding, Functional Independence, Cohesion, Coupling; Design Documentation, Design Strategies-Top Down and Bottom Up Design; Design Model-Data Design Elements, Architectural Design, User Interface Design, Component-Level Design, Deployment-Level Design, Implementation Issues and Programming Support Environment, Quality Metrics for Design Model and Source Code		
UNIT-IV	**Software Testing:** Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, Regression Testing, Test Characteristics, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, Test Plan, Test Case Design, Quality Metrics for Testing.		
UNIT-V	**Software Maintenance:** Nature and Need of Maintenance, Types of Maintenance (Perceptive, Preventive, Adoptive, Corrective), Cost of Maintenance, Evolution of Software, Software Maintenance Process, Software Maintenance Techniques-Reverse Engineering, Reengineering; Factors affecting Software Maintenance, Key Issues in Maintenance, Software Configuration Management, Version and Release Control, Change Control, Configuration Audit, Metrics for Maintenance.		
Text Books	1. Roger S. Pressman, "*Software Engineering: A Practitioner's Approach*", Addison-Wesley 2. Pankaj Jalote, "*An Integrated Approach to Software Engineering*", Springer.		
Referential Books	1. K. K. Aggarwal & Yogesh Singh "*Software Engineering*", New Age International. 2. I. Sommerville, "*Software Engineering*", Pearson Education. 3. James Peter, W. Pedrycz, "*Software Engineering: An Engineering Approach*", John Wiley & Sons. 4. Subramanian Chandramouli, SaikatDutt, ChandramouliSeetharaman, B. G Geetha, "*Software Engineering",* Pearson Education India.		

Python			
Course Code- **BCS-243E1**	**Theory Course**	**L-T-P-C**	**3-0-2-4**
Course Contents			
UNIT-I	**Introduction to Python:** Features of Python, Elements of Python. Python Interpreter, Python shell, Indentation, Atoms, Identifiers and keywords, Variables, Data Types, Literals, Comments, Operators(Arithmetic Operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).		
UNIT-II	**Conditional Statement** - If, If- else, Nested if-else, elif . **Looping** - while Loop, for Loop and nested loops, Loop Control Statements-break, continue and pass.		
UNIT-III	**Data Structures:** Lists, Tuples, Dictionary, Sets, Numbers, Strings **Functions:** Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **Module:** Importing a module, Packages.		
UNIT-IV	**File I/O Operations:** Opening and Closing File, Reading and Writing a File, In-built Functions: tell(), seek(), write(), writelines(), read(), readlines(), file Object Attributes, Directories in Python. **Exceptions:** ExceptionHandling, try Statement, expect Clause, finally Clause, User-defined Exceptions, raise Statement.		
UNIT-V	**Object Oriented Programming:** Class and object, Constructor, Destructor, Inheritance, Overloading, Overriding, and Data hiding. **GUI programming** usingtkinter, Database handling using MySQLdb		
Text Books	**1.** Pooja Sharma, *"Programming in Python",* BPB Publications. **2.** Mark Summerfield, "*Programming in Python 3: A Complete Introduction to the Python Language",* Pearson Education.		
Referential Books	1. Mark Lutz, *"Programming Python"***,** O'Reilly Media. 2. Wesley J. Chun, ***"****Core Python Programming****",*** Prentice Hall. 3. Alex Martelli, *"Python in a Nutshell"***,** O'Reilly Media.		

.Net with C#			
Course Code- **BCS-243E2**	**Theory Course**	**L-T-P-C**	**3-0-2-4**
Course Contents			
UNIT-I	**The .Net framework:** Introduction, The Origin of .Net Technology, Architecture of .Net Framework, Features and Advantages of .Net, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In-Time Compilation, Framework Base Classes.		
UNIT-II	**C# Basics:** Introduction, Data Types, Identifiers, Variables, Constants, Literals, C# statements, Operators, Conditional Control Structure, Loop Control Structure, Methods, Array and Strings, Structure, Enumeration		
UNIT-III	**Object Oriented Concept**s: Object and Classes, Inheritance and Polymorphism, Operator Overloading, Interfaces, Type conversion.		
UNIT-IV	**Advanced Features:** Collections, Delegates, Events, Indexes, Attributes, Reflection, Versioning, Multi-Threading, Managing Console I/O Operations, Error Handling, Unsafe Code.		
UNIT-V	**Developing GUI Application and Data Handling:**Web Forms, Web Form Controls,Web Services, Window Services, Building Windows Applications, Graphical Device interface with C#, Data Access with ADO.NET, Components of ADO.NET.		
Text Books	1. E. Balaguruswammy, "Programming in C#", Tata McGraw Hill 2. Jesse Liberty, "*Programming C#",* O'Reilly Media.		
Referential Books	1. Mark Michaelis, "Essential C# ", Pearson Education 2. ShibiParikkar, "Magic of C# with .Net Frame Work", Firewall Media. 3. Pappas & Murray, "C# for Web Programming", Prentice Hall. 4. B. Rama Krishna Rao, *"Programming With C#: Concepts and Practice",* PHI Learning		

Distributed Systems			
Course Code-BCS-244E1	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web Challenges. Architectural Models, Fundamental Models. **Theoretical Foundation for Distributed System:** Limitation of Distributed System-Absence of Global Clock, Shared Memory;Lamport's Logical & Vectors Clocks, Concepts in Message Passing Systems		
UNIT-II	**Distributed Mutual Exclusion:** Classification of Distributed Mutual Exclusion, Requirement of Mutual Exclusion Theorem, Token Based and Non Token Based Algorithms, Performance Metric for Distributed mutual Exclusion Algorithms. **Distributed Deadlock Detection:** System Model, Resource Vs Communication Deadlocks, Deadlock Prevention, Avoidance, Detection & Resolution, Centralized Deadlock Detection, Distributed Deadlock Detection-Path Pushing Algorithms, Edge Chasing Algorithms.		
UNIT-III	**Agreement Protocols:** Introduction, System Models, Classification of Agreement Problem-Byzantine Agreement Problem, Consensus Problem, Interactive Consistency Problem; Solution to Byzantine Agreement Problem, Application of Agreement Problem. **Distributed File System:** Design Issues in Distributed File Systems, Architecture, and Mechanism for Building Distributed File Systems.		
UNIT-IV	**Failure Recovery in Distributed Systems:**Basic Concepts, Classification of Failure, Concepts in Backward and Forward Recovery, Recoveryin Concurrent Systems, Obtaining Consistent Checkpoints, Recovery in Distributed Database Systems. **Fault Tolerance:** Issues in Fault Tolerance, Commit Protocols, Voting Protocols, Dynamic Voting Protocols.		
UNIT-V	**Transactions and Concurrency Control:** Transactions, Flat and Nested Transactions, Atomic Commit Protocol, Concurrency Control in Distributed Transaction: Locks, Optimistic Concurrency Control, and Timestamp Ordering; Distributed Deadlocks, Transaction Recovery,Replication: System Model and Group Communication, Fault - Tolerant Services, Highly Available Services, Transactions with Replicated Data.		
Text Books	1. Coulouris, Dollimore, Kindberg, "*Distributed System: Concepts and Design*", Pearson Education 2. GarimaVerma, KhusbooSaxena, Sandeep Saxena, "*Distributed System",* BPB Publications. 3. Tenanbaum& Steen, "*Distributed Systems*", Pearson Prentice Hall		
Referential Books	1. Singhal&Shivaratri, "*Advanced Concept in Operating Systems"*, Tata McGraw Hill 2. Ramakrishna &Gehrke, "*Database Management Systems*", Tata McGraw Hill 3. Vijay K. Garg, "*Elements of Distributed Computing*", Wiley.		

Data Mining			
Course Code- **BCS-244E2**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Data Mining - Overview, Motivation, Definition & Functionalities, Major issues in Data Mining, Integration of Data Mining System with Data Warehouse System. **Data Preprocessing**: Descriptive Data Summarization, Data Cleaning-Missing Values, Noisy Data, Data Integration and Transformation, Data Reduction-Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction, Discretization and Concept Hierarchy Generation		
UNIT-II	**Association Rules:** Introduction, Frequent Itemsets, Closed Itemsets, Methods to Discover Association Rules, Apriori Algorithm, Multilevel Association Rule Mining, and Rule Evaluation Metrics.		
UNIT-III	**Classification and Prediction:** Classification Techniques-Decision Tree, Rule-Based Classification, Bayesian Classification, k-Nearest-Neighbor Classifier, Linear Regression, Accuracy and Error Measures		
UNIT-IV	**Cluster Analysis:** Introduction, Types of Data, Partitioning Methods- k-Means and k-Medoids, Hierarchical Clustering- Chameleon, Density Based Methods- DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods- Neural Network Approach, Outlier Analysis.		
UNIT-V	**Recent Trends and Applications:** Web Mining, Spatial Data Mining, Text Mining, Multimedia Data Mining, Applications of data mining in finance, business, social networks.		
Text Books	1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.		
Referential Books	1. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education. 2. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press 3. Pieter Adriaans&DolfZantinge, *"Data Mining"*, Pearson Education		

Design and Analysis of Algorithms			
Course Code-BCS-351	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction** Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.		
UNIT-II	**Algorithm Design Techniques** Iterative techniques, Divide and Conquer, DynamicProgramming, Greedy Algorithms.		
UNIT-III	**Sorting and Searching Techniques:** Elementary sorting techniques–Bubble Sort, InsertionSort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, complexity analysis;		
UNIT-IV	**Lower Bounding Techniques :** Decision Trees **Balanced Trees** Red-Black Trees **Advanced Analysis Technique** Amortized analysis		
UNIT-V	**Graphs :** Graph Algorithms–Breadth First Search, Depth First Search and its Applications,Minimum Spanning Trees. **String Processing :**String Matching, KMP Technique		
Text Books	1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "*Introduction to Algorithms*", PHI		
Referential Books	1. Sarabasse& A.V. Gelder,"*Computer Algorithm – Introduction to Design and Analysis*", Pearson		

Computer Networks			
Course Code-BCS-352	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction**: Goals and Applications Of Networks, Types of Networks, Network Structure And Architecture, The OSI Reference Model, TCP/IP Model, Network Topology, Network Devices. **Physical Layer:** Transmission Media, Multiplexing, Switching Methods, ISDN.		
UNIT-II	**Data Link Layer:** Elementary DataLink Protocols, Framing, Error Detection and Correction: Hamming Code, Parity Bit, Cyclic Redundancy Check, and Checksum; Sliding Window Protocols. **Medium Access Sub Layer:** Channel Allocations, LAN Protocols- ALOHA Protocols, CSMA, CSMA-CD, Overview Of IEEE Standards, FDDI.		
UNIT-III	**Network Layer:**Design Issues, Routing Algorithms: Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Broadcast Routing, Multicast Routing; Congestion Control Algorithms, Internetworking, IP Packet, IP Addresses, IPv6.		
UNIT-IV	**Transport Layer:** Design Issues, Connection Management, Error Control, Flow Control, Transport Layer Protocols- TCP, UDP. **Session Layer:** Design Issues, Remote Procedure Call. **Presentation Layer:** Design Issues, Data Compression Techniques, Cryptography.		
UNIT-V	**Application Layer:**DNS, File Transfer Protocols- FTP, TFTP;Network Management Protocol, Electronic Mail: SMTP, MIME;HTTP, Virtual Terminals.		
Text Books	1. A. S. Tanenbaum, "*Computer Networks*"; Pearson Education. 2. William Stallings, "*Data and Computer Communications*", Pearson Education.		
Referential Books	1. Behrouz A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill. 2. Larry L. Peterson, Bruce S. Davie, "*Computer Networks: A Systems Approach***",** Elsevier. 3. Prakash C. Gupta, "*Data Communications and Computer Networks",* PHI Learning.		

Cloud Computing			
Course Code- **BCS-353E1**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction to Cloud Computing:**History of Cloud Computing, Characteristics and Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing, Cloud Computing Platforms and Technologies, Pros and Cons of Cloud Computing.		
UNIT-II	**Virtualization:** Basics of Virtualization, Characteristics of Virtualized Environments, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Pros and Cons of Virtualization, Industry Example of Virtualization.		
UNIT-III	**Cloud Computing Architecture:**Cloud Computing Reference Model, Comparison With Traditional Computing Architecture (Client/Server), Services Provided At Various Levels, Service Models- Infrastructure As A Service (Iaas), Platform As A Service (Paas), Software As A Service (Saas), How Cloud Computing Works, Deployment Models, Types Of Clouds - Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud.		
UNIT-IV	**Cloud Platforms in Industry:** Amazon Web Services, Google App Engine, Microsoft Azure, Cloud Computing in Scientific Applications, Business and Consumer Applications.		
UNIT-V	**Cloud Security:** Security Overview, Cloud Security Challenges and Risks, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control, Autonomic Security.		
Text Books	1. RajkumarBuyya*, "Mastering Cloud Computing",Tata McGraw-Hill Education.* 2. RajkumarBuyya, James Broberg& Andrzej Goscinski, *"Cloud Computing: Principles and Paradigms"*, Wiley.		
Referential Books	1. Nikos Antonopoulos & Lee Gillam, *"Cloud Computing: Principles, Systems and Applications*", Springer. 2. Ronald L. Krutz& Russell Dean Vines, *"Cloud Security: A Comprehensive Guide to Secure Cloud Computing*", Wiley-India. 3. Anthony T. Velte, Tobey J. Velte& Robert Elsenpeter, *"Cloud Computing: A Practical Approach*", Tata McGraw Hill.		

Machine Learning			
Course Code-BCS-353E2	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction** Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs.Unsupervised Learning **Software for Machine Learning and Linear Algebra Overview** Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using R/Python.		
UNIT-II	**Descriptive Statistics:**Qualitative and Quantitative Data, Data exploration (histograms, bar chart, box plot, line graph, scatter plot), Measure of Central Tendency (Mean, Median and Mode),Measure of Positions (Quartiles, Deciles, Percentiles),Measure of Dispersion (Range, Median, Absolute deviation about median, Variance andStandard deviation)		
UNIT-III	**Linear Regression** Prediction using Linear Regression, Gradient Descent, LinearRegression with one variable, Linear Regression withmultiple variables, Polynomial Regression, Feature Scaling /Selection, Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with onevariable and with multiple variables.		
UNIT-IV	**Classification:** Naïve Bayes Classifier, K-Nearest Neighbors, Support Vector Machine, Decision Trees.		
UNIT-V	**Clustering:**Distance Measures, Different clustering techniques (Distance, density and hierarchical), Iterative Distance-based clustering, K-means Clustering Cross Validations, Dimensionality reduction, Principle component analysis		
Text Books	1. EthemAlpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009. 2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.		
Referential Books	1. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007. 2. Mevin P. Murphy, "Machine Learning: A Probab 3. Peter Harrington, Machine Learning in Action, Dreamtech Press		

Digital Image Processing			
Course Code- **BCS-353E3**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Filtering, sampling and quantization.		
UNIT-II	**Spatial Domain Filtering:** Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.		
UNIT-III	**Filtering in the Frequency domain:** Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.		
UNIT-IV	**Image Restoration:** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.		
UNIT-V	**Image Compression:** Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding. **Image Segmentation:** Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm		
Text Books	1. R C Gonzalez , R E Woods, "*Digital Image Processing*", 3rd Edition, Pearson Education.2008. 2. A K Jain, "*Fundamentals of Digital image Processing"*, Prentice Hall of India.1989. 3. K R Castleman, "*Digital Image Processing*", Pearson Education.1996		
Referential Books	1. Schalkoff, "Digital Image Processing and Computer Vision", John Wiley and Sons.1989. 2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins," Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.		

Artificial Intelligence			
Course Code-BCS-361	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).		
UNIT-II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, Nondeductive Inference Methods, Rules.		
UNIT-III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts.		
UNIT-IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/Output and Streams, Databases, Implementation of All Concepts in Prolog.		
UNIT-V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition,Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in ProblemSolving, Learning from Example-Induction, Explanation Based learning.		
Text Books	1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. 2. Dan W. Patterson,*"Introduction to Artificial Intelligence& Expert Systems"*, PHI.		
Referential Books	1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall. 2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.		

Theory of Automata and Formal Languages			
Course Code-BCS-362	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Basic Concepts:** Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Chomsky Hierarchy.		
UNIT-II	**Finite Automata:** Deterministic Finite Automata (DFA)-Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata.		
UNIT-III	**Regular Languages:** Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression, Arden's Theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages, Closure properties of Regular Languages, Pumping Lemma, Application of Pumping Lemma, Decidability.		
UNIT-IV	**Context Free Languages and Pushdown Automata:**Context Free Grammar (CFG), Context Free Languages (CFL), Parse Trees, Ambiguity, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF),Pumping Lemma for CFL, Closure Properties of CFL, Decision Problems of CFL, Pushdown Automata: Nondeterministic Pushdown Automata (NPDA), Deterministic Pushdown Automata(DPDA), Deterministic Context free Languages(DCFL), Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata.		
UNIT-V	**Turing Machines and Models of Computation:** Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Decidability, Techniques for Turing Machine Construction, Turing Machine as a Model of Computation, Universal Turing machine, Linear Bounded Automata, Recursive and Recursively Enumerable language, Halting Problem.		
Text Books	1. J. E. Hopcraft, R. Motwani, and Ullman, "*Introduction to Automata theory, Languages and Computation*", Pearson Education. 2. J Martin, "*Introduction to Languages and the Theory of Computation*", Tata McGraw Hill.		
Referential Books	1. C Papadimitrou and C. L. Lewis, "*Elements and Theory of Computation*", PHI. 2. Y. N. Singh, "*Mathematical Foundation of Computer Science*", New Age International.		

Cryptography and Network Security			
Course Code- **BCS-363E1**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Attack, Services and Mechanism, A Model for Network Security. **Cryptography:** Notion of Plain Text, Encryption, Key, Cipher Text, Decryption, ClassicalEncryption Algorithm,Requirements for Cryptography, Cryptanalysis, Symmetric Vs Asymmetric, Block and Stream ciphers, DES.		
UNIT-II	**Public Key Encryption&. Message Authentication**:Public Key Cryptography Principles & Applications, Algorithms: RSA, MessageAuthentication: One way Hash Functions, Message Digest, MD5, SHA1, Digital Signatures, Digital Certificates, and Certificate Authorities.		
UNIT-III	**Key Distribution and Authentication Application:** Key Distribution using Symmetric and Asymmetric Encryption, Kerberos, X.509, Public Key Infrastructure. **Web Security:** Requirement, Secure Socket Layer, Transport Layer Security, and Secure Electronic Transactions.		
UNIT-IV	**Network Management Security:** Overview of SNMP Architecutre-SMMPVI1 Communication Facility, SNMPV3. **IP security Architecture:** Overview, Authentication header, Encapsulating Security Pay Load, Combining Security Associations, Key Management. **Electronic Mail Security:** Pretty Good Privacy, S/Mime.		
UNIT-V	**System Security:** Intruders, Viruses and Related Threats, Firewall: Need, Characteristics, Types and Design Principles. Comprehensive Examples using Available Software Platforms/Case Tools.		
Text Books	1. W. Stallings, *"Cryptography and Network Security, Principles and Practice*", Pearson Education. 2. W. Stallings, *"Networks Security Essentials: Application & Standards"*, Pearson Education.		
Referential Books	1. Behrouz A. Forouzan, "*Data Communications and Networking",* McGraw-Hill. **2.** Atul Kahate, "*Cryptography and Network Security",* Tata McGraw-Hill Education.		

Android Application Development			
Course Code- **BCS-363E2**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction to Android :** Overview, History, Features of Android, Architectureof Android, Android Phones, SDK, Android Development Tools, AndroidEmulator, Creating Android Virtual Device, Creating your first AndroidApplication		
UNIT-II	**Activities:**Introduction, Activity Lifecycle, **Intents:** Introduction, Linking Activities using Intents, Calling built-in applications using Intents, **Fragments:** Introduction, Adding Fragments Dynamically, Lifecycle of Fragment, Interaction between Fragments		
UNIT-III	**Android User Interface:** Understanding the components of a screen, Display Orientation **Designing Your User Interface with Views:** Basic Views, Picker Views, List View, Specialized Fragment, Displaying Pictures and Menus with views		
UNIT-IV	**Databases –SQLite:** Introduction, Creating , Opening and Closing Database, Working with Cursors, Insert, Update, Delete, Building and Executing Queries.		
UNIT-V	**Messaging and E-mail:** SMS Messaging and Sending E-mail. **Developing Android Services:** Creating Services, Communication between a Service and an Activity, Binding Activities to Services. **Publishing Android Applications:** Preparing for Publishing, Deploying APK Files		
Text Books	1. Wei-Meng Lee, *"Beginning Android4 Application Development*", Wiley India Edition,Wrox Publication. 2. J. F. DiMarzio, *"Beginning Android Programming with Android Studio",* Wiley India Edition, Wrox Publication.		
Referential Books	1. Bill Philips & Brian Hardy, *"Android Programming: The Big Nerd Ranch Guide"*, Big Nerd Ranch. 2. Greg Nudelman, *"Android Design Patterns: Interaction Design Solutions for Developers*",Wiley. 3. Dave Smith & Jeff Friesen, *"Android Recipes: A Problem-Solution Approach", Apress.* 4. Ed Burnette, *"Hello, Android: Introducing Google's Mobile Development Platform",*The Pragmatic Programmers.		

Mobile Computing			
Course Code- **BCS-363E3**	**Theory Course**	**L-T-P-C**	**4-0-0-4**
Course Contents			
UNIT-I	**Introduction:** Mobile Computing, Mobile Computing Vs wireless Networking, Mobile Computing Applications, Characteristics of Mobile computing, Structure of Mobile Computing Application. MAC Protocols, Wireless MAC Issues, Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes.		
UNIT-II	**Mobile Internet Protocol And Transport Layer:** Overview of Mobile IP, Features of Mobile IP, Key Mechanism in Mobile IP, route Optimization. Overview of TCP/IP, Architecture of TCP/IP, Adaptation of TCP Window, Improvement in TCP Performance.		
UNIT-III	**Mobile Telecommunication System** Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS).		
UNIT-IV	**Mobile Ad-Hoc Networks:** Ad-Hoc Basic Concepts, Characteristics, Applications, Design Issues, Routing, Essential of Traditional Routing Protocols, Popular Routing Protocols,Vehicular Ad Hoc networks (VANET), MANET Vs VANET, Security.		
UNIT-V	**Mobile Platforms And Applications:** Mobile Device Operating Systems, Special Constrains & Requirements, Commercial Mobile Operating Systems, Software Development Kit: iOS, Android, BlackBerry, Windows Phone, M-Commerce – Structure – Pros & Cons, Mobile Payment System- Security Issues.		
Text Books	1. J. Schiller, "Mobile Communications", Addison Wesley. 2. Upadhyaya, "Mobile Computing", Springer		
Referential Books	1. Charles Perkins, Ad hoc Networks, Addison Wesley. 2. Charles Perkins, Mobile IP, Addison Wesley.		