Undergraduate Degree Courses in Engineering & Technology

BACHELOR OF ENGINEERING (COMPUTER SCIENCE & ENGINEERING)

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	0.5 credits 1 credit

B. Structure of Undergraduate Engineering program:

S. No.	Category	Suggested Breakup of Credits (Total 160)
1.	Basic Science Courses (BSC)	20
2.	Engineering Science Courses (ESC)	30
3.	Humanities, Social Science and Management Courses (HSMC)	10
4.	Professional Core Courses (PCC)	60
5.	Professional Elective Courses (PEC)	18
6.	Open Elective Courses (OEC)	14
7.	Seminar	2
8.	Project	10
9.	Internships in industry	8
10.	Mandatory Courses (MC)	NC
	Total Credits	172

C. Course code and definition:

Course code	**Definitions**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

**Minor variation is allowed as per need of the respective disciplines.*

B.E II Year (Semester-III) Computer Science & Engineering
Course Structure & Evaluation Scheme

S.No.	Subject Category	Subject Code	Name of theSubject	Periods			EvaluationScheme				Subject Total	Credit
							Sessional			ESE		
				L	T	P	CT	TA	Total			
THEORYSUBJECT												
1	PCC	BCS301	Database Management System	3	0	0	30	10	40	60	100	3
2	PCC	BCS302	Data Structures	3	0	0	30	10	40	60	100	3
3	PCC	BCS303	Software Engineering	3	0	0	30	10	40	60	100	3
4	ESC	BEC301	Digital Electronics	3	1	0	30	10	40	60	100	4
5	BSC	BSC301	Mathematics-III	3	1	0	30	10	40	60	100	4
6	MC	MC302	Human values & Professional Ethics	2	0	0	30	10	40	60	100	0
PRACTICALS												
1	PCC	BCS352	Data Structure Lab	0	0	2	20	20	40	60	100	1
2	ESC	BEC351	Digital Electronics Lab	0	0	2	20	20	40	60	100	1
3	PCC	BCS351	Database Management System Lab	0	0	2	20	20	40	60	100	1
4	PROJECT	BCS353	Mini project/ Internship Assessment	0	0	-	-	-	100	-	100	2
			TOTAL	**17**	**2**	**6**			**460**	**540**	**1000**	**22**

Hours per week = 17 (L) +2 (T) +6(P) = 25 Hours

L-Lecture, P- Practical, CT-ClassTest, TA-Teacher'sAssessment, ESE-EndSemesterExamination

Dean (Academics) **Director**

B.E II Year (Semester-IV) Computer Science & Engineering
Course Structure & Evaluation Scheme

S. No.	Subject Category	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Sessional			ESE		
							CT	TA	Total			
THEORYSUBJECT												
1	PCC	BCS403	Design and Analysis of Algorithms	3	1	0	30	10	40	60	100	4
2	PCC	BCS401	Computer Organization	3	1	0	30	10	40	60	100	4
3	PCC	BCS402	OOPs using JAVA	3	1	0	30	10	40	60	100	4
4	PCC	BCS404	Discrete Mathematics	3	1	0	30	10	40	60	100	4
5	HSMC	BHSM401	Industrial Management	3	0	0	30	10	40	60	100	3
6	MC	MC401	Environment and Ecology	2	0	0	30	10	40	60	100	0
PRACTICALS												
1	PCC	BCS451	OOPs using java Lab	0	0	4	20	20	40	60	100	2
2	PCC	BCS452	Design and Analysis of Algorithms Lab	0	0	2	20	20	40	60	100	1
			TOTAL	**17**	**4**	**06**			**320**	**480**	**800**	**22**

Hours per week = 17 (L) +04 (T) +06 (P) = 27 Hours

L-Lecture, P- Practical, CT-ClassTest, TA-Teacher'sAssessment, ESE-EndSemesterExamination

Dean (Academics) **Director**

BCS-301	Database Management System	3L-T-2P	CREDIT -4

Unit 1: (8 Hours)

Introduction: An overview of database management system, 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.

Unit 2: (8 Hours)

Relational data Model and Language: Relational data model concepts, integrity 8 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

Unit 3: (8 Hours)

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.

Unit 4: (8 Hours)

Transaction Processing Concept: Transaction system, Testing of serializability, 8 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

Unit 5: (8 Hours)

Concurrency Control Techniques: Concurrency control, Locking Techniques for 8 concurrency control, Time stamping protocols for concurrency control, validation-based protocol, multiple granularity, Multi version schemes **Database Failure and Recovery:** Database Failures, Recovery Schemes: Shadow Paging and Log-based Recovery, Recovery with Concurrent transactions.

Objectives of the course:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational,hierarchical, and network models
3. To understanduse data manipulation language to query, update, and manage a database.

4. To develop an understanding of essential DBMS concepts such as: database security,integrity, concurrency, distributed database, and intelligent database, Client/Server(Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Suggested reference books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education.
4. " Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes:

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using E-R method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms.
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

BCS302	**Data Structure**	**3L-T-2P**	**CREDIT -3**

Unit 1 (7 Hours)
Introduction: Basic concepts and notations, Mathematical background, Revision of arrays and pointers, Recursion and implementation of Recursion,Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off.
Searching: linear search and binary search techniques.

Unit 2 (9 Hours)
Stacks and Queues: Sequential representation of stacks and queues, Primitive Stack operations: Push & Pop, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, conversion of infix to postfix.
Lists: List representation techniques, Dynamics Storage allocation, Representation of stacks and queues using linked list, Operations on a Linked List: Insertion, Deletion, Traversal, Introduction to Doubly linked list, introduction to circularly linked list.

Unit 3 (6 Hours)
Sorting Algorithms and hashing: Insertion sort, Bubble sort, Quick sort, Merge sort, Heap sort, Shell sort, Time and Space complexity of sorting algorithms, hashing.

Unit 4 (7 Hours)
Trees: Definition and basic concepts, Linked tree **r**epresentations, Binary tree traversal algorithms, (Preorder, Inorder, Postorder), Binary search tree, Insertion and Deletion in Binary search tree, Multiway search trees, B trees, B+ tree and their applications.

Unit 5 (7 Hours)
Graphs: Introduction to Graphs, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Graph Traversal: Depth First Search and Breadth First Search, Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data Structures

Suggested reference books:

1. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, Data Structure Using C and C++. Second Edition, Prentice Hall of India, 1997.
2. Seymour Lipschutz, Data Structures ,Schaum's Outlines, Tata McGraw Hill , New Delhi, 2006
3. Lafore – Data structure & Algorithms in java, (BPB Publication)
4. Sartaj Sahni – Data structure, Algorithms & application in C++ (McGraw Hill)

Course Outcomes:

1. To review the concepts of fundamental data structures to be used in programming. To understand various searching algorithms.
2. To understand the various operations on different types of data structures such as stacks, queues and linked lists. To apply and analyze various data structures on different applications.
3. To understand, analyze and compare various sorting algorithms. To understand the concept of hashing and its techniques.
4. To understand the various types of tree structures and their implementation. To evaluate various tree structures. To be able to apply tree structures on various problems.
5. To understand and implement various types of graphs**.** To study and implement various shortest path algorithms on graphs.

BCS303	**Software Engineering**	**3L-T-P**	**CREDIT -3**

Unit-1: (6Hours)
Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Development Life Cycle (SDLC) Models: WaterFall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, Selection of Software Development Models.

Unit-2: (7Hours)
Software Requirement Specifications (SRS) Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS, Estimation of various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

Unit-3: (7Hours)
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.

Unit-4: (8Hours)
Software Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down 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.

Unit-5: (7Hours)
Software Maintenance: 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, Defect Detection and Removal: Defect Amplification Model, An Overview of CASE Tools.

Text and References Books:
1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. Ian Sommerville, Software Engineering, Addison Wesley.
4. Pankaj Jalote, Software Engineering, Narosa Publication
5. Pfleeger, Software Engineering, Macmillan Publication.

BEC 301	**Digital Electronics**	**3L-1T-2P**	**CREDIT -4**

Unit 1: (7Hours)

Digital : Number Systems – Decimal, Binary, Octal, Hexadecimal, 1„s and 2„s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

Unit 2: (8Hours)

Combinational Logic Design : Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, Digital Comparator, Paritygenerators/checkers, Multiplexers and their use in combinational logic designs, multiplexer, De-multiplexers and their use in combinational logic designs, Decoders, demultiplexer.

Unit 3: (9Hours)

Sequential Logic Design:

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops.Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters,twisted ring counters), Sequence Generators, ripple counters,up/downcounters,synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation.

Unit 4: (8Hours)

Digital Logic Families:

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements.TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic , open drain output. Interfacing CMOS and TTL.Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.

Unit 5: (8Hours)

Programmable Logic Devices and Semiconductor Memories:

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM,ROM,EPROM, EEPROM, NVRAM, SRAM,DRAM.

Suggested reference books:

1. R.P. Jain, "Modern digital electronics", 3rd edition, 12th reprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, "Digital Logic and Computer Design" 4th edition, Prentice Hall of India, 2013.
3. Anand Kumar, "Fundamentals of digital circuits" 1st edition, Prentice Hall of India, 2001
4. Tokheim, H. Roger L. "Digital Electronics Principles & Application"/ Tata McGraw-Hill / 6thEd.
5. NPTEL video lectures on Digital Circuits.

Objectives of the course:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

MC 302	**Human values and Professional Ethics**	**2L-0T-0P**	**No CREDIT**

UNIT-1 (6 Hours)

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

UNIT-2 (6 Hours)

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

UNIT-3 (7 Hours)

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

UNIT-4 (6 Hours)

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

UNIT-5 (6 Hours)

Implications of the Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco friendly production systems, technologies and management models. Improving quality of work life at work place.

References Books:

1. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
2. R. Subramanian,2017, Professional Ethics,
3. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
4. A N Tripathy, 2003, Human Values, New Age International Publishers.
5. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
6. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers , Oxford University Press
7. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
8. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
9. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted

Course Objective

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

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

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

BSC 301	**Mathematics-III**	**3L-1T-0P**	**CREDIT -4**

Unit – I: (7 Hours)
Fourier Transform :
Fourier integral, conditions of convergence, Fourier sine and cosine integrals, complex form, applications, Inversion formula for Fourier transform, operational properties. Discrete and Fast Fourier transform. Applications of Fourier transform to solve boundary value problems.

Unit- II: (8 Hours)
Functions of a Complex Variable and Conformal mapping:
Limit, Continuity, Differentiability and Analyticity of functions of a complex variable, Cauchy-Riemann equations, Harmonic functions, Complex functions as mappings, Linear Transformation, Inverse transformation, Bilinear Transformations, Conformal Mapping & applications.

Unit- III: (8Hours)
Integration of Complex Functions:
Contour integrals and evaluations, Cauchy's Theorem, Cauchy's Integral Formulae, Liouville's theorem, Convergence of power series, Taylor series, Laurent series, Zeros and Singularities of a complex function, Residues and Residue theorem, Evaluation of definite and improper integrals.

Unit- IV: (9 Hours)
Curve- Fitting& Probability:
Curve-fitting: method of least- squares, Normal equations, Normal equation in case of straight line, Fitting a straight line, Polynomial, non-linear and exponential curves, Change of origin.

Probability: Basics of probability, random variables, Expectation, Baye's theorem and probability distributions, Binomial, Poisson and Normal distributions.

Unit- V: (8 Hours)
Statistical Methods:
Sampling Theory, Parameters of Statistics, Tests of hypothesis and significance, z-test, t-test, $\chi 2$**-test ,**Goodness of fit test**,** Time series analysis, Index numbers, Quality control chart and acceptance sampling, Introduction to design of experiments, Forecasting models.

Books Recommended:

1. R.K. Jain & S.R.K. Iyengar; Advanced Engineering Mathematics, Narosa Publishing House, 2002.
2. ErwinKreyszig; Advanced Engineering Mathematics, John Wiley & Sons, 1962.
3. R.V. Churchill and J.L. Brown, Complex Variables and Applications, McGraw Hill, 1990.
4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
5. J.H. Mathews and R.W. Howell, Complex analysis for Mathematics and Engineering, 3rd Ed. Narosa, 1998.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Solve the Fourier Transform of function.
2. Compute poles & zeros.
3. Evaluate the real & complex integrals with the help of Cauchy's Residue Theorem.
4. Utilize curve fitting techniques for data representations and computation in engineering analysis.
5. Employee the principle of linear regression and correlation, translate real- world problems into probability models, use Binomial, Poisson & Normal Distribution to solve statistical problems.

Objectives of the course:

1. Fourier transform is useful in study of frequency response of filter, In the theories of communication engineering, wave propagation, transmission lines and solution of boundary value problems. Discrete and fast fourier transform are used in signal analysis.Fourier transform is also used in electromagnetic field, medical application and in error control coding. Discrete analysis playes an important role in the development of communication engineering.

2. Complex Analysis is the study of analytic functions. It is an elegant and powerful method useful in the study of heat flow, fluid dynamics and electrostatics. Two-dimensional potential problem can be solved using analytic functions.

3. The other important applications of this theory is to evaluate many real integrals which can not be evaluated by usual methods.

4. In many engineering problems to establish a linear, quadratic, cubic or exponential relationship between two quantities, it is required two or more unknowns in such a way that these follow whole data, such situations occur in the problems of curve fitting etc.

5. Correlation and regression are the most commonly used techniques for investigating the relationship between two quantitative variables. The theory of probability is the study of such random phenomenon, which are not deterministic. In analyzing and interpreting data that involves an element of "chance" or uncertainty, probability theory plays a vital role in the theory and application of statistics. Probability distribution is the theoretical counterpart of frequency distribution and plays an important role in the theoretical study of populations.

BCS 403	**Design and Analysis of Algorithms**	**3L-1T-4P**	**CREDIT -4**

Unit 1: (8 Hours)
Introduction: Review of elementary data structures, analyzing algorithms, asymptotic notation, recurrence relations, Hash tables, Binary search trees.

Unit 2: (9 Hours)
Sorting and Order Statistics: Heapsort, Priority queues, Quicksort, Merge sort, Sorting in linear time.
Advanced Design and Analysis Techniques: Dynamic programming – Elements, Matrix-chain multiplication, longest common subsequence, Travelling Salesperson problem, Greedy algorithms – Elements, activity-selection problem, Huffman codes, task scheduling problem, Knapsack Problem, Backtracking – Elements, 8 – Queens, Graph Coloring, Hamiltonian Cycles.

Unit 3: (7 Hours)
Advanced Data Structures: Operations in B-Trees, Binomial heaps, Fibonacci heaps, data structures for disjoint sets, strings.

Unit 4: (8 Hours)
Graph Algorithms: Review of graph algorithms, topological sort, strongly connected components, minimum spanning trees – Kruskal and Prim's, Single source shortest paths, relaxation, Dijkstra's algorithm, Bellman-Ford algorithm, single source shortest paths for directed acyclic graphs.

Unit 5: (8 Hours)
P – Hard & NP – Complete problems: Basic concepts, Clique Decision problem, Node Cover decision problem, Travelling Salesperson decision problem, Introduction to approximation algorithms Planer Graph Coloring, Maximum programs stored problem.

Suggested reference books:

1. Cormen, Leiserson and Rivest: Introduction to Algorithms, 2/e, PHI.
2. Horowitz, Sahni, and Rajasekaran: Fundamentals of Computer Algorithms, Second Edition, Universities Press, Hyderabad.
3. Aho, Hopcroft, and Ullman: The Design and Analysis of Computer Algorithms, Addison Wesley.

Course Outcomes:

1. Gain insight about design and analysis of standard searching and sorting algorithms. Learn various algorithm Analysis techniques.
2. Able to compare between different data structures i.e., trees, heaps etc. also, pick an appropriate data structure for a design situation.
3. Learn divide and conquer, Greedyparadigms and understand and analyze when an algorithmic design situation calls for them.
4. Developing and analyzing the solutions for the problems using Dynamic programming, backtracking and Branch and bound approaches..
5. Understand NP completeness and difference between NP-Hard & NP-complete problems..

Objectives of the course

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

BHSM 401	**Industrial Management**	**3L-0T-0P**	**CREDIT -3**

Unit I (6 Hours)

Introduction: Concept and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Unit II (7 Hours)

Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Social responsibilities of Management, Introduction to Human resources management: Nature of HRM, functions and importance of HRM.

Unit III (7 Hours)

Work Study: Introduction, definition, objectives, steps in work study, Method study: definition, objectives, steps of method study, Work Measurement: purpose, types of study — stop watch methods — steps — allowances — standard time calculations — work sampling, Production Planning and Control Inventory Control: Inventory, Cost, Models of inventory control: EOQ, ABC, VED

Unit IV (7 Hours)

Quality Control: statistical quality control, Control charts for variables and attributes, Acceptance Sampling- Single sampling- Double sampling plans, Introduction to TQM.

Unit V (7 Hours)

Project Management: Project network analysis, CPM, PERT and Project crashing and resource Leveling.

References:

1. Engineering Management (Industrial Engineering & Management)/ S.C. Sharma & T.R. Banga, Khanna Book Publishing Co. (P) Ltd., Delhi (ISBN: 978-93-86173-072)
2. Industrial Engineering and Management/ P. Khanna, Dhanpatrai publications Ltd.
3. Production & Operation Management /PaneerSelvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Management I RaviShankar/ Galgotia.

BCS-401	**Computer Organization**	**3L-1T-0P**	**CREDIT -4**

Unit 1: **(7 Hours)**
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Unit 2: (8 Hours)
Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit 3: (9 Hours)
Introduction to x86 architecture**. CPU control unit design:** hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. **Memory system design:** semiconductor memory technologies, memory organization. **Peripheral devices and their characteristics**: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit 4: (7 Hours)
Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit 5: (7 Hours)
Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Suggested reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course outcomes:

1. Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
3. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
5. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

Objectives of the course:

To expose the students to the following:

1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

BCS 402	**Object oriented programming using java**	**3L-1T-4P**	**CREDIT -4**

Unit 1: (8 Hours)

Introduction to Java : Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Unit 2: (8 Hours)

Objects and Classes : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Unit 3: (7 Hours)

Inheritance and Polymorphism : Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

Unit 4: (9 Hours)

Event and GUI programming : Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

Unit 5: (7 Hours)

Multithreading in Java and I/O programming : Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Reference Books:

1 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2 Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
3 Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
4 Core Java Volume-I Fundamentals, Eight Edition, Horstmann& Cornell, Pearson Education.
5 The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.
6 Java Programming, D. S. Malik, Cengage Learning.

BCS403	Discrete Mathematics	3L-1T-0P	CREDIT -4

Unit-I: (8 Hours)
Set Theory, Relation & Function:
Sets,Operation on sets,Proof of some general identities on sets, Relations, Operation on Relation, Properties of Relations,Composite Relations, Recursive definition of Relation, Order of Relation, Closures of Relation, Equivalence Relation, Functions definition, Recursively defined function, Natural number Introduction, Mathematical Induction, Strong Induction.

Unit- II: (8 Hours)
Algebraic Structures:
Definition, Semi groups, Groups, Subgroups and order, Integer modulo m, cyclic group, Cosets,Lagrange's theorem, Normal subgroups, Permutation and Symmetric groups,Group Homomorphism, Isomorphism of Groups, Definition and elementary properties of Rings and Fields.

Unit –III: (7 Hours)
Propositional Logic:
Proposition, well formed formula, Truth tables,Tautology, Satisfiability, Contradiction, Validity, Logical operators, Logical Equivalence, De-Morgan's laws,Algebra of proposition, theory of Inference, Normal form, Connectivity NOR & NAND, Argument, theory of Argument, law of Duality, theory of Predicate logic,Quantifiers.

Unit –IV: (7 Hours)
Partially Ordered sets &Combinatories:
Partially ordered set, Hasse-diagram, Lattices (Definition and some properties). Introduction to combinatories, Counting techniques, Permutation & Combination, Practical problems on Permutation and Combination, Pigeon-Hole Principle, Recurrence Relation and their solutions, Generating Function.

Unit-V: (7 Hours)
Graphs:
Trees, Binary tree, Binary trees traversal, Binary search trees,Spanning trees, Kuruskal's algorithm for a shortest Spanning Tree,Travelling Salesman Problem, Graphs, Incedence, Degrees, Walks, Paths, Circuits, Characterization, Connectedness, Bipartite graphs, Planar graph, Euler & Hamiltonian graphs, Euler's formula, Kuratowski's two graphs, Utility problem.

Books Recommended:

1. C.L.Liu: Discrete Mathematics.
2. B.Kolman, R.C.Busby and S.C.Ross: Discrete Mathematical Structure, 5\e, Prentice Hall, 2004.
3. J.L.Mott, A.Kandel and T.P.Baker: Discrete Mathematical Structures for Computer Scientist & Mathematicians, Prentice-Hall India.
4. J.P.Trembley,R.Manohar: Discrete Mathematical Structures with applications to Computer Science, McGraw-Hill, Inc. New York, NY, 1975.
5. Swapan Kumar Sarkar: AText Book of Discrete Mathematics, S.Chand& Company Ltd., New Delhi.
6. J.P.Chauhan: Discrete Structures & Graph Theory, Krishna Prakashan Media (P) Ltd.

Course Objective :

1. Apply the operation of Sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion.Describe binary relations between two sets, Determine the domain and range of a discrete or non discrete function, graph functions, identify one to one function, perform the composition of functions, find inverse of a function, and apply the properties of functions to application problems.
2. This course aims to introduce students to two basic algebraic concepts, namely, groups, rings & fields. These concepts constitute an essential part of mathematical culture.
3. Simplify and evaluate basic logic statements including compound statements implications, inverses, converses, and contrapositives using truth tables and properties of logic. Express a logic sentence in terms of predicates, quantifiers, and logical connectives. Apply the rules of Inference, test for validity, and methods of proof including direct and indirect forms, proof by contradiction & proof by cases.
4. Solve counting problems by applying the elementary counting techniques using the sum and product rules, Permutations and Combinations, the Pigeon-hole principle, Identify the base step and or inductive step in applied problems, solve problems using recurrence relations & generating function.
5. Understand basic concepts about Trees and Graphs,represent a graph using an adjancy list and an adjancy matrix and apply graph theory to application problems. Determine if a graph is Euler or a Hamilton path or circuit. Use the properties of trees to classify trees, use binary search trees or decision trees solve problems.

Course Outcomes:

At the end of this course, students will be able to:

1. Understand the basic principles of sets and operation in sets. Demonstrate and understanding of relations and functions and be able to determine their properties. Determine when a function is 1-1 and "onto".
2. Use the theory, methods and techniques of the course to solve problems about groups, rings and fields.
3. Write an argument using logical notation and determine if the argument is or is not valid.
4. Apply counting principle to determine probabilities.
5. Demonstrate different traversal methods for trees and graphs.

MC-401	**Environmental &Ecology**	**2L-0T-0P**	**Non-Credit**

UNIT-I: (7 Hours)
Nature of Environment Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel

UNIT-II: (6 Hours)
Impact of Human Activity on Environment Human Population and Environment – Population growth, population explosion and migration; Impact of farming, housing, mining, transportation and industrial growth Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics

UNIT-III: (7 Hours)
Environmental Changes and Human Health Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution, Climate change– Greenhouse effect and global warming, acid rain, ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards

UNIT- IV: (7 Hours)
Environmental Protection through Assessment and Education Indicators and Impact Assessment – Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring Environmental Protection– Role of individuals, organizations and government in pollution control Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection Environmental education–women and value education Recommended

Textbook: Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India. **Recommended Reference Books:**

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, McGrawHill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology, Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill

BCS-352	**Data structure lab**	**0L-0T-2P**	**1**

Write Program in C / C++ for following:

1. To implement stack using array.
2. To implement queue using array.
3. To implement circular queue using array.
4. To implement various operations on linked list:
   (a)insert (b)delete (c) display
5. To implement stack using linked list.
6. To implement queue using linked list.
7. To implement linear search.
8. To implement binary search.
9. To implement bubble sort.
10. To implement insertion sort.
11. To implement merge sort.
12. To implement quick sort.
13. Program to find the factorial of a number using recursion.
14. To implement Heap sort.
15. Implementation of graph menu driven program.

BEC 351	**Digital Electronics Lab**	**0L-0T-2P**	**1**

List of experiment:

1. To study about logic gate and verify their Truth table.
2. To design and implement half adder and full adder.
3. To design and implement half subtractor and full subtractor
4. To design and implement 8:1 MUX.
5. To design and implement 1:8 DEMUX.
6. To design and implement Encoder.
7. To design and implement Decoder.
8. To design and implement R-S flip flop and J K flip flop
9. To design and implement D& T flip flop
10. To design and implement Master -Slave flip flop
11. To design and implement SISO AND SIPO.
12. To design and implement PISO and PIPO
13. To design and implement DECAD counter.
14. To design and implement 4 bit shift register.
15. To convert Analog to Digital and Digital to Analog.

BCS 351	**Database Management System Lab**	**0L-0T-2P**	**1**

List of experiments:

Lab 1: Data Definition Language (DDL) commands in RDBMS

Lab 2: Data Manipulation Language (DML) and Data Control Language (DCL)

Lab 3: High level language extensions with cursors

Lab 4: High level language extension with Triggers

Lab 5: Procedures and Functions 8 6 Embedded SQL

Lab 6: Database design using E-R model and Normalization

Lab 7: Design and implementation of payroll processing system

Lab 8: Design and implementation of Banking system

Lab 9: Design and implementation of Library Information System

Lab 10: Design and implementation of Student Information System

Lab 11: Automatic Backup of Files and Recovery of Files

BCS 451	**Object Oriented programming using JAVA**	**0L-0T-4P**	**2**

List of experiments:

1.Program to define a structure of a basic JAVA program.

2 Program to define the data types, variable, operators, arrays and control structures.

3 Program to define class and constructors. Demonstrate constructors.

4 Program to define class, methods and objects. Demonstrate method overloading.

5 Program to define inheritance and show method overriding.

6 Program to demonstrate Packages.

7 Program to demonstrate Exception Handling.

8 Program to demonstrate Multithreading.

9 Program to demonstrate I/O operations.

10 Program to demonstrate Network Programming.

11 Program to demonstrate Applet structure and event handling.

12 Program to demonstrate Layout managers.

BCS452	**Design and Analysis of Algorithm**	**0L-0T-2P**	**1**

List of Experiments

1. To implement the following using array as data structure and analyse its time complexity
    a. Insertion sort
    b. Selection sort
    c. Bubble sort
    d. Quick sort
    e. Merge sort
    f. Bucket sort
    g. Shell sort
    h. Radix sort
    i. Heap sort
2. To implement Linear and Binary search and analyze its time complexity
3. To implement Matrix Chain Multiplication and analyze its time complexity
4. To implement Longest Common Subsequence problem and analyze its time complexity
5. To implement Optimal Binary Search Tree problem and analyze its time complexity
6. To implement Huffman coding and analyze its time complexity
7. To implement Dijkstra's algorithm and analyze its time complexity
8. To implement Bellman Ford algorithm and analyze its time complexity
9. To implement DFS and BFS and analyze their time complexities.
10. To implement following string matching algorithms and analyze time complexities:
    a. Naïve
    b. Rabin karp
    c. Knuth Morris Pratt