INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN

(Established by Govt. of Delhi vide Act 9 of 2012)

B.TECH (IT)

Third Semester (Second Year)

S. No.	Subject Code	Subject	L-T-P	Credits	Category
1.	BCS-201	Data Structures	3-0-2	4	**DCC**
2.	BIT-201	Database Management Systems	3-0-2	4	**DCC**
3.	BCS-203	Discrete Structures	3-1-0	4	**DCC**
4.	BIT-203	Software Engineering	3-0-2	4	**DCC**
5.	GEC-201	Generic Open Elective	0-2-0 0-0-4 2-0-0	2	**GEC**
6.	BIT-253	Industrial Training/Internship	-	1	**DCC**
7.	BAS-201 BAS-203 BEC-209 BMA-209	Material Science and Engineering Numerical Methods Analog and Digital Electronics Engineering Measurement and Metrology	3-1-0 3-1-0 3-0-2 3-0-2	4	**OEC**
		Total		23	

Fourth Semester (Second Year)

S. No.	Subject Code	Subject	L-T-P	Credits	Category
1.	BCS-202	Computer Organization and Architecture	3-0-2	4	DCC
2.	BIT-202	Operating System	3-0-2	4	DCC
3.	BCS-204	Design and Analysis of Algorithms	3-0-2	4	DCC
4.	BIT-204	Object Oriented Programming	3-0-2	4	DCC
5.	BAS-202 BAS-204 BAS-206 BEC-210 BMA-210	Nano Structures & Materials in Engineering Optical Engineering Optimization Techniques Elements of Information Theory Operations Management	3-1-0 3-0-2 3-1-0 3-1-0 3-1-0	4	OEC
6.	HMC-202	Disaster Management	1-0-2	2	HMC
		Total		22	

Fifth Semester (Third Year)

S. No	Subject Code	Subject	L-T-P	Credits	Category
1.	BCS-301	Artificial Intelligence	**3-0-2**	4	**DCC**
2.	BIT-301	Data Communication and Computer Networks	**3-0-2**	4	**DCC**
3.	BAS-301	Modelling and Simulation	3-0-2	4	**BAS**
4.	BCS-303	Theory of Computation	**3-1-0**	4	**DCC**
5.	HMC-301	Professional Ethics and Human Values	**3-0-0**	3	**HMC**
6.	BIT-353	Industrial Training/Internship	-	1	**DCC**
7.	GEC-301	Generic Open Elective	**0-2-0** **0-0-4** **2-0-0**	2	**GEC**
		Total		22	

Sixth Semester (Third Year)

S. No.	Subject Code	Subject	L-T-P	Credits	Category
1.	BCS-302	Wireless Networks	**3-0-2**	4	**DCC**
2.	BIT-304	Cloud Computing	**3-0-2**	4	**DCC**
3.	BIT-306	Data Mining and Machine Learning	**3-0-2**	4	**DCC**
4.	DEC-3xx	Departmental Elective Course-1	**3-1-0/** **3-0-2**	4	**DEC**
5.	DEC-3xx	Departmental Elective Course-2	**3-1-0/** **3-0-2**	4	**DEC**
6.	HMC-302 HMC-304 HMC-306 HMC-308	Principles of Management Marketing Management Financial Management Human Resource Management	**2-0-0** **2-0-0** **2-0-0** **2-0-0**	2	**HMC**
		Total		22	

Seventh Semester (Fourth Year)

S. No.	Subject Code	Subject	L-T-P	Credits	Category
1.	BIT-401	Mobile Computing	**3-0-2**	4	**DCC**
2.	BIT-403	Software Testing	**3-0-2**	4	**DCC**
3.	DEC-4xx	Departmental Elective Course-3	**3-1-0 3-0-2**	4	**DEC**
4.	DEC–4xx	Departmental Elective Course-4	**3-1-0/ 3-0-2**	4	**DEC**
5.	BIT-451	Minor Project	**0-0-8**	4	**DCC**
6.	BIT-453	Industrial Training/Internship	**-**	1	**DCC**
		Total		21	

Eighth Semester (Fourth Year)

S. No.	Subject Code	Subject	L-T-P	Credits	Category
1.	BIT-402	Information and Network Security	**3-0-2**	4	**DCC**
2.	DEC-4xx	Departmental Elective Course-5	**3-0-2**	4	**DEC**
3.	DEC-4xx	Departmental Elective Course-6	**3-1-0 3-0-2**	4	**DEC**
4.	BIT-452	Major Project	**0-0-16**	8	**DCC**
5.	GEC-402	Generic Open Elective	**0-2-0 0-0-4 2-0-0**	2	**GEC**
		Total		22	

List of Departmental Elective Courses

Category	Course Code	Subject	Credits
Departmental Elective Course-1	BIT-308	Advanced Data Structure and Algorithm	3-0-2
	BIT-310	Internet of Things	3-0-2
	BIT-312	Advanced Database Management Systems	3-0-2
	BCS-314	Computer Graphics	3-0-2
Departmental Elective Course-2	BIT-314	Enterprise Java Programming	3-0-2
	BCS-306	Compiler Design	3-1-0
	BIT-316	Computer Vision	3-0-2
	BIT-318	Swarm and Evolutionary Optimization	3-0-2
Departmental Elective Course-3	BIT-405	Soft Computing	3-0-2
	BIT-407	Big Data Analytics	3-0-2
	BEC-409	Digital Image Processing	3-0-2
	BIT-409	Distributed Systems	3-0-2
Departmental Elective Course-4	BIT-413	Software Project Management	3-1-0
	BIT-415	Advanced Operating Systems	3-1-0
	BIT-417	E-Commerce	3-1-0
	BIT-419	Cyber Security and Forensics	3-0-2
Departmental Elective Course -5	BIT-404	Requirement Estimation Theory	3-1-0
	BCS-406	Natural Language Processing	3-0-2
	BIT-406	Information Retrieval	3-0-2
	BIT-408	Neural Networks and Deep Learning	3-0-2
Departmental Elective Course-6	BIT-410	Cryptography	3-1-0
	BCS-410	Quantum Computing	3-1-0
	BIT-412	Advanced Software Engineering	3-0-2
	BCS-412	Computational Optimization Techniques	3-1-2

DATA STRUCTURES	
Course Code: BCS-201 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 3

Introduction: Data structure is a specific way to store and organize data in a computer's memory so that these data can be used efficiently later. This course introduces about various data structures and their useful applications in computer science domain.

Course Objectives:

- To study different kinds of data structures with their respective applications.
- To learn applications of data structures
- To apply data structures in various programs
- Learn to use data structures for different programs

Pre-requisite: Fundamentals of Programming

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

- Get the knowledge of different kinds of data structures with their respective applications.
- Devise data structures for programs
- Differentiate between static and dynamic data structures
- Develop programs using different types of data structures

Pedagogy: Classroom teaching which focuses on developing understanding of students to digest the concepts of subject with large number of examples.

Contents

UNIT-I	10 Hours
Introduction: Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. Introduction to List data structure. **Arrays and Strings:** Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations.	
UNIT-II	**10 Hours**
Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks, Applications of Stacks: recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues. **Linked Lists:** Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list.	
UNIT-III	**12 Hours**
Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion, Applications of Binary search Trees, Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees. **Searching and Sorting:** Linear Search, Binary search, Interpolation Search, Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.	
UNIT-IV	**10 Hours**
Graphs: Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths. **File Structure:** File Organization, Indexing & Hashing, Hash Functions, Collision Resolution Techniques.	

Text Books	
1	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications, 1983
2	Tannenbaum, "Data Structures", PHI, 2007(Fifth Impression)
3	An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill).
Reference Books	
1	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI, 2009(Fourth Impression)
2	Seymour Lipschutz Saucham's series , data Structures, Mc, Graw Hill Publication, 2018
3.	Nitin Upadhaya, Data Structures using C, S K Kataria Publications, 2015

DATABASE MANAGEMENT SYSTEMS	
Course Code: BIT-201 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 3

Introduction:
Database Management System (DBMS) is used for creating and managing the databases. The main aim of a DBMS is to supply a way to store-up and retrieve the desired database information as per the application requirement, which is both convenient and efficient.

Course Objectives:

- To introduce the concepts of database management systems
- To design of relational databases by applying normalization techniques to normalize the database
- Strong practice in SQL programming through a variety of database problems.
- Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Pre-requisites: Basic concepts of set theory

Course Outcomes: After completion of the course, the students will be able:

- To have a high-level understanding of major DBMS components and their function.
- To model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
- To write SQL commands to create tables and indexes, insert/update/delete data, and query data in a relational DBMS.
- To understand the concept of Transaction, concurrency and Query processing.

Pedagogy:
Lecture delivery via discussions, whiteboard, slideshows, online learning material. Lab-work with exercises on SQL

Contents

UNIT-I	10 Hours
Overview of Concepts and Conceptual Database Design: Database Administrator and Database Users, Characteristics of the Database, Database Systems, Concepts and Architecture, Data Models, Schemes & Instances, DBMS Architecture & Data Independence, Database Languages & Interfaces, Overview of Hierarchical, Network & Relational Data Base Management Systems, Data Modeling using Entity-Relationship Model, Strong and Weak Entity Sets, Generalization, Specialization, and Aggregation.	
UNIT-II	11 Hours
Relational Model, Languages & Systems: Relational Model Concepts, Relational Model Constraints, Translating your ER Model into Relational Model, Relational Algebra, Relational Calculus (Tuple Calculus) SQL: A Relational Database Language, Data Definition in SQL, View and Queries in SQL, Specifying Constraints and Indexes in SQL, Practicing SQL commands	
UNIT-III	11 Hours
Relational Data Base Design: Functional Dependencies & Normalization for Relational Databases, Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF), Lossless Join and Dependency Preserving Decomposition, Multivalued Dependency, Join dependency. Transaction Management: Transaction Concept and State, Implementation of Atomicity and Durability, Serializability, Recoverability, Implementation of Isolation	
UNIT-IV	10 Hours
Concurrency Control: Lock-Based Protocols, Timestamp-based Protocols, Deadlock Handling, Recovery System, Failure Classification, Storage Structure, Recovery and Atomicity, Log-based Recovery. Query Processing: Query Processing Overview, Measures of Query Cost. Framework of Distributed Data Base Management Systems, Introduction to Enhanced Databases: Multimedia Databases, Object Oriented Databases, Mobile Databases.	
Text Books	
1	Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, Pearson, 6th Ed. (June 2017)
2	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw Hill, 6^{th} Ed
3	Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3^{rd} Ed., 2003
Reference Books	
1	Ceri and Pelagatti, Distributed Databases : Principles & Systems, McGraw-Hill, 2017.
2	Conolly & Begg, Database Management Systems, Pearson Education Asia., 5th Edition, 2010

DISCRETE STRUCTURE	
Course Code: BCS -203 Contact Hours: L-3 T-1 P-0 Course Category: DCC	Credits: 4 Semester: 3

Introduction: The discrete structures subject introduces Propositional logic, Sets, Relations, and Functions, Algebraic structures, Graphs and Trees required for building mathematical foundation of computer science.

Course Objectives:

- To introduce and understand the fundamental notions in discrete mathematics
- To understand basic concept of an algorithm and its application in combinatorial mathematics
- To introduce the basic properties of graphs and trees and model simple applications
- Learn concepts of discrete mathematics

Pre-requisite: Nil

Course Outcome: After studying this course, students will be able to:

- Distinguish between the notion of discrete and continuous mathematical structures
- Become Familiar with application of induction and other proof techniques towards problem solving
- Understand concepts of discrete structures
- Will learn use of discrete structures in program development

Pedagogy: Classroom teaching which focuses on developing understanding of students to digest the concepts of subject with large number of examples.

Contents

UNIT-I	10 Hrs
Propositional logic: Syntax, semantics, valid, satisfiable and unsatisfiable formulas, Mathematical reasoning, propositions, negation disjunction and conjunction, implication and equivalence, truth tables, predicates quantifiers, natural deduction, rules of Inference **Methods of proofs:** Forward proof, proof by contradiction, contra positive proofs, proof of necessity and sufficiency.	
UNIT-II	**10 Hrs**
Sets, relations and functions: Operations on sets, relations, binary relations, partial ordering relations, equivalence relations and partitions, Partial orderings, Posets, Linear and well-ordered sets, principles of mathematical induction. Functions, mappings, injection and surjections, composition of functions, inverse functions, special functions; Peono postulates; pigeonhole principle; recursive function theory. **Size of a set:**Finite and infinite sets, countable and uncountable sets, Cantor's diagonal argument and the power set theorem, Schröder-Bernstein theorem.	
UNIT III	**12 Hrs**
Algebraic structures and Morphisms: Algebraic structures with one binary operation - semigroups, monoids and groups, subgroups and their properties, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups. Algebraic structures with two binary operations - rings, integral domains and fields. Boolean algebra and Boolean ring.	
UNIT IV	**10 Hrs**
Graphs and trees: Terminology, Graphs and their basic properties - degree, path, cycle, subgraphs, isomorphism, Eulerian and Hamiltonian walks, Graph coloring, planar graphs, directed graphs, Trees terminology, tree traversals, spanning trees.	
Text Books	
1	Kenneth H Rosen (Editor-in-chief), Handbook of Discrete and Combinatorial Mathematics, CRC Press, 2000.
2	C L Liu, Elements of Discrete Mathematics, Second Edition, Tata McGraw-Hill.
3	Bernard Kolman, Robert C Busby, and Sharon Cutler Ross, Discrete Mathematical Structures, fifth edition, Prentice-Hall of India.
Reference Books	
1	Ralph P Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education Asia.
2	Norman L Biggs, Discrete Mathematics, Oxford University Press.
3	J P Tremblay and R Manohar, Discrete mathematical structures with applications to Computer Science, Tata McGraw-Hill.

SOFTWARE ENGINEERING	
Course Code: BIT-203 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 3

Introduction:

Software engineering is the branch of computer science that creates practical, cost-effective solutions to computing and information processing problems, preferentially by applying scientific knowledge, developing software systems in the service of mankind. This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools. The course will combine a strong technical focus with a capstone project providing the opportunity to practice engineering knowledge, skills, and practices in a realistic development

Course Objectives:

- Study the current software engineering techniques and examines the software life-cycle, including software specification, design implementation, testing and maintenance.
- Present software engineering methodologies for the development of Quality, cost-effective, schedule adhered software.
- Develop an understanding of ethical and professional issues related to Software Project Delivery.

Pre-requisite: Nil

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

- Understand various phases of software development lifecycle
- Analyze the requirements systematically and develop the model using standard tools and methodologies
- Apply key aspects of software engineering processes for the development of a complex software system
- Develop a quality software project through effective team-building, planning, scheduling and risk assessment
- Keep abreast of current trends in the area of software engineering

Pedagogy

Through Lectures, ppt, Online Material, NPTEL, Assignments, Quiz. Lab will be based on a case study with complete software development life cycle.

Contents

UNIT-I	10 Hours
Introduction: Introduction of Software (SW), Type of Software, SW Components: Process, People, Project, Product, Software crisis, Software Process Models: Details of People involve in each Process, SDLC methods/models: Build & Fix, Waterfall, Prototype (Evolutionary & Throw-away), Iterative, Incremental iterative, Spiral, RAD, Agile methodology.	
UNIT-II	11 Hours
Requirement Analysis & Specifications: Requirement Analysis, Requirement Specification, Approaches to Requirement analysis, Specifying Behavioural & Non-Behavioural Requirements, SRS Components & various User's of SRS. Introduction of Requirement Specification: Dataflow(DF) Diagram, Data dictionaries, Entity-Relationship (ER) diagram, Object Diagram etc., Requirement Validation.	
UNIT-III	11 Hours
Software Design and Testing: Design Architecture and Patterns, Modularity, Function oriented design, Object Oriented Design, Software Testing: Software Testing Strategy and Techniques, Functional testing, Structural testing, Debugging and testing tools, SW/HW reliability, Reliability concepts and models, Reliability allocation, Software Maintenance: Introduction to SW Maintenance and types, SW Maintenance models: Re-engineering & Forward Engineering.	
UNIT-IV	10 Hours
Software Project Planning: Role of Software Project Planning, Estimation method, Estimation of Effort & Schedule, Software Metrics: Introduction to Size metrics, Data structure metrics, information flow metrics, entropy-based measures, metric analysis. Basic COCOMO, Intermediate COCOMO, Detailed COCOMO, Quality Planning, Planning Parameter, Quality Defect Removal Cycle, Role of Risk Analysis.	
Text Books	
1	K. K. Aggarwal, Yogesh Singh: Software Engineering, New Age International Ltd, 3rd Ed. 2008.
2	Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing, 2010.
Reference Books	
1	R.S. Pressman, Software Engineering – A Practitioner's Approach, 8th Edition, McGraw Hill, 2019.
2	Ian Sommerville, Software Engineering, 10th Edition, Pearson, 2017.

MATERIAL SCIENCE AND ENGINEERING	
Course Code: BAS-201 Contact Hours: L-3 T-1 P-0 Course Category: OEC	Credits: 4 Semester: 3

Introduction: At the core of any technological advancement are the materials. Material Science and Engineering course give insight into importance of materials, their various classifications and physical properties. The course also provides an insight into various characterization techniques useful in studying the physical properties of materials.

Course Objectives:

- To provides an insight into the scope of Material Science and Engineering and classification of various Materials.
- To acquire basic understanding of the electronic, superconducting dielectric and magnetic properties of materials for technological applications.
- To familiarize with modern engineering materials and bio-materials in various applications.
- To develop an understanding of principles, working and applications of various material characterization techniques.

Pre-requisites: Basic understanding of Applied Physics Course.

Course Outcomes: Upon completion of this course, the students will be able to:

- Understand scope and importance of materials in technological developments.
- Learn importance and utilization of various physical properties of materials in device applications.
- Enhance the knowledge of latest advancements in field of materials, Modern Engineering and Biomaterials.
- Learn the principles, working and applications of various material characterization techniques in studying the materials.

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Content

UNIT-I	4 Hours
Introduction to materials: Importance of Material science and Engineering, Classification of Materials: Metallic, Ceramic, Polymeric, Electronic and Composite Materials.	
UNIT-II	16 Hours
PROPERTIES OF MATERIALS **Electronic Materials:** Fermi energy and Fermi–Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect. **Superconducting Materials:** Normal and High temperature superconductivity, Applications. **Dielectric Materials:** Polarization mechanisms in dielectrics, Frequency and temperature dependence of polarization mechanism, Piezoelectric properties. **Magnetic Materials:** Types of Magnetism: Diamagnetism, Paramagnetism, Ferromagnetism, Anti-ferromagnetism, Ferrimagnetism, Classification of magnetic materials based on spin, Hard and soft magnetic materials, Spintronics (GMR).	
UNIT-III	10 Hours
MODERN ENGINEERING AND BIOMATERIALS **Photonic Materials:** LED – LCD – Photo conducting materials, Photo detectors, Photonic crystals and applications. **Smart materials:** – Shape memory alloys, Chromic materials (Thermo, Photo and Electro),– Composite Materials. **Bio-materials:** Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials.	
UNIT-IV	10 Hours
MATERIALS CHARACTERIZATION **Structural Analysis:** X-ray diffraction, SEM, TEM, AFM- Principals, Instrumentations and applications. **Optical Characterizations:** UV-Vis, FTIR-Principals, Instrumentations and applications. **Thermal Analytical Techniques:** TGA, DTA, DSC-Principals, Instrumentations and applications.	

Text Books	
1	William D. Callister, Materials Science and Engineering: An Introduction, 8th Edition Edition, John Wiley & Sons, 2010.
2	Sam Zhang, Lin Li, Ashok Kumar, "Materials Characterization Techniques", 1st Edition, CRC Press, 2008.
3	T. Pradeep, "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012.
Reference Books	
1	Elements of X–ray Diffraction, B. D. Cullity, S.R. Stock, 3rd Edition, Pearson,2001
2	R. F. Egerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, 2nd Edition, Springer,2016.

NUMERICAL METHODS	
Course Code: BAS 203 Contact Hours: L-3 T-1 P-0 Course Category: OEC	Credits: 4 Semester: 3

Introduction: Numerical Methods give insight into problems we cannot otherwise solve. These methods provide us the way to solve problem when exact methods fails or unable to produce the desirable results.

Course Objectives:

- To motivate the students to understand and learn various numerical techniques to solve mathematical problems representing various engineering, physical and real life problems.
- To provide constructive methods for obtaining answers to such problem for which analytical methods fails to find solutions.

Pre-requisites: Calculus, Differential equations, some exposure to linear algebra (matrices) helps.

Course Outcomes: Upon completion of this course, the students will be able to:

- Understand the errors, source of error and its effect on any numerical computations and also analysis the efficiency of any numerical algorithms.
- Learn how to obtain numerical solution of nonlinear equations using bisection, secant, Newton, and fixed-point iteration methods.
- Solve system of linear equations numerically using direct and iterative methods.
- Understand how to approximate the functions using interpolating polynomials.
- Learn how to solve definite integrals and initial value problems numerically.

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Content

UNIT-I	10 Hours
Floating-Point Numbers: Floating-point representation, rounding, chopping, error analysis, -conditioning and stability. Non-Linear Equations: Bisection, secant, fixed-point iteration, Newton method for simple and multiple roots, their convergence analysis and order of convergence.	
UNIT-II	11 Hours
Linear Systems and Eigen-Values: Gauss elimination method using pivoting strategies, LU decomposition, Gauss-Seidel and successive-over-relaxation (SOR) iteration methods and their convergence, ill and well-conditioned systems, Rayleigh's power method for eigen-values and eigen-vectors.	
UNIT-III	11 Hours
Interpolation and Approximations: Finite differences, Newton's forward and backward interpolation, Lagrange and Newton's divided difference interpolation formulas with error analysis, least square approximations. Numerical Integration: Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and their error analysis, Gauss--Legendre quadrature formulae.	
UNIT-IV	10 Hours
Differential Equations: Solution of initial value problems using Picard, Taylor series, Euler's and Runge- Kutta methods (up to fourth-order), system of first-order differential equations.	
Text Books	
1	Jain M.K., Iyengar, S.R.K., and Jain, R.K. Numerical Methods for Scientific and Engineering Computation, 6th Edition, New Age International Publication, 2012.
2	Sastry S., Introductory Methods of Numerical Analysis, 5th Edition, Prentice Hall India Learning Private Limited; 2012.
3	Conte, S.D and Carl D. Boor, Elementry Numerical Analysis: An Algorithmic approach, SIAM-Society for Industrial and Applied Mathematics, 2017.
4	Grewal, B. S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers, 2012.
Reference Books	
1	Gerald C.F and Wheatley P.O., Applied Numerical Analysis, 8th Edition, Pearson Education, 2011.
2	Chappra S.C., Numerical Methods for Engineers, 7th Edition, McGraw-Hill Higher Education, 2014.

ENGINEERING MEASUREMENT AND METROLOGY	
Course Code: BMA-209 Contact Hours: L-3 T-0 P-2 Course Category: OEC	Credits: 4 Semester: 3

Introduction: This is a basic introductory course on measurement and metrology to be used in industry focussed on how to adopt and apply various methods of measurement. It enlightens the students about the various errors, calibration, sensors, accuracy of measurements thus to help in standardising the methods

Course Objectives:

- To enlighten the students on measurement process and why it is so important.
- The course aims to explain the students that in what best way to do measurement and develop standardization of measuring methods.
- The students are to be provided hands on practical exposure on topics covered in the course.

Pre-Requisites: NIL

Course Outcomes: Having successfully completed this course, the student will be able to

- Understand Measurement Process and various techniques
- Understand sensors and Transducers
- Understand measurement instrument capabilities
- Understand Statically control techniques

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The hand written notes, PowerPoint slides and assignments will be provided to the students and also mailed to them. The students can also raise their issues related to the course in the class and mail.

Contents:

UNIT I	11 Hours
Introduction: Introduction to measurement and measuring instruments generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration concept of error, Types and sources of error, statistical analysis of errors. **Sensors and Transducers:** Types of sensors, types of transducers and their characteristics, Difference b/w Open loop and Closed loop measurement system, Signal conditioning unit, indicating unit, static characteristics i.e. accuracy, precision, sensitivity, resolution, linearity. **Measurement of flow:** Methods of flow measurement, hot wire anemometer, ultrasonic flow meter.	
UNIT II	11 Hours
Measurement of pressure: Elastic and indirect type pressure transducers. Measurement of very low pressures. **Strain measurement:** Types of strain gauges and their working, temperature Compensation. **Measurement of force and torque:** Different types of load cells, elastic transducers, pneumatic and hydraulic systems. **Temperature measurement:** Thermocouples, pyrometers.	
UNIT III	10 Hours
Metrology and Inspection: Sources of error, Standards of linear measurement, line and end standards, Limit fits and tolerances, Interchangeability and standardization. **Length Standards:** Line standards, end standards, transfer from line standards to end standards, Numerical based on-line standards, slip gauges – its use and care, methods of building different heights using different sets of slip gauges. **Linear and angular measurements devices and systems Comparators:** Types of Gauges, Limit Gauge, Snap Gauge, Receiving Gauge, Taylor's Principle of Gauge Design.	
UNIT IV	10 Hours
Measurement of geometric forms like straightness, flatness, roundness, Tool maker's microscope, profile project autocollimator. **Interferometry:** principle and use of interferometer, optical flat. Measurement of screw threads and gears. **Surface texture:** quantitative evaluation of surface roughness and its measurement, Comparators, Feature inspection Form Tolerance Inspection. Tolerance Stack Analysis, CMM, working and features.	
Text Books	
1.	A.K. Tayal, "Instrumentation and Mechanical Measurement", Galgotia Publications Pvt. Ltd., 2003..
2.	T.G. Beckwith, R.D. Maragoni and J.H Lienhard, "Mechanical Measurements", Addison- Wesley, 1999.
Reference Books	
1.	R.K. Jain, "Engineering Metrology", Khanna Publishers, Delhi,2010
2.	I.C. Gupta, "Engineering Metrology", Dhanpat Rai Publications, Delhi,2011
3.	F.W. Galyer& C.R. Shotbolt, "Metrology for Engineers", ELBS edition, 2009

ANALOG & DIGITAL ELECTRONICS	
Course Code: BEC-209 **Contact Hours:**L-3 T-0 P-2 **Course Category:**	**Credits:** 4 **Semester:** 3

Introduction: The course will introduce fundamental principles of analog and digital electronics. The course provides sufficient basic knowledge for the undergraduate to understand the design of diodes and transistor based circuits, op-amps and their applications as well as the design of digital circuits.

Course Objectives:

- Understand the design and analysis of various analog electronic circuits
- Understand the fundamental concepts and techniques used in digital electronics

Pre-requisite:

- Basic concept of circuit theory
- Student should have the prior knowledge of semiconductor electronics
- Basic concept of number system

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

- Understand basic electronic devices such as diodes, BJT & FET transistors
- Understand various applications of Op-Amp
- Analyse logic processes and implement logical operations using combinational logic circuits
- Design sequential circuits

Pedagogy: Class room teaching, problem solving approach, practical based learning, tutorials

Contents

UNIT-I	12 Hours
Semiconductor diodes, Characteristics and operation, Applications of p-n junction diode. Bipolar Junction Transistor: Construction and operation, Common base (CB) configuration, Transistor amplifying action, Common emitter (CE) and Common collector (CC) configurations, definition of α and β, saturation, regions of operation of transistor, biasing methods. Amplifiers: CE, CC, CE amplifier circuits and their comparisons, RC coupled amplifier, Frequency response, Gain-bandwidth, and Darlington pair,	
UNIT-II	10 Hours
Field Effect Transistor: Introduction, JFET characteristics, Depletion & enhancement MOSFET, CMOS. Operational amplifier: Characteristics of ideal Op-Amp, Inverting & non-inverting amplifier, Differential amplifier, Adder & Subtractor, Integrator, Differentiator, Instrumentation amplifier, Schmitt trigger, Astable multivibrator.	
UNIT-III	10 Hours
Digital electronics: Analog & digital signals, Logic gates, Boolean algebra. Standard representation of logical functions, K-map representation and simplification of logical functions, Don't care conditions, X-OR & X-NOR simplification of K-maps. Combinational circuits: Multiplexers, Demultiplexers, Decoders & Encoders, Adders & Subtractor, Code converters, Comparators, Decoder/drivers for display devices, A/D and D/A converters.	
UNIT-IV	10 Hours
Flip Flops: S-R, J-K, D & T Flip-flops, Excitation table of a flip-flop, Race around condition Sequential circuits: Shift registers, Ripple counter, Design of synchronous counters and Sequence detectors, Sequence generators	

Text Books

1	Morris Mano, "Digital Design", PHI, 5th edition, 2013.
2	Millman and Halkias, "Electronic Devices and Circuits" T MH, 4th Edition, 2015.
3	Salivahanan, Suresh Kumar, Vallavaraj, "Electronic Devices and Circuits" MH, 4th Edition, 2016.

Reference Books

1	Balbir Kumar and S. B. Jain, "Electronic Devices and Circuits" PHI, 2nd Edition 2014.
2	R.P. Jain, "Modern Digital Electronics", TMH, 4th Edtion, 2010
3	Roy Choudhury and Jain, "Linear Integrated Circuits", New Age Publishers, 4th Edition, 2017.