COMPUTER SCIENCE & ENGINEERING

Course Name	**:**	**INTRODUCTION TO COMPUTER SCIENCE AND ENGINEERING**
Course Code	**:**	**CSN101**
Credits	**:**	**2**
L T P	**:**	**2 0 0**

Course Objectives:
The students should know about various disciplines in Computer Science and Engineering and are aware of emerging trends of Computer Science and Engineering.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**COMPUTER HARDWARE** Basics of Number System, Evolution of Computer Hardware, Moore's Law.	**4**
2	**LOGIC DEVELOPMENT AND ALGORITHMS** Various techniques to solve a problem, Ways to specify an algorithm, Flow charting techniques.	**4**
3	**VARIOUS DISCIPLINES OF COMPUTER SCIENCE AND ENGINEERING** Basics of Operating Systems, Artificial Intelligence, Computer Networks, Information Security, Software Engineering, Computer Vision.	**16**
4	Current and future trends and challenges in various fields of computing. Social, ethical and economical issues related to computing technology. Exploration of career and professional development opportunities.	**4**

Course Outcomes: At the end of the course, students will have:	
1	Knowledge about various fields of Computer Science and Engineering.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Computing Fundamentals, Peter Nortan, 4th Ed., Tata McRaw Hill	2001
2	Computer Science Handbook, Allen B. Tucker, CRC Press	2004

Course Name	**:**	**DATA STRUCTURES**
Course Code	**:**	**CSN 102**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to describe and implement various data structures including lists, arrays, stacks, queues, binary search trees, graphs, hash tables, and matrices. The student will be able to analyze and apply various algorithms for shortest path calculation, sorting and searching applications.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Introduction to Data Structures and data types, Efficient use of memory, Recursion, time and space complexity of algorithms, Big O Notation and theta notations.	**4**
2	**ELEMENTARY DATA STRUCTURES** Stacks, queues, Infix, Postfix & Prefix conversions, evaluations of expressions, multiple	**7**

	stacks and queues, priority queues as heaps, double ended queue, implementation of stacks and queues.	
3	**LINKED LISTS** Singly linked lists, linked stacks and queues, polynomial addition, sparse matrices, doubly linked lists and dynamic storage management, circular linked list, Applications of Stacks, Queues and Linked lists, Garbage collection, Josephus Problem.	**7**
4	**TREES** Basic terminology, binary trees, binary tree traversal, representations of binary tree, application of trees, decision tree, game trees, Threaded Trees, Binary Search Tree, AVL tree, B-tree.	**8**
5	**GRAPH THEORY** Graph representations, Graph Traversals, Dijkstra's algorithm for shortest path, Prim's and Kruskal's Algorithm for Minimal Spanning tree.	**8**
6	**SORTING AND SEARCHING** Searching: Linear search, binary search and hash search. Sorting: Insertion sort, selection sort, bubble sort, quick sort, merge sort, heap sort, and Bucket sort.	**8**

List of Experiments:		**Number of Turns**
1	Implement stack and its various applications.	**1**
2	Implement queue and its various applications.	**1**
3	Implement linked list and its various applications.	**2**
4	Implement binary trees and its various applications.	**2**
5	Implement AVL tree.	**1**
6	Implement binary search tree and its various applications.	**1**
7	Implement graphs.	**2**
8	Implement minimum spanning tree.	**2**
9	Implement various searching and sorting algorithms	**1**

Course Outcomes: At the end of the course, students will be able to:	
1	Choose the data structures that effectively model the information in a problem and analyze the efficiency trade-offs (run time and memory usage) among alternative data structure implementations or combinations.
2	Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.
3	Use efficient data structure (linked lists, stacks and queues) to solve a particular problem.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Data Structures and Program Design in C By Robert L. Kruse,C.L. Tondo, Bruce Leung, Pearson Education.	2007
2	Data Structures Using C & C++, By Langsam, Augenstein, Tanenbaum, Pearson Education.	1989
3	Fundamentals of Data Structures, By Ellis Horowitz and Sartaj Sahni, Computer Science Press.	2011
4	An introduction to data structures with applications, By J.P. Trembley & P.G. Sorensen, TMH.	2004

Course Name	**:**	**DIGITAL ELECTRONIC AND LOGIC DESIGN**
Course Code	**:**	**CSN103**
Credits	**:**	**4**

L T P	:	3 0 2

Course Objectives:
Students should be able to apply the principles of Boolean algebra to manipulate and minimize logic expressions. Analyze the operation of sequential circuits built with various basic devices. Design combinational circuits using various devices.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems.	**2**
2	**NUMBER SYSTEMS AND CODES** Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.	**6**
3	**COMBINATIONAL LOGIC SYSTEMS** Definition and specification; Truth table; Basic logic operation and logic gates.	**4**
4	**BOOLEAN ALGEBRA AND SWITCHING FUNCTIONS** Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map, Synthesis of combinational logic circuits.	**8**
5	**COMBINATIONAL LOGIC MODULES AND THEIR APPLICATIONS** Decoders, encoders, multiplexers, demultiplexers and their applications; Parity circuits and comparators; Arithmetic modules- adders, subtractors and ALU; Design examples.	**6**
6	**SEQUENTIAL LOGIC SYSTEMS** Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples, Registers, counters, shift register, application examples.	**6**
7	**MEMORY** Introduction to Read-only memory, read/write memory - SRAM and DRAM	**4**
8	**LOGIC FAMILIES** Introduction to different logic families: RTL, TTL, Metal Oxide Semiconductor.	**2**
9	**PROGRAMMABLE LOGIC DEVICES** PLAs, PALs and their applications; Sequential PLDs and their applications; State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs)	**4**

List of Experiments:		**Number of Turns**
1	Introduction and hands on with the simulation environment	**1**
2	Investigate the behavior of various logic gates (NAND, NOR, NOT, AND,OR, XOR).	**1**
3	Simulate a logic function using logic gates.	**1**
4	Design and simulate Adder and Subtractor circuits.	**1**
5	Design and simulate code converters.	**2**
6	Design and simulate Combinational circuits using Multiplexers.	**2**
7	Simulate Flip-flops using NAND and NOR Gates.	**1**
8	Simulate the operation of shift register.	**1**
9	Simulate the operation of counters.	**1**
10	Design and simulate the synchronous sequential circuits.	**1**
11	Design and simulate applications based on digital circuits.	**1**

Course Outcomes: At the end of the course, students will be able to:	
1	Design two-level logic functions with various gates.
2	Design combinational circuits using gates.
3	Design and build complex digital systems using state-of-the-art components.
4	Understand how to use state diagrams to design finite state machines using various types of flip-flops and combinational circuits.
5	Articulate how modern microelectronics has impacted society.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Digital Design by Morris Mano, 4th Ed. Pearson	2006
2	Digital logic and computer design by Morris Mano, Pearson Education Inc.	1979
3	Digital principles and applications by Malvino Leech, Tata McGraw Hill Education Pvt. Ltd	2006
4	Digital Electronics by R.P. Jain, Tata McGraw Hill Education Pvt. Ltd.	2003
5	Digital System Principals and Applications by R J Tocci, Pearson Education Inc.	2010

Course Name	**:**	**DISCRETE STRUCTURES FOR COMPUTER SCIENCE**
Course Code	**:**	**CSN 201**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
Students should be able to understand Discrete Mathematical Structures (DMS) for the development of theoretical computer science, problem solving in Programming language using Discrete Structure and importance of discrete structures towards simulation of a problem in computer science and engineering.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**MATHEMATICAL REASONING** Mathematical reasoning, Propositions, Negation, disjunction and conjunction, Implication and Equivalence, Truth tables, Predicates, Quantifiers, Natural deduction, Rules of Inference, Methods of proofs, Resolution principle, Application to PROLOG.	**8**
2	**SET THEORY** Paradoxes in set theory, Inductive definition of sets and proof by induction, Peano postulates, Relations, Properties of relations, Equivalence Relations and partitions, Partial orderings, Posets, Linear and well-ordered sets.	**8**
3	**COMBINATORICS** Elementary combinatorics, Counting techniques, Recurrence relation, Generating functions	**4**
4	**FUNCTIONS** Functions; mappings, Injection and Surjections, Composition of functions, Inverse functions, Special functions, Pigeonhole principle, Recursive function theory	**6**
5	**GRAPH THEORY** Elements of graph theory, Euler graph, Hamiltonian path, trees, Tree traversals, Spanning trees, Representation of relations by graphs.	**8**
6	**GROUPS, RINGS, FIELDS** Definition and elementary properties of groups, Semigroups, Monoids, Rings, Fields, Vector spaces and lattices	**6**
7	**DISCRETE PROBABILITY** Introduction, Discrete random variables, Applications to Binary Search Tree.	**2**

Course Outcomes: At the end of the course, students will be able to:	
1	Acquire complete knowledge on various discrete structures.
2	Apply Applications of Discrete Structures in Computer Science and Engineering.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	K. H. Rosen, Discrete Mathematics and applications, 6th Edition, Tata McGraw Hill	2007
2	C. L. Liu, Elements of Discrete Mathematics, 2nd Edn., Tata McGraw-Hill	2000
3	J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Second edition, Prentice Hall of India	1986
4	W. K. Grassmann and J. P. Trembnlay, Logic and Discrete Mathematics, A Computer Science Perspective, Prentice Hall Inc	1996

Course Name	**:**	**COMPUTER ARCHITECTURE AND ORGANIZATION**
Course Code	**:**	**CSN202**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
Students should be able to understand basic principles of Computer Systems. They should be able to understand various logic design techniques and their applications. They should be capable of analyzing the system performance.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**BASICS** Introduction to computers with block diagrams, Impact of technology. Designing combinational and sequential logic, computers registers and instructions, timing, and control, instructions cycle, memory reference instruction, I-O interruption.	**5**
2	**COMPUTER ARITHMETIC** Adder and Subtractor circuits, Booth Multiplication Algorithm, Performance bench marks.	**7**
3	**CONTROL PATH DESIGN** Sequence counter method, Micro programmed controllers address sequencing, symbolic microinstructions.	**7**
4	**CENTRAL PROCESSING UNIT** Registers General register organization, stack organization, instructions formats, address instructions, addressing modes, data transfer and manipulations, program control, RISC instruction set design, three address instructions and arithmetic pipelines with example of floating point adder, instructions pipelines , advanced pipelining using instruction level parallelism.	**10**
5	**MEMORY ORIGINATION** Memory device characteristics, Random Access Memory, Serial Access Memory, virtual memory, associative memory, cache memory, memory management hardware, hierarchy of various memories.	**7**
6	**I/O ORGANIZATION** I/O interface asynchronous data transfer, DMA interrupt, I/O processor.	**6**

Course Outcomes: At the end of the course, students will be able to:	
1	Design the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.
2	Learn different computer architectures and hardware.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	M. Morris Mano, Computer System & Architecture, Prentice Hall of India	2002
2	John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach, Morgan Kaufmann/ Elsevier, 4th Edition	2007
3	Hayes .J.P, Computer architecture and organization by McGraw-Hill Companies	1998
4	M.Morris and Charles R. Kinre , Logic and computer design Fundamental, PHI	1995

Course Name	**:**	**OBJECT ORIENTED PROGRAMMING**
Course Code	**:**	**CSN203**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand the concept of object oriented programming like classes, constructors, polymorphism, inheritance, templates and file handling.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO PROGRAMMING PARADIGMS** Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm	**2**
2	**C++ CONSTRUCTS** Tokens, Expressions and control structures, various data types and data structures, Variable declarations, Dynamic Initializations, Operators and Scope of Operators, Typecasting, Unformatted and formatted console I/O Operations	**2**
3	**FUNCTIONS, CLASSES AND OBJECTS** Prototyping, Referencing the variables in functions, Inline, static and friend functions. Memory allocation for classes and objects. Arrays of objects, pointers to member functions.	**4**
4	**CONSTRUCTORS AND DESTRUCTORS** Constructor and Destructor types, Dynamic Constructors, Applications, Order of Invocation, C++ garbage collection, dynamic memory allocation.	**5**
5	**POLYMORPHISM** Function and Operator overloading, overloading using friend Functions, type conversions from basic data types to user defined and vice versa.	**5**
6	**INHERITANCE** Base classes and Derived classes, types of inheritance, various types of classes, Invocation of Constructors and Destructors in Inheritance, aggregation, composition, classification hierarchies, metaclass/abstract classes.	**5**
7	**POINTERS** Constant pointers, Use of this Pointer, Pointer to derived and base classes, virtual functions, Bindings, Pure virtual Functions and polymorphism.	**5**
8	**I/O OPERATIONS AND FILES** Classes of files, Operations on file, file pointers.	**5**
9	**GENERIC PROGRAMMING WITH TEMPLATES** Definition of class template, Function Templates, Overloading Template Functions, Class templates and member functions templates with parameters, Standard C++ classes, persistent objects, streams and files, namespaces, exception handling, generic classes, standard	**4**

	template library: Library organization and containers, standard containers, algorithm and Function objects, iterators and allocators, strings, streams, manipulators, user defined manipulators and vectors.	
10	**ADVANCED MEMORY HANDLING** Storage types in C++, Automatic Life, Dynamic Life, Static Life, Object with special storage restrictions.	**2**
11	**CASE STUDY** Features of Different Object Oriented languages	**3**

List of Experiments:		**Number of Turns**
1	Implement various C++ constructs	**1**
2	Implement friend functions	**1**
3	Implement pointers to member functions	**2**
4	Implement constructors and destructors	**1**
5	Implement operator and function overloading	**2**
6	Implement inheritance	**1**
7	Implement run time polymorphism	**2**
8	Implement file operations	**2**
9	Implement templates	**1**

Course Outcomes: At the end of the course, students will be able to:	
1	Understand real world problem and identify object in given problem.
2	Construct C++ classes and apply various C++ concepts with proficiency

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	C++ Primer, 5th Edition, Pearson Education Inc.	2012
2	Object Oriented Programming in C++, Robert Lafore, 4th Edition, SAMS	2001
3	C++ Primer Plus By Prata, Pearson Education	2012
4	C++:The Complete Reference, By Schildt, McGraw-Hill	2003
5	Object Oriented Programming with C++, Balaguruswamy, Tata Mc Graw Hill	2008

Course Name	**:**	**ANALYSIS AND DESIGN OF ALGORITHMS**
Course Code	**:**	**CSN204**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to analyze various algorithms mainly for time and space complexity. They should be able to develop algorithm for solving various computational problems by applying various algorithm design strategies. They should be able to understand the affect of choice of data structures on the complexity of algorithm.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**BASIC CONCEPTS OF ALGORITHMS** Introduction – Notion of Algorithm – Fundamentals of Algorithmic Solving – Important problem types – Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.	**6**

2	**MATHEMATICAL ASPECTS AND ANALYSIS OF ALGORITHMS** Mathematical analysis of non-recursive algorithms. Mathematical analysis of recursive algorithm: recurrence relations, solution of recurrence relations using substitution method.	**5**
3	**BRUTE FORCE** Selection sort, Bubble sort, Sequential searching (Linear Search), Brute force string matching.	**4**
4	**DIVIDE AND CONQUER STRATEGY** General method, Merge sort, Quick Sort, Binary Search, Strassen's matrix multiplication	**4**
5	**GREEDY APPROACH** General method, Fractional Knapsack problem, Minimum cost spanning tree: Prim's and Kruskal's algorithm, Single source shortest path problem	**5**
6	**DYNAMIC PROGRAMMING** General method, Principle of optimality, Multi-stage graph problem, All pair shortest path problem, 0/1 Knapsack problem, Traveling salesperson problem.	**6**
7	**BACKTRACKING** General method, N-Queen problem, 0/1 Knapsack problem	**4**
8	**BRANCH AND BOUND** General method, 0/1 Knapsack problem, Traveling sales person problem	**4**
9	**LOWER BOUND THEORY AND COMPELXITY CLASSES** Lower bounds, Decision trees, P, NP and NP Complete problems	**4**

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate the ability to select the best data structure for designing an algorithm to solve a given problem.
2	Demonstrate the ability to compare algorithms with respect to time and space complexity.
3	Develop algorithms to solve various computational problems.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Algorithm Design, Jon Kelinberg and Eva Tardos, 1st Edition, Pearson Education	2014
2	Fundamentals of algorithms, Horowitz E, Sahini S, Rajasekaran S., University Press	2008
3	Introduction to algorithms, Cormen, Leiserson, Rivest, Stein, 3rd Edition, PHI.	2012
4	An introduction to analysis of algorithms, R. Sedgewick, 1st edition, Pearson Education	1996
5	Data Structures and Program Design in C By Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education.	2007

Course Name	**:**	**ENGINEERING ANALYSIS AND DESIGN**
Course Code	**:**	**CSN206**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
Students should be able to understand the concept and importance of Information Systems. They should be able to extract information requirements from any business system and design information systems by using Engineering Techniques used in industrial applications.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO INFORMATION SYSTEMS** Business Systems Concepts, Important systems characteristics, Business systems, Business	6

	Information Systems, Components of Information System, Categories of Information Systems, Scope of Information Systems, Modern Information Systems: Embedded, Mobile Applications, Big Data etc, Technology drivers for modern Information Systems	
2	**MANAGING THE APPLICATION DEVELOPMENT PORTFOLIO** Reasons for project proposals for information systems, Corporate missions and the role of information systems, Information System Building Blocks, Identifying and selecting Systems Development Projects, Initiating and Planning Systems Development Projects, Assessing Project Feasibility.	8
3	**REQUIREMENTS ANALYSIS AND DETERMINATION** Requirements determination, Basic Requirements, User Transaction Requirements, User Decision Requirements, Organization-wide Requirements, Fact-Finding Techniques, Tools for documenting procedures and decisions, Tools for Analysis and Determination, Structured Analysis.	8
4	**SYSTEMS MODELING AND DESIGN** Process Modeling, Data Modeling, Modeling Systems Requirements with Use Cases, System Design, Elements of Design, Logical design elements, Physical design elements, Features that must be designed, Transition from analysis to design, Systems design for In-House development-The Build solution, Systems design for Integrating Commercial Software-The Buy solution.	8
5	**APPLICATION ARCHITECTURE AND MODELING** Application Architecture, Physical Data Flow Diagrams, Information Technology Architecture, IT alternatives and trends influencing design decisions, Distributed Architecture, Centralized Systems, File Server Architecture, Client Server Architectures-Distributed Presentation, Distributed Data, Distributed Data and Application, Internet Based Computing Architectures, Data Architectures, Interface Architectures, Process Architectures, Modeling the Application Architecture of an Information System.	8
6	**FIELD CASE STUDIES** Various components of an Information Systems Project, Information Requirements of various Projects as Case studies Such as Various University Departments, Local City Bus Transport System, Local Radio-Taxi Booking System, Patient Registration System, Internet Based Computing-Online Shopping, Mobile Computing Applications etc.	4

Course Outcomes: At the end of the course, students will be able to:	
1	Understand the fundamentals of information system.
2	Understand about the various roles in information technology projects
3	Analyze, design and model various information system.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Analysis and Design of Information Systems by James A. Senn, McGraw-Hill, Computer Science Series.	1989
2	Systems Analysis and Design Methods by Whitten, Bentley and Dittman, Tata McGraw-Hill.	2001
3	Modern Systems Analysis and Design by Jeffrey A. Hoffer, Joey F. George and Joseph S. Valacich, Pearson Education Asia.	2008

Course Name	**:**	**MICROPROCESSOR AND ITS APPLICATIONS**
Course Code	**:**	**CSN207**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

Students should be able to understand microprocessor based systems and interfacing techniques. Learn assembly language, assembly directives. Interface microprocessor with memories like RAM and ROM. Interface microprocessor with various peripheral devices. Overview of high end processors.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**ARCHITECTURE OF MICROPROCESSORS** Introduction to the general structure of 8 and 16 bit Microprocessors. Overview of 8085 microprocessor. Overview of 8086 microprocessor. Signals and pin diagram of 8086 microprocessor, Register structure, ALU, Bus Organization, Timing and Control.	**6**
2	**ARCHITECTURE OF A 16-BIT MICROPROCESSOR** Internal organization of 8086, Signal descriptions, Physical memory organization, BIU, EU, Minimum mode 8086 system and timings, Maximum mode 8086 system and timing.	**6**
3	**ASSEMBLY LANGUAGE OF 8086** Addressing modes, Instruction set, Assembler directives and Operators, Data movement instructions, Arithmetic and logic instructions, Program control instructions, Recursive procedures.	**10**
4	**SPECIAL ARCHITECTURAL FEATURES AND RELATED PROGRAMMING** Stack structure, Interrupts and Interrupt service routine, Interrupt programming, Macros, Timings and delays.	**5**
5	**BASIC PERIPHERALS AND THEIR INTERFACING** Memory interfacing, Interfacing I/O ports, Programmable Peripheral Interface (8255), Interfacing A/D and D/A converters.	**3**
6	**SPECIAL PURPOSE PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING** Programmable Interval Timer (8253/8254), Programmable Interrupt Controller (8259), Keyboard/Display Controller (8279), Programmable Communication Interface (8251), DMA Controller (8237/8257).	**5**
7	**MICROPROCESSOR'S APPLICATION** Interfacing scanned multiplexed displays and Liquid crystal displays, Interfacing matrix keyboard, Stepper motor interfacing, Case studies of microprocessor based systems, Standards for bus architecture and ports.	**5**
8	**HIGH END PROCESSORS** Introduction to Pentium and onwards	**2**

List of Experiments:		**Number of Turns**
1	To introduce Assembly Language, Assembly Language Fundamentals	1
2	Assembling, Linking and Debugging, Data Allocation Directives	1
3	Programming Data Transfer Instructions (8086 Instruction Set)	2
4	Programming Arithmetic Instructions (8086 Instruction Set)	2
5	Programming Multiply and Divide Instructions (8086 Instruction Set)	1
6	Programming Logical Instruction (8086 Instruction Set)	1
7	Programming Shift Rotate Instructions (8086 Instruction Set)	1
8	Programming Transfer Control Instructions "CALL and RET" (8086 Instruction Set)	1
9	Programming Transfer Control Instructions "Jump" (8086 Instruction Set)	1
10	Programming Transfer Control Instructions "Conditional Jump" (8086 Instruction Set))	1
11	Programming Stack Operation Instructions "PUSH & POP" (8086 Instruction Set)	1

Course Outcomes: At the end of the course, students will be able to:	
1	Program a microprocessor based system.
2	Interface a microprocessor with various peripheral devices.
3	Implement real time embedded applications
4	Use microprocessor peripherals effectively

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, Pentium, and Pentium Pro Processor- B.B. Brey, Pearson Education	2009
2	Advanced Microprocessors and Peripherals, Ray and Bhurchandi, 2nd Edition, Tata McGraw Hill	2006
3	Microprocessor and Interfacing - D. V. Hall, McGraw Hill Publishing Co.	1990
4	Microprocessors and Microcomputer based System Design- Rafiquzzaman , PHI	2002

Course Name	**:**	**DATA BASE MANAGEMENT SYSTEM**
Course Code	**:**	**CSN208**
Credits	**:**	**3 0 2**
L T P	**:**	**4**

Course Objectives:
Students should be able to understand various applications of DBMS and query languages.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Database Languages: DDL, DML **STORAGE AND FILE STRUCTURE** Overview of physical storage media, magnetic disks, RAID, file organization, organization of records in files, indexing and hashing **DATABASE MODELS:** Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Weak and Strong entity types, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model Network model, Hierarchical model	8
2	**RELATIONAL MODE**L: Introduction to relational model, basic structure, Types, Keys, views in a relational database. **SQL:** Fundamentals, basic structure, set operations, aggregate operations, DDL, DML, DCL, nested queries, complex queries, Integrity Constraints, PL/SQL Concepts, triggers	8
3	**RELATIONAL ALGEBRA AND RELATIONAL CALCULUS** Relational Algebra: Fundamental operations, Additional Operations Relational calculus: Tuple Relational calculus, Domain Relational calculus	5
4	**RELATIONAL DATABASE DESIGN:** Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	9
5	**TRANSACTION MANAGEMENT** Transaction concept, transaction state, ACID properties, serializability, Recoverability , Implementation of Isolation , Testing for serializability . concurrency control, Lock based concurrency control, Time stamping methods	7
6	**DISTRIBUTED DATABASES** Introduction, data mining, Big Data, No SQL, New SQL, Modern databases based on these concepts.	5

List of Experiments:		Number of Turns
1	For a given scenario of database application, Create the required tables using SQL Commands	1
2	Write Sql queries to apply the constraints i.e. Primary Key, Foreign key, UNIQUE to the tables.	2
3	SQL queries for Null values and different clauses	2
4	Usage of SELECT, rename, tuple operations, DELETE etc.	2
5	SQL queries for implementing various String operations, Set operations	2
6	SQL queries for implementing JOINs and types of joins with conditions.	1
7	SQL nested queries for a particular scenario.	1
8	SQL queries to create the views ,triggers	1
9	SQL queries to create indexes and apply on a database.	1

Course Outcomes: At the end of the course, students will be able to:	
1	Design a database in various environments
2	Design , implement, test and debug the SQL queries
3	Design a database with triggers for maintaining the consistency of the database

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill,	2006
2	"Fundamentals of Database Systems", Elmsari and Navathe, Pearson Education	2013
3	Database Management Systems , Ramakrishnan and Gehrke, McGrawHill	2003
4	"An Introduction to Database Systems", C.J.Date, A.Kannan, S.Swamynathan, Pearson Education	2006
5	J. D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications	1999

Course Name	**:**	**OPERATING SYSTEMS**
Course Code	**:**	**CSN209**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able to describe the purpose, structure and functions of operating system. They should be able to understand the file system, processes synchronization, process scheduling, system calls and memory management techniques used in an operating system.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**CONCEPTS OF OPERATING SYSTEMS** Computer system overview, concept of an operating system, batch system, multiprogramming, multiprocessing, multi user, time sharing, personal system, parallel system, real time system, simple monitors, general system architecture, System components, operating system services, system calls, system programs, system structure, Approaches to OS design and implementation: Microkernel, Layered, Kernel Approach	**8**
2	**PROCESSES AND THREADS** Concept of process, process states, process state transitions, process control block, operations on processes, threads, concurrent processes, mutual exclusion and	**8**

	synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, Inter process synchronization, Inter process communication, Linux, IPC Mechanism, Remote procedure calls, RPC exception handling, security issues	
3	**MEMORY MANAGEMENT** Logical and physical address space, storage allocation and management techniques, swapping concepts of multi programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithm, thrashing	**8**
4	**INPUT/OUTPUT AND DATA MANAGEMENT** File organization, record blocking, access method, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels	**8**
5	**OS SECURITY** Types of Threats in OS, Basic OS Security Mechanisms, Understanding the Threats: Malware Taxonomy: Viruses, Worms, Rootkits, Defense -- An Overview, Logging, Auditing, and Recovery, OS-level Memory Protection	**4**
6	**CASE STUDIES** Linux/Unix OS design and architecture, Unix shell, Unix operating system services, user perspective, representation of files in Unix system processes and their structure, input-output system, memory management in Unix	**4**
7	**OS ABSTRACTIONS** Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace Files: open, close, read, write, lseek, stat, sync Directories: mkdir, rmdir, link, unlink, mount, umount users + Security: chown, chmod, getuid, setuid, Inter process communication: signals, pipe Networking: socket, accept, snd, recv, connect	**2**

List of Experiments:		**Number of Turns**
1	To perform shell programming	2
2	Implement memory management techniques like paging or segmentation	2
3	Implement any file allocation technique (Linked, Indexed or Contiguous)	2
4	Use the system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount users +	2
5	Use the following system calls of UNIX operating system: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace, open, close, read, write, lseek, stat, sync	2
6	Use the following system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount users +, chown, chmod, getuid, setuid	2
7	Use the following system calls of UNIX operating system: signals, pipe, socket, accept, snd, recv, connect	1

Course Outcomes: At the end of the course, students will be able to:	
1	Explain about operating systems and its major components.
2	Write and/or modify concurrent programs.
3	Apply security as well as recovery feature in the design of algorithms.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Operating system, Galvin & Silberschatz, 7th Edition, John Willey	2004
2	Operating Systems-A Concept Based Approach By Dhamdhare, TMH	2006
3	Operating systems Internals and design principles By William Stallings, Pearson Education	2012
4	Operating Systems –A Design Oriented approach By Crowley, TMH	2001

5	Operating systems Design and Implementation By Andrew S. Tanenbaum, Pearson Education	2009

Course Name	**:**	**COMPUTER NETWORKS**
Course Code	**:**	**CSN210**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

Students should be able to have an understanding of the fundamental concepts of computer networking and have a basic knowledge of the various networks models and their uses. They should be able to understand the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks. They should be able to analyze simple protocols and independently study literature concerning computer networks.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**COMPUTER NETWORKS AND THE INTERNET** What is the Internet; network edge; network core; Delay, Loss and throughput in Packet-Switched Networks; Protocol Layers and their Service Models.	6
2	**APPLICATION LAYER** Principles of Network Applications; The Web and HTTP; File Transfer: FTP;Electronic Mail in the Internet; DNS - The Internet's Directory Service; Peer-to-Peer applications; Socket Programming – Creating network applications.	8
3	**TRANSPORT LAYER** Introduction and Transport-Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Principles of Reliable of Data Transfer; Connection-Oriented Transport: TCP; Principles of Congestion Control;TCP Congestion Control.	10
4	**NETWORK LAYER** Introduction; Virtual circuit and datagram networks; What is inside a router; Internet Protocol (IP): Forwarding and Addressing in the Internet; Routing Algorithms; Routing in the Internet; Broadcast and Multicast Routing.	10
5	**DATA LINK LAYER** Introduction to the link layer; Error Detection and Correction Techniques; Multiple Access links and Protocols; Switched local area networks.	8

List of Experiments:		**Number of Turns**
1	Programs using TCP and UDP Sockets	2
2	Simulation of sliding window protocols	2
3	Simulation of Routing Protocols	3
4	Configure given network topologies using any network simulator software	3
5	Programs for error detecting codes, RSA algorithm	2
6	Programs for Client server Communication	1

Course Outcomes: At the end of the course, students will be able to:	
1	Independently understand basic computer network technology.
2	Understand and explain various components of computer networks.
3	Identify the different types of network topologies and protocols.
4	Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5	Identify the different types of network devices and their functions within a network.
6	Understand and build the skills of routing mechanisms.

7	Familiarize with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	James F. Kurose and Keith W. Ross, "Computer Networking: A top down approach", Pearson Education, 6th edition.	2012
2	A.S. Tanenbaum, "Computer Networks", 5th Edition, PHI	2010
3	G. Keiser, "Local Area Networks", 2nd Edition, TMH	2002
4	D. Bertesekas and R. Gallager, "Data Networks", 2nd Edition, PHI	2000
5	William Stallings, "Data & Computer Communication", PHI, 10th Edition	2013
6	B.A. Forouzan, "Data communications and networking", TMH, 5th Edition	2012
7	B.A. Forouzan, "Local Area Networks", TMH.	2002
8	B.A. Forouzan, "TCP/IP Protocol Suite", TMH.	2004

Course Name	**:**	**THEORY OF COMPUTATION**
Course Code	**:**	**CSN301**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
Students should be able to understand fundamental mathematical and computational principles that are foundations of computer science. They should learn about abstract models of computation, finite representations for languages and will gain formal understanding of algorithms and procedures.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**AUTOMATA** Introduction to formal proof, Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.	**9**
2	**REGULAR EXPRESSIONS AND LANGUAGES** Regular Expression, FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata	**9**
3	**CONTEXT-FREE GRAMMARS AND LANGUAGES** Context-Free Grammar (CFG), Parse Trees , Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG Deterministic Pushdown Automata.	**9**
4	**PROPERTIES OF CONTEXT-FREE LANGUAGES** Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM, Variations of TM, Non-Universal TM, Universal TM.	**8**
5	**UNDECIDABALITY** A language that is not Recursively Enumerable (RE), An undecidable problem that is RE Undecidable problems about Turing Machine, Post's Correspondence Problem, The classes P and NP.	**7**

Course Outcomes: At the end of the course, students will be able to:	
1	Express computer science problems as mathematical statements and to formulate proofs.

2	Become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education	2007
2	H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education	2003
3	Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education.	2007
4	J. Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata Mc Graw Hill.	2007

Course Name	**:**	**SOFTWARE ENGINEERING**
Course Code	**:**	**CSN302**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should learn the concept and importance of Software Engineering. They should be able to construct software that is reasonably easy to understand, modify, maintain and reliable. They should learn strengths and weaknesses of various Software Engineering Techniques used in industrial applications.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO SOFTWARE ENGINEERING** Software, Software Engineering, Myths, Software Process, Work Products, Importance of Software Engineering.	**4**
2	**SOFTWARE PROCESS MODELS** Standard for Software Process, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model, 4th Generation models, Formal Methods, Agile Development.	**6**
3	**REQUIREMENT ENGINEERING** Software Requirements, Types of Requirements, Requirement Engineering Cycle, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation.	**4**
4	**SOFTWARE PROJECT MANAGEMENT** Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Software Process and Project metrics.	**6**
5	**SOFTWARE DESIGN** Process, Data and Behavioral Modeling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document.	**6**
6	**CODING AND TESTING** Coding styles and documentation, Testing principles, Testing strategies, Black-box and White-box Testing Techniques, Levels of testing -unit, integration, system, regression, Test Plan, Test Cases Specification, Software debugging, Software Maintenance.	**6**
7	**SOFTWARE QUALITY**	**4**

	Software Quality Assurance (SQA), SQA tasks, Software amplification and removal, Formal Technical Reviews, Software Quality Factors, ISO 9126, SEI CMM, CMMI, Software Reliability. Software Availability.	
8	**COMPUTER AIDED SOFTWARE ENGINEERING** Computer Aided Software Engineering (CASE) and its Scope, CASE support in Software Life Cycle, Architecture of CASE Environment, Upper CASE and Lower CASE, Exposure to CASE tools.	**3**
9	**ADVANCED TOPICS IN SOFTWARE ENGINEERING** Software Process Improvement, Component Based Software Engineering, Web Engineering, Reverse Engineering, Software Engineering challenges of Big Data, Mobile Applications.	**3**

List of Experiments:		**Number of Turns**
1	Project Development with Software Engineering practices.	3
2	Programming Exercises for software design concepts.	3
3	Programming Exercises for software testing concepts.	3
4	Programming Exercises for Project Management concepts.	2
5	Exposure to UML, Rational software Architect.	2

Course Outcomes: At the end of the course, students will be able to:	
1	Design software in various application domains
2	Design software solution independently as well as in teams

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Software Engineering-A Practitioners Approach, By R. Pressman, McGraw Hill International edition.	2004
2	Software Engineering, Ian Sommerville, Addison-Wesley.	2010
3	An Integrated Approach to Software Engineering, Pankaj Jalote, Narosa.	2014
4	Fundamentals of Software Engineering, By Rajib Mall, PHI Learning Pvt. Ltd.	2014
5	Software Engineering (3rd ed.), By K.K Aggarwal & Yogesh Singh, New Age International Publishers	2007

Course Name	**:**	**WEB TECHNOLOGIES**
Course Code	**:**	**CSN303**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should understand fundamentals of programming in Java. They should be able to design and develop Java programs using JDK environment. They should learn the basics about Client side scripts and Server side scripts.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO JAVA** Creation of Java, importance to Internet, Java applets and applications, security, portability, Java's Byte code. Understanding the java programs, compiling the program, control statements, lexical issues, Data types in Java, Java literals, variables, scope and lifetime of variables, type conversion,	4

	declaring and using arrays	
2	**OPERATORS IN JAVA** Arithmetic, Modulus, Assignment, Bitwise, Relational, Assignment, ternary operator, Operator precedence. Control statements, classes, garbage Collection, overloading methods, overloading constructors, using objects as parameters. Argument passing by value and by reference, returning objects, static and final keywords. Inheritance in Java using super keyword, abstract classes.	6
3	**EXCEPTION HANDLING IN JAVA** Exception types, using try and catch, multiple catch classes, nested try statement, using throw, Java Built in Exceptions, creating user defined exceptions.	6
4	**MULTITHREADED PROGRAMMING IN JAVA** Java thread model, Thread priorities, synchronization, creating thread using thread class and runnable interface, creating multiple threads, deadlocks.	6
5	**APPLETS AND AWT** Applet fundamentals, Applet architecture, creating and running applets, Passing parameters in Applets. AWT : AWT Basics, AWT classes, Working with event frame windows, working with graphics, creating and selecting a font, Managing Text output using Font Metrics.	6
6	**USING AWT CONTROLS** Menus, using Labels, buttons, checkboxes, Checkbox group, choice controls, using Lists, managing scrollbars, using a textField, textArea. Layout manager FlowLayout, borderLayout, gridLayout, menubars, menus.	4
7	**SCRIPTING** Client side scripting : Java script Server side scripting: Java server pages	6
8	**CONTENT MANAGEMENT SYSTEM** HTML5,CSS, Wordpress, druppal, Joomla	4

List of Experiments:		**Number of Turns**
1	Java program based on operators, loop, decision making statement and type casting.	1
2	Java program to define class, constructors and method overloading.	1
3	Java programs based on different types of inheritance.	1
4	Java program to demonstrate the use of interfaces.	1
5	Java program to demonstrate the use of packages.	1
6	Java programs based on exception handling.	1
7	Java program based on multithreading and synchronization.	1
8	Program to design simple applet using graphics class.	1
9	Program to design simple applet using AWT class.	1
10	Web based project using Applet, AWT class, client side scripting and server side scripting concepts.	4

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate object-oriented design principles including encapsulation and information hiding, inheritance.
2	Write, compile and execute Java programs to solve problems.
3	Design and develop projects using concepts like Applet, AWT class, client and server side scripting.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	The Complete Reference Java 2, 5th Edition, by Herbert Schildt, McGraw-Hill	2007
2	Programming with JAVA, by Balagurusamy, Tata McGraw-Hill publishing company limited	2009

3	Professional wordpress: design and development, 3rd Edition, by Hal Stern, David Damstra, Brad Williams, Wiley India Private Limited	2015
4	JOOMLA BIBLE,1st Edition, by RIC SHREVES, Wiley	2010
5	BEGINNING DRUPAL, 1st Edition, by Jacob Redding, Wiley	2010
6	JavaScript the complete reference, 3rd Edition, by Thomas A Powell, Fritz Schneiider, McGraw-Hill	2012

Course Name	**:**	**COMPUTER GRAPHICS**
Course Code	**:**	**CSN304**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should be able to understand contemporary terminology, progress, issues and trends in the area of computer graphics. They should be able to design algorithms for drawing various graphical entities like lines, circles, ellipses and other graphical objects. They should be able to transform various graphical objects in 2-D and 3-D.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**GRAPHICS HARDWARE** Introduction, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems, graphics output and input devices.	**4**
2	**OUTPUT AND FILLED AREA PRIMITIVES** Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms, Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.	**6**
3	**2-D GEOMETRIC TRANSFORMATIONS** Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems	**6**
4	**2-D VIEWING** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman and Weiler-Atherton polygon clipping algorithm.	**6**
5	**3-D GEOMETRIC TRANSFORMATIONS** Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D projections.	**6**
6	**3-D OBJECT REPRESENTATION** Polygon surfaces, quadric surfaces, spline representation, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods.	**4**
7	**VISIBLE SURFACE DETECTION** Classification, back-face detection, Hidden surface removal algorithms.	**4**
8	**ILLUMINATION MODELS AND SHADING** Gouraud Shading, Phong Shading.	**3**
9	**INTERACTIVE COMPUTER GRAPHIC TECHNIQUES** Inking, Trailing, Rubber-band techniques, dumb-bell shape of line	**3**

List of Experiments:		**Number of Turns**
1	Implement various line drawing algorithms such as DDA, Bresenham, Mid-point line drawing algorithms, etc.	**3**

2	Implement various circle drawing algorithm.	**2**
3	Implement ellipse drawing algorithm.	**1**
4	Implement 2-D transformation.	**4**
5	Implement 3-D projections and 3-D transformations.	**3**

Course Outcomes: At the end of the course, students will be able to:	
1	Understanding of contemporary graphics hardware.
2	Design interactive graphics applications using C, C++ and other libraries like OPENGL
3	Understanding of object hierarchy in graphics applications.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Computer Graphics with OPENGL, Donald Hearn and M. Pauline Baker, Pearson Education	2014
2	Computer Graphics: Principles and Practices, J. D. Foley, A. Van Dam, S. K. Feiner and R. L. Phillips, Addison Wesley	1996
3	Computer Graphics, F S Hill Jr, Pearson Education	2003
4	OpenGL programming Guide, Shreine, Woo, Neider and Davis, Pearson Education	2008

Course Name	**:**	**ARTIFICIAL INTELLIGENCE**
Course Code	**:**	**CSN305**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
Students should learn the basic concepts and techniques of Artificial Intelligence. They should be able to develop AI algorithms for solving practical problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION:** Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, Importance, functions, advantages, and limitations of AI	4
2	**PROBLEM SOLVING TECHNIQUES:** State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening	8
3	**KNOWLEDGE REPRESENTATION SCHEMES:** Mapping between facts and representations, Approaches to knowledge representation,	6
4	**LOGIC:** Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm,	4
5	**KNOWLEDGE REPRESENTATION AND REASONING:** procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts	6
6	**PLANNING:** The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning	6

7	**NATURAL LANGUAGE PROCESSING AND EXPERT SYSTEM:** Basic Tasks of Natural Language processing, Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.	5
8	**AI PROBLEMS:** Pattern (biological sequence) recognition, Voice recognition, Feature extraction	3

Course Outcomes: At the end of the course, students will be able to:	
1	Solve problems by applying suitable AI techniques
2	Apply knowledge representation schemes for designing knowledgebase
3	Solve the challenges in the field of AI

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education	2010
2	Artificial Intelligence by Rich and Knight, TMH	2003
3	Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier	1997
4	Artificial Intelligence by Luger, Pearson Education	2008
5	Artificial Intelligence by Padhy, Oxford Press	2005
6	Introduction to Artificial Intelligence by Charniak and Mcdermott, Addison-Wesley	1985

Course Name	**:**	**COMPILER DESIGN**
Course Code	**:**	**CSN401**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to understand the concept of language translation and compiler design. They should learn various parsing techniques. They should develop practical programming skills for constructing a compiler.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**COMPILER STRUCTURE** Analysis-synthesis model of compilation, various phases of a compiler, passes of compilers, bootstrapping, tool based approach to compiler construction.	**4**
2	**PHASES OF COMPILERS** Lexical analysis: Interface with input, parser and symbol table, token. Difficulties in lexical analysis. Error reporting. Implementation. Regular definition, One-pass compilation techniques, Transition diagrams, implementation techniques, use of lexical analyzer generators LEX, specific source language issues.	**4**
3	**SYNTAX ANALYSIS AND BASIC PARSING TECHNIQUES** Syntax directed definitions like Inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions. CFGs, derivations and parse trees, ambiguity, associativity, precedence, use of syntax analyzer generators, top down parsing, shift reduce parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR(k) parsing (SLR, LALR, LR), YACC.	**6**
4	**AUTOMATIC CONSTRUCTION OF SOME EFFICIENT PARSERS**	**6**

	Canonical collection of LR(0) items, constructing SLR parsing tables, constructing LR parsing table, constructing LALR parsing tables, ambiguous grammars usages, implementation of LR parsing tables, constructing LALR sets of items.	
5	**INTERMEDIATE CODE GENERATION** Syntax directed translation schemes and their implementation, Intermediate languages, quadruples and triples, assignment statements, boolean expressions, array references, procedure calls, declarations, case statements.	**4**
6	**SEMANTIC ANALYSIS** Type checking, type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.	**4**
7	**RUN TIME SYSTEM AND OPTIMIZATION** Storage organization, activation tree, activation record, parameter passing, symbol tables, data structures for symbol tables, handling recursive calls, global optimization through flow graph analysis, dynamic storage allocation, local optimization techniques, loop optimization techniques, loop-invariant, peephole optimization.	**4**
8	**ERROR DETECTION AND RECOVERY** Introduction to errors in all phases of compilers, lexical-phase errors, synthetic phase errors, semantic errors and various recovery methods.	**5**
9	**CODE GENERATION AND INSTRUCTION SELECTION** Basic blocks and flow graphs, register allocation, code generation, DAG representation of programs, code generation from dags, code generator generators, specifications of machine, Compiler-Compilers, Parser generators, machine independent code generation	**5**

Course Outcomes: At the end of the course, students will be able to:	
1	Use of lex tool & yacc tool to develop a scanner & parser.
2	Design experiments for Intermediate Code Generation and translation in compiler.
3	Design & implement a software system for backend of the compiler.
4	Code optimization in terms of speed & space.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	A. V. Aho, J. D. Ullman, M. S. Lam, R. Sethi. Compilers: Principles, Techniques and Tools , Addison-Wesley.	2014
2	C. Fischer and R. LeBlanc. Crafting a Compiler , Benjamin Cummings	2007
3	A. C. Holub. Compiler Design in C , Prentice-Hall Inc.	2002
4	K. Louden, Compiler Construction, Principles and Practice, Cengage Learning	1997

Course Name	**:**	**SOFTWARE TESTING**
Course Code	**:**	**CSN402**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

Students should be able to learn fundamentals of software Development life cycle and identify relationship between testing and development. They should be able to identify the testing challenges associated with several applications.

Total No. of Lectures – 42

Lecture wise breakup	**Number of Lectures**

1	**FUNDAMENTALS OF TESTING** Errors, Faults, Failures and Defects in software, Fundamentals of Test Process, General Principles of Testing, Test Metrics, Role of Testing in SDLC, Comparing Software and Hardware Testing, Verification and Validation, Exhaustive testing, Impractical complete testing, All Test paths.	**6**
2	**SOFTWARE TESTING APPROACHES** Introduction to Test cases, test case design, Levels of testing - module, integration, system, regression, Structural versus Functional Technique Categories, Static versus Dynamic Testing, Control flow & Data flow testing, Determining Metrics, Black Box Testing, White Box Testing.	**10**
3	**TEST MANAGEMENT** Test Organization, Test Planning, Test Strategies, Test Prioritization, Performance, Load, Stress & Security Testing, Debugging.	**4**
4	**OBJECT ORIENTED TESTING** Object Oriented Testing Issues, OO Testing Methodologies, Analysis and Design Testing-UML Based, Class Testing, Integration Testing, Testing Hierarchies.	**8**
5	**DIFFERENT SOFTWARE TESTING TECHNIQUES** GUI testing, Validation testing, Regression testing, Scenario testing, Specification based testing, Adhoc testing, Smoke testing, Random Testing, Availability and Safety, Advances in Software Testing Methods.	**8**
6	**TEST AUTOMATION** Software test automation, scope of automation, design and architecture for automation, requirements for a test tool, challenges in automation, Test metrics and measurements, Types of reviews.	**6**

List of Experiments:		**Number of Turns**
1	Exercise for Functional test/ Black box Testing.	**2**
2	Programming Exercises for Dynamic memory by using graphs.	**2**
3	Programming Exercise for Control flow graph, independent paths, cyclomatic complexity and generation of test cases.	**2**
4	Programming Exercise for Data flow testing	**1**
5	Combination of paths and flow analysis	**1**
6	Exposure to Automated Testing Tools & Case studies, Study of Testing tools	**2**
7	Minor project	**3**

Course Outcomes: At the end of the course, students will be able to:	
1	Generate test cases effectively from Requirements, Design Models, Code etc.
2	Generate test cases automatically.
3	Apply various test cases to industrial applications.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Boris Beizer, Software Testing Techniques, John Wiley & Dreamtech.	2003
2	Aditya P. Mathur, Foundations of Software Testing, Pearson Education.	2008
3	Yogesh Singh, Software Testing, Cambridge University Press.	2012
4	William E. Perry, Effective Methods for Software Testing, John Wiley & Sons.	2006
5	Glenford J. Myers, The Art of Software Testing, Wiley India Pvt. Ltd.	2006
6	John D. McGregor & David A, A practical guide to testing object-oriented software, Addison-Wesley object technology series.	2001

Course Name	**:**	**SOFT COMPUTING**
Course Code	**:**	**CSN403**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able to understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO NEURAL NETWORKS** Structure and working of Biological Neural Network, Fundamentals of Artificial Neural Networks & Applications, Characteristics of Artificial Neural Networks, History of neural network research, characteristics of neural networks terminology	7
2	**NEURAL NETWORKS MODELS** Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks	5
3	**LEARNING METHODS AND PROPAGATION** Learning Methods, Backpropagation, Counterpropagation, ART, BAM, Associative memories	6
4	**INTRODUCTION TO FUZZY LOGIC** Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification	6
5	**GENETIC ALGORITHMS** Overview, Problem solving using GA, Implementation of GA and GP	5
6	**NEURO-FUZZY SYSTEMS** Introduction, Architecture of a Neuro-Fuzzy system and its applications	4
7	**MACHINE LEARNING:** Supervised learning: Primitive algorithms, Generative algorithms, Support Vector Machine, Ensemble methods. Unsupervised learning: K-means, Principal component analysis, Independent component analysis. Reinforcement learning and control.	6
8	**APPLICATIONS** Applications of GA & GP, Hybrid systems	3

List of Experiments:		**Number of Turns**
1	Implement OR, AND Using Perceptron in MATLAB Command-line Argument"	2
2	Implement OR, AND Using Perceptron in MATLAB GUI	2
3	Implement OR, AND, X-OR gate, Using back propagation algorithm in MATLAB using Command-line Argument as well as GUI.	2
4	Solve a given problem-1 (Operations) using Fuzzy Logic in MATLAB.	2
5	Solve a given problem-1 (Max-Min Composition) using Fuzzy Logic in MATLAB.	2
6	To find the solution of the function Maximize, given the constraints using GA approach.	1
7	Solve a given problem-1using using Fuzzy Logic in MATLB GUI	1
8	Study GA tool in MATLAB.	1

Course Outcomes: At the end of the course, students will be able to:	
1	Identify and describe soft computing techniques and their roles in building intelligent machines
2	Recognize the feasibility of applying a soft computing methodology for a particular problem
3	Effectively use existing software tools to solve real problems using a soft computing approach
4	Evaluate and compare solutions by various soft computing approaches for a given problem.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	Neuro fuzzy and soft computing by Jang, Pearson Education	1996
2	Learning and Soft Computing by Kecman, Pearson Education	2001
3	Fuzzy Sets and Fuzzy Logic - Klir and Yuan, PHI	1995
4	Neural Network in computer Intelligence by Fu, TMH	2003
5	Bio-Inspired Artificial Intelligence – Dario Floreano, PHI	2008

Course Name	**:**	**DIGITAL IMAGE PROCESSING**
Course Code	**:**	**CSN404**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should be able to learn the basic theory and algorithms that are widely used in digital image processing. They should learn current technologies and issues that are specific to image processing systems. They should develop hands-on experience to process images.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**INTRODUCTION AND FUNDAMENTAL TO DIGITAL IMAGE PROCESSING** Origin of Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Digital Image Processing System, Image sensing and acquisition, Image sampling, quantization and representation, Basic relationship between pixels.	7
2	**IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN & FREQUENCY DOMAIN** Basic grey level transformation, Histogram processing, Basics of Spatial filtering, Smoothing and Sharpening spatial filters, Introduction to Fourier Transform and the Frequency Domain, Discrete Fourier Transform, Smoothing and Sharpening Frequency – Domain filters.	8
3	**IMAGE RESTORATION** Image Degradation/Restoration Process, Noise models, restoration in presence of noise, Inverse filtering, Minimum Mean Square Filtering, Geometric menu filter, Geometric transformations.	5
4	**COLOR IMAGE PROCESSING** Color Fundamentals, Color models, Basis of full color image processing, Color transformations.	3
5	**IMAGE COMPRESSION** Fundamentals, Image compression models, Error free compression, Lossy compression.	5
6	**IMAGE SEGMENTATION** Detection of Discontinuities, Edge linking and boundary detection, Threshold, Region oriented segmentation.	5
7	**REPRESENTATION, DESCRIPTION AND RECOGNITION** Representation-chain codes, polygonal approximation and skeletons, Boundary descriptors-simple descriptors, shape numbers, Regional descriptors, topological descriptors.	3
8	**PATTERN RECOGNITION** Pattern and pattern classes, Tree classifiers: Decision trees, random forests, Parametric techniques: Maximum likelihood Estimation, Non-Parametric techniques: Kernel Density estimators, Nearest Neighbour methods.	6

List of Experiments:	Number of

		Turns
1	Implement the basic commands/ functions of an image processing tool.	1
2	Take an input image and plot its histogram with various ways as imhist, bar, stem, plot and Prove that histogram processing can be used for image enhancement.	1
3	Filtering using MATLAB package	1
4	Filtering for Blurring and Sharpening the image	2
5	Implement various Nonlinear Spatial Filters.	2
6	Implement various types of filters to remove the noise in an image.	2
7	Implement image compression algorithms.	2
8	Design problems related to image segmentation	1
9	Design problems related to image recognition, pattern recognition	1

Course Outcomes: At the end of the course, students will be able to:	
1	Develop simple image processing applications.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Digital Image processing By Rafael C. Gonzalez and Richard E. Woods- Pearson Education	2006
2	Digital Image Processing by A.K. Jain, PHI	1995
3	Digital Image processing (An algorithmic approach) By Madhuri A. Joshi - PHI	2006

Course Name	**:**	**CLOUD COMPUTING**
Course Code	**:**	**CSN405**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:

Students should be able to understand the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures. They should learn the basic Cloud types and delivery models. They should develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO CLOUD COMPUTING** Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing	**3**
2	**CLOUD COMPUTING ARCHITECTURE** Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, CPU Virtualization, Discussion on Hypervisors Storage Virtualization, The SPI Framework for Cloud Computing, The Cloud Services Delivery Model	**7**
3	**CLOUD DEPLOYMENT MODELS** Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	**3**
4	**SECURITY ISSUES IN CLOUD COMPUTING** Security in cloud computing environment, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security,	**7**
5	**IDENTITY AND ACCESS MANAGEMENT**	**5**

	Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	
6	**SECURITY MANAGEMENT IN THE CLOUD** Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS	**5**
7	**PRIVACY ISSUES** Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations	**5**
8	**AUDIT AND COMPLIANCE** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-As-a-[Cloud]	**7**

List of Experiments:		**Number of Turns**
1	Installation & Configuration of Oracle Virtual box for Windows XP & Android.	2
2	Installation Configuration of Hadoop.	2
3	Using Hadoop for counting word frequency with map reduce.	1
4	Service deployment research & uses over cloud- Google app & Amazon web services.	2
5	Mobile App Development using Google app & Amazon web services	4
6	Performance Evaluation of Services over cloud- Google App &Amazon Web Services.	1
7	Design and deploy a Private Cloud using Open Source Tools	1

Course Outcomes: At the end of the course, students will be able to:	
1	Identify security aspects of each cloud model
2	Develop a risk-management strategy for moving to the Cloud
3	Implement a public cloud instance using a public cloud service provider
4	Apply trust-based security model to different layers in the infrastructure stack
5	Distinguish between cloud providers and 3rd party managed service providers

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date	2009
2	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media	2009
3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, Publisher: O'Reilly Media; ISBN-10: 0596156367, ISBN-13: 978-0596156367	2009
4	Cloud Computing Bible by Barrie Sosinsky Wiley Publication, ISBN-10: 0470903562	2011
5	Introduction to Cloud Computing by Timothy Chou	2010

Course Name	**:**	**AGILE SOFTWARE DEVELOPMENT**
Course Code	**:**	**CSN406**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should be able to understand the background and driving forces for taking an Agile approach to software development. They should understand the business value of adopting Agile approaches. They should understand the Agile development practices.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**FUNDAMENTALS OF AGILE** The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools**.**	**8**
2	**AGILE SCRUM FRAMEWORK** Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and `content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.	**10**
3	**AGILE TESTING** The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester	**10**
4	**AGILE SOFTWARE DESIGN AND DEVELOPMENT** Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control	**7**
5	**INDUSTRY TRENDS** Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies	**7**

List of Experiments:		**Number of Turns**
1	Understand a given business scenario and identify product backlog, user stories and sprint tasks	2
2	Define user stories for a given feature	2
3	Fill user stories, sprint schedule and sprint tasks in an Agile tool such as AgileFant	2
4	Write unit tests aligned to xUnit framework for TDD	2
5	Refactor a given design for next sprint requirements	2
6	Execute continuous integration using a tool such as Jenkins	2
7	Automate a set of given tests using Test automation tool	1

Course Outcomes: At the end of the course, students will be able to:	
1	Understand the background and core practices for taking an Agile approach to software development
2	Understand the significance of value-driven delivery and continuous customer and user feedback in increasing team effectiveness
3	Have a guidance and decision making framework for self-organising Agile teams

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/**

		Reprint
1	Succeeding with Agile: Software development using Scrum, Mike Cohn, Pearson Education.	2010
2	Agile Software Development with Scrum, 1st Edition, Ken Schwaber	2014
3	Agile Software Development with Scrum By Ken Schawber, Mike Beedle, Pearson.	2008
4	Agile Software Development, Principles, Patterns and Practices By Robert C. Martin , Prentice Hall**.**	2002
5	Agile Testing: A Practical Guide for Testers and Agile Teams, By Lisa Crispin, Janet Gregory, Addison Wesley.	2008
6	Agile Software Development: The Cooperative Game By Alistair Cockburn, Addison Wesley	2006
7	User Stories Applied: For Agile Software By Mike Cohn, Addison Wesley.	2004

Course Name	**:**	**Natural Language Processing**
Course Code	**:**	**CSN407**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to study language and the tools that are available to efficiently study and analyze large collections of text. They should learn about and discuss the effects of electronic communication on our language.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** A computational framework for natural language, description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, The different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.	**7**
2	**WORD LEVEL AND SYNTACTIC ANALYSIS** Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine-readable dictionaries and lexical databases , RTN, ATN.	**8**
3	**SEMANTIC ANALYSIS** Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.	**10**
4	**NATURAL LANGUAGE GENERATION** Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.	**10**
5	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES** Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net,Frame Net, Stemmers, POS Tagger.	**7**

List of Experiments:		**Number of Turns**
1	Implement program to perform automatic word analysis	1
2	Implement program to perform word generation	3

3	Implement programs related to morphology, N-Grams, N-Grams Smoothing	3
4	Implementation of Hidden Markov Models	3
5	Program to build POS Tagger, Chunker	3

Course Outcomes: At the end of the course, students will be able to:	
1	Learn natural language processing with manual and automated approaches.
2	Learn computational frameworks for natural language processing.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Natural Language understanding by James Allen, Pearson Education	2008
2	NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall	1995
3	Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press	2000
4	An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education	2008
5	Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley	1989

Course Name	**:**	**SOFTWARE PROJECT MANAGEMENT**
Course Code	**:**	**CSN408**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able to discuss various aspects of project management. To understand the tasks (organizing, planning and controlling) in software project management. To gain the ability to select tools and methodologies for various projects.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT** The characteristics of software projects, Reasons for IT project failure, Objectives of project management: time, cost and quality, Basics of Project Management, Stakeholders, Stages of Project, Activities Covered By Software Project Management, Project and Product Life Cycles, Project Management Knowledge areas, Project success factors, role of project manager.	**5**
2	**PROJECT EVALUATION AND PLANNING** Strategic Assessment, Cost Benefit Analysis and techniques, earned value analysis, Understanding organizations, stakeholder's management, project phases & project life cycles, Objectives of project planning, Project schedule, Iterative steps for planning, Project Plan documentation methods, Software Requirement Specification, Types Of Risk, Managing Risk, Risk Planning And Control.	**6**
3	**MONITORING AND CONTROL** Visualizing Progress, Cost Monitoring, Plan versus Control, managing the plan, Change Control, The Deadline Effect, Reviews, feedback and reporting mechanisms, revisiting the plan.	**3**
4	**PROJECT SCOPE MANAGEMENT** Scope Planning & Scope management plans, Function point calculation, Scope definitions & project scope statement, Work Breakdown Structure (WBS), WBS dictionary, scope verification, scope change control.	**3**

5	**PROJECT TIME AND COST MANAGEMENT** Development of project schedule, activities sequencing and their dependencies, network diagrams, activity recourse estimation, activity duration estimation, schedule development, Gantt Charts, Critical path method, Programme evaluation & review technique (PERT) and CPM, concept of slack time, schedule control, Basic principles of cost management, Cost estimating, type of cost estimate, COCOMO, cost budgeting, cost control, earned value management.	**6**
6	**PROJECT RISK MANAGEMENT** Risk Management planning, sources of risk, risk identification, Reactive V/S proactive Risk Strategies, risk register, qualitative risk analysis, decision trees & expected monetary value, simulation, risk response planning, risk refinement, risk mitigation, risk monitoring & control, Risk assessment.	**3**
7	**PROJECT QUALITY MANAGEMENT** Quality Planning, quality Assurance, Quality control, Tool & techniques for quality control, Formal approaches to SQA, Pareto Analysis, Six Sigma, CMMI, ISO Standards, configuration management, Defect Prevention Planning.	**4**
8	**PROJECT HUMAN RESOURCE MANAGEMENT** Human resource planning, project organizational charts, responsibility assignment metrics, acquiring project team, resource assignment, resource loading, resource leveling, Different team structures developing project teams.	**3**
9	**PROJECT COMMUNICATION MANAGEMENT** Communication Planning, project metrics, Performance reporting, managing stakeholders, Improving project communication, Performance reporting.	**3**
10	**PROJECT PROCUREMENT MANAGEMENT** Procurement management plans, contracting- contract statement of work, planning contracts, requesting seller responses, selecting sellers, administrating the contract, closing the contract, outsourcing of products.	**3**
11	**SOFTWARE CONFIGURATION MANAGEMENT:** Why versions exist, why retain versions, SCI, Releases vs. version, Change Control and Management.	**3**

List of Experiments:		**Number of Turns**
1	Using Function Point calculation tools for estimation	1
2	Implementation of various exercises using PERT, CPM methods	2
3	Preparing Project Plan for a Software Project for Lab Project or case study.	2
4	SCM/ Change management	2
5	Exposure to Project management tool	3
6	Minor Project with project management activities	3

Course Outcomes: At the end of the course, students will be able to:	
1	Understand and practice the process of project management and its application in delivering successful Software projects;
2	Demonstrate the ability to structure a problem, evaluate and analyze the project work.
3	Monitor the progress of a project, revising targets or countract drift.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Bob Hughes, Mike Cotterell and Rajib Mall, Software Project Management, Third Edition, Tata McGraw-Hill.	2009
2	Gopalaswamy Ramesh, Managing global software Projects: How to lead geographically distributed Teams, Manage Processes and Use Quality Models, Tata McGraw-Hill.	2006
3	Project Management Body Of Knowledge(PMBOK).	2000

4	Pankaj Jalote, Software Project Management in Practice, Pearson Education.	2004
5	S.A. Kelkar, Software Project Management, A Concise Study, Revised Edition, Prentice-Hall India	2003
6	Elaine Marmel, Microsoft Office Project 2003 Bible, Wiley Publishing Inc.	2004
7	Kathy Schwalbe; Information Technology Project Management fourth edition, Thomson Course Technology.	2006

Course Name	**:**	**BIG DATA ANALYTICS**
Course Code	**:**	**CSN409**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects. The student should identify and successfully apply appropriate techniques and tools to solve big data problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO BIG DATA** Introduction to BigData Platform, Traits of Big data, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability, Analysis vs Reporting, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference, Prediction Error.	**6**
2	**BASIC DATA ANALYSIS AND DATA ANALYTIC METHODS USING R** Regression Modelling, Multivariate Analysis, Bayesian Modelling, Inference and Bayesian Networks, Support Vector and Kernel Methods, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks: Learning And Generalization, Competitive Learning, Principal Component Analysis and Neural Networks, Fuzzy Logic: Extracting Fuzzy Models from Data Fuzzy Decision Trees, Stochastic Search Methods. Introduction to R, Statistics for Model Building and Evaluation.	**10**
3	**FREQUENT ITEMSETS AND CLUSTERING** Mining Frequent Itemsets: Market Based Model, Apriori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithm, Counting Frequent Itemsets in a Stream, Clustering Techniques: Hierarchical, K-Means, Frequent Pattern based Clustering Methods.	**8**
4	**MINING DATA STREAMS** Introduction to Streams Concepts: Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream: Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform(RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.	**10**
5	**FRAMEWORK, TECHNOLOGIES, TOOLS AND VISUALIZATION** MapReduce: Hadoop, Hive, MapR, Sharding, NoSQL Databases: S3, Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Interaction Techniques; Systems and Analytics Applications, Analytics using Statistical packages, Industry challenges and application of Analytics.	**8**

List of Experiments:		**Number of Turns**
1	Hands-on with Map Reduce: Hadoop, Hive, MapR	4
2	Hands-on with NoSQL Databases: S3, Hadoop Distributed File System(HDFS)	3
3	Hands-on with Statistical Packages	3
4	Hands-on with Visual Data Analysis tools	3

Course Outcomes: At the end of the course, students will be able to:	
1	Explain the statistics of Big Data Analytics.
2	Describe and use various analytical methods.
3	Analyze data in real applications and design efficient mining techniques
4	Analyze various applications on tools like MapReduce, Hadoop, and S3.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to data Science and its Applications", Wiley publications.	2014
2	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.	2007
3	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.	2012
4	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons	2012
5	Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons.	2007

Course Name	**:**	**BIOINFORMATICS**
Course Code	**:**	**CSN410**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand the scope of Bioinformatics. They should know about popular bioinformatics databases and sequence alignment algorithms.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** History, scope and important contributions, aims and tasks of Bioinformatics, applications of Bioinformatics, challenges and opportunities, introduction to NCBI data model, various file formats for biological sequences.	**6**
2	**BIOLOGICAL DATABASES** Importance of databases, biological databases, primary sequence databases, composite sequence databases, secondary databases, nucleic and sequence databases, protein sequence databases, structure databases, bibliographic databases, specialized genomic resources, analysis packages	**7**
3	**DATABASE SEARCH METHODS** Methods for searching sequence databases like FASTA and BLAST algorithms, Statistical analysis and evaluation of BLAST results.	**7**
4	**SEQUENCE COMPARISON METHODS** Methods for comparison of two sequences, Needleman Wush and Smith Waterman algorithms. Analysis of computational complexities, merits and demerits of these algorithms, theory of scoring matrices and their use for sequence comparison.	**8**
5	**SEQUENCE ALIGNMENT METHODS** Sequence analysis of biological data, significance of sequence alignment, pair wise sequence alignment methods, use of scoring matrices and gap penalties in sequence alignments, multiple sequence alignment methods, tools and applications of multiple sequence	**8**

	alignment.	
6	**PREDICTIVE METHODS USING DNA AND PROTEIN SEQUENCES** Gene prediction strategies, protein prediction strategies, molecular visualization tools, phylogenetic analysis: concept of trees, phylogenetic trees and multiple alignments.	**6**

List of Experiments:		**Number of Turns**
1	Hands-on with Nucleic acid databases (NCBI, DDBJ, EMBL), Protein databases (Primary, Composite and Secondary)	2
2	Hands-on with Specialized Genome databases (SGD, TIGR, ACeDB), Structure databases (CATH, SCOP, PDBsum)	2
3	Hands-on with methods for searching sequence databases	3
4	Hands-on with sequence comparison and sequence alignment methods	3
5	Hands-on with predictive methods	3

Course Outcomes: At the end of the course, students will be able to:	
1	Search various biological sequence databases
2	Perform sequence comparison
3	Perform sequence alignment
4	Apply predictive methods on DNA and protein sequences

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Andreas D Baxevanis & B F Francis, "Bioinformatics-A practical guide to analysis of Genes and Proteins", John Wiley	2010
2	T K Attwood, D J Parry-Smith, " Introduction to Bioinformatics", Pearson Education	2005
3	Neil C. Jones, Pavel A. Pevzner, "An introduction to Bioinformatics Algorithms", MIT Press	2005
4	Gary Benson Roderic, "Algorithms in Bioinformatics", Springer	2004

Course Name	**:**	**NETWORK SECURITY**
Course Code	**:**	**CSN411**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to investigate core security technologies and security policies to mitigate risks. They should gain an understanding of network perimeter security design principles. They should also gain an understanding of free/ commercial security tools and their applications and develop the security solution for a given application/scenario.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**PACKET FILTERING** Packet Filtering Principle, TCP and UDP Ports, TCP's Three-way Handshake, Router as a Packet Filter, An Alternative Packet Filter: IP Chains, Egress Filtering, Industry standard protocols: working of router protocol.	**5**
2	**STATEFUL & PROXY FIREWALLS** Working of Stateful Firewall, The Concept of State, Stateful Filtering and Stateful Inspection, Fundamentals of Proxying, Pros and Cons of Proxy Firewalls, Types of Proxies,	**5**

	Tools for Proxying	
3	**SECURITY POLICY** Firewalls Policy, Design of a security policy, Perimeter Considerations	**2**
4	**VIRTUAL PRIVATE NETWORKS** VPN Basics, Advantages and Disadvantages of VPNs, IPSec Basics	**3**
5	**NETWORK INTRUSION DETECTION & PREVENTION SYSTEMS** Network Intrusion Detection Basics, the Roles of Network IDS in a Perimeter Defense, IDS Sensor Placement, IPS, IPS Limitations, NIPS, Host-Based Intrusion Prevention Systems, Case Studies	**4**
6	**HOST HARDENING & DEFENSE COMPONENTS** Need for Host Hardening, Removing, Disabling or Limiting Access of Unnecessary Programs, Data and Configuration Files, Controlling User and Privileges, hardening hosts and the Perimeter, Antivirus Software, Host-Based Firewalls, Host-Based Intrusion Detection, Challenges of Host Defense Components, Preventing TCP/UDP exploits from DoS attacks.	**8**
7	**DESIGNING A SECURE NETWORK PERIMETER** The Role of a Router, The Router as a Perimeter & Security Device, Router Hardening, Fundamentals of Secure Perimeter Design, Gathering Design Requirements, Design Elements for Perimeter Security, Separating Resources, Security Zones, Common Design Elements, VLAN-Based Separation	**7**
8	**MAINTAINING A SECURITY PERIMETER** System and Network Monitoring, Incident Response, Accommodating Change	**4**
9	**NETWORK LOG ANALYSIS** The Importance of Network Log Files, Log Analysis Basics, Analyzing Router Logs, Analyzing Network Firewall Logs, Analyzing Host-Based Firewall and IDS Logs	**4**

List of Experiments:		**Number of Turns**
1	Use of Cain and Abel Tool Cracking the system password by using brute force method. Cracking the system password by using dictionary attack. Sniff the password of user's account on the network. Getting the list of all wireless access points which are security enabled and which are not.	**8**
2	Email Tracing	**2**
3	Consider any 4 apps of mobile phone and compare their security permissions and personal information being accessed.	**3**

Course Outcomes: At the end of the course, students will be able to:	
1	Explain fundamental concepts of network vulnerabilities and attacks.
2	Demonstrate the skill to penetrate service vulnerability.
3	Implement, monitor and maintain a secure network consisting of enterprise level routers and switches
4	Understand the role of AAA and IPSec in securing networks.
5	Understand how to design and implement firewall technologies that complement network policies in securing the perimeter of a network
6	Learn to design/develop/ implement the security solution for a given application.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Inside Network Perimeter Security, Second Edition, Stephen Northcutt; Lenny Zeltser; Scott Winters; Karen Kent; Ronald W. Ritchey, Sams	2005
2	Network Perimeter Security: Building Defense In-Depth , Cliff Riggs, Proteris Group, Waterbury, Vermont, USA	2003
3	W. Stallings, Network Security Essentials (3rd Edition), Prentice-Hall,	2007

4	W. R. Stevens, TCP/IP Illustrated, Vol. 1: The Protocols, Addison-Wesley	1993
5	D. E. Comer, Internetworking with TCP/IP, Vol.1 (4th Edition), Prentice Hall,	2000
6	R. Oppliger, Internet and Intranet Security (2nd edition), Artech House	2002
7	W. R. Cheswick and S.M. Bellovin, Firewalls and Internet security (2nd edition), Addison-Wesley,	2003

Course Name	**:**	**APPLIED CRYPTOGRAPHY**
Course Code	**:**	**CSN412**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand basic number theory, with a focus on computational aspects and applications in cryptography. They should understand basic design principals of symmetric and asymmetric cryptography. They should learn how cryptanalytic attacks work and thereby how to avoid common design flaws.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**FOUNDATIONS** Substitution Ciphers and Transposition Cipher, Block cipher, Stream cipher.	**4**
2	**CRYPTOGRAPHIC PROTOCOLS** Introduction to Protocols, Communications using Symmetric Cryptography, One-Way Functions, Communications using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo-Random Sequence Generation, Basic Protocols: Key Exchange, Authentication, Authentication And Key Exchange, Formal Analysis Of Authentication And Key-Exchange Protocols, Multiple-Key Public-Key Cryptography.	**8**
3	**CRYPTOGRAPHIC TECHNIQUES** **Key Length & Management:** Symmetric Key Length, Public-Key Key Length, Comparing Symmetric And Public-Key Key Length, **,**Generating Keys, Nonlinear Keyspaces, Transferring Keys, Verifying Keys, UPDATING KEYS, Storing Keys, Backup Keys.	**10**
4	**CRYPTOGRAPHIC ALGORITHMS** Mathematical Theory, NUMBER THEORY, FACTORING, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard: Description of DES, Security of DES, Differential And Linear Cryptanalysis, Design Criteria, DES Variants, DES modes of operation, Other Stream Ciphers and One-Way Hash Functions RC4, One-Way Hash Functions, MD5, Secure Hash Algorithm (SHA), Message Authentication Codes	**8**
5	**PUBLIC-KEY ALGORITHMS** Background, RSA, Elliptic Curve Cryptosystems, Digital Signature Algorithm, Key-Exchange Algorithms: DIFFIE-HELLMAN	**8**
6	**IMPLEMENTATIONS** PRETTY GOOD PRIVACY (PGP), SMART CARDS	**4**

List of Experiments:		**Number of Turns**
1	Install JCRYPT tool (or any other equivalent) and demonstrate Asymmetric, symmetric crypto algorithm, hash and digital/PKI Signatures.	**3**
2	Using Wireshark / Ethereal Protocol Analyser • How to capture the network's traffic. • How to save the filtered traffic. • Saving the traffic in file in pcap or in log format.	**2**

	• Study and analyzing the captured packets. • Creating a case where the server and client had a conversation. • Eavesdropping the particular IP in the network.	
3	Frequency Analysis This lab will introduce students to frequency analysis, a method used to decode ciphertext by studying the frequency of letters.	**2**
4	Hash Function This lab will introduce students to hash functions and how they provide for message integrity. Students will be asked to use hashing to detect if an encrypted message has been tampered with. Students will also need to show that this integrity check can be bypassed by tampering with both the ciphertext and the hash code.	**2**
5	Hands On: Some sample Problems which can be given to the students • How to Ensure the validity of Forensic Evidence by Using a Hash Function? • How to extract evidence from a Mobile Phone? • How to use Open SSL to generate digital Signatures • Conduct Performance Analysis between various Symmetric Algorithms	**4**

Course Outcomes: At the end of the course, students will be able to:	
1	Apply the basic rules of public key and symmetric encryption for practical cryptographic problems.
2	Demonstrate the design and use of hash functions, digital signatures, and key distribution with a wide range of key types.
3	Design and implement a cryptography algorithm.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Applied Cryptography protocols, algorithms, and source code in C, Second Edition, Bruce Schneier, John Wiley & Sons	1996
2	Handbook of Applied Cryptography, by Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, CRC Press ISBN: 0-8493-8523-7.	1996

Course Name	**:**	**COMPUTER CRIME INVESTIGATION AND FORENSICS**
Course Code	**:**	**CSN413**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to have technical skills and competencies in the field of forensic computing. They should be able to protect the computer system during the forensic examination from any possible alteration, damage, data corruption, or virus introduction. They should understand how information is stored and used on digital devices.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Types of computer crime, history, surveys, statistics and global connections, Aspects of Cyber Warfare and Cyber Terrorism, Dynamic, Human and Technical Aspects of Cyber Warfare and Cyber Terrorism, Identification, Authorization and Access Control.	**7**
2	**SOCIAL ENGINEERING** Mail Bombs, Bug Exploits, Stalking, Spam, Phishing and Pharming	**4**

3	**MALWARE** The types, effects and investigations, DoS and Distributed DoS: the causes, mechanisms, case studies and counter-measures.	**7**
4	**NETWORK CRIMES** Unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, Internet hacking and cracking, Hacking methodologies via Internet and attacks to other networks, Virus attacks.	**4**
5	**COMPUTER FORENSICS & INVESTIGATION** Preparation of Investigation, Procedures, Understanding Data Recovery, Data Acquisition, Processing Crime & Incident scenes, Current Computer Forensic tools, Computer Forensic Analysis & Validations, recovery Graphic Files, Network Forensics, Email Investigations, Mobile Device Forensics	**6**
6	**DIGITAL FORENSICS** Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.	**4**
7	**LEGAL MEASURES** Computer Misuse, Criminal Damage, Software Piracy, Forgery, Investigative Powers	**4**
8	**CASE STUDIES** Investigations into hacking, cases and PC misuse, Investigations, Incident Handling and Forensic Examination, The Future: The expansion of the Internet, unsuitable material Identity Theft and Fraud	**6**

List of Experiments:		**Number of Turns**
1	Practical problems on Data and Evidence Recovery	2
2	Practical problems on Hacking Methodologies	2
3	Practical problems on Mobile Device Forensics	2
4	Practical problems on Windows Forensics	2
5	Practical using Cyber Forensic Investigation Tools	3
6	Practical problems on Web Browser Forensics and Email Tracing	2

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate use of computer forensics tools and appropriate skills and knowledge to perform investigations
2	Analyze digital devices to establish user activity
3	Research the development of new devices and technologies and how current digital forensics methods will apply to them.
4	Gain insight knowledge to understand attack profiles, investigation tools and techniques
5	Gain ability to perform Critical analysis of data to identify evidence
6	Be able to trace malicious internet activity and analyze email trails.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Cyber Warfare and Cyber Terrorism , Andrew Colarik and Lech Janczewski, editors Dorothy E. Denning, ISBN13: 9781591409915.	2007
2	Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, CENGAGE Learning	2009
3	Information Warfare and Security, Addison-Wesley, Hedley & Aplin,	1999
4	Blackstone's Statutes on IT and E-Commerce, Oxford University Press, C. Stoll, The Cuckoo's Egg, Pan Book Publishers.	2002

Course Name	**:**	**BIOMETRIC SECURITY**
Course Code	**:**	**CSN414**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand a broad range of approaches to biometrics reflecting both fundamental principles and the current state-of-the-art practices. They should develop an understanding of the fundamental components common to all biometric systems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**BIOMETRICS INTRODUCTION** Benefits of biometrics over traditional authentication systems, benefits of biometrics in identification systems, comparison of various biometric traits, selecting a biometric for system, Applications. Key biometric terms and processes, biometric verification and identification, how biometric matching works, Accuracy in biometric systems, Metrics for evaluating biometric systems: FAR, FRR, ERR etc.	**7**
2	**PHYSIOLOGICAL BIOMETRIC TECHNOLOGIES** Fingerprints: Technical description, characteristics, Competing technologies, strengths, weaknesses and deployment. Facial scan: Technical description, characteristics, weaknesses and deployment. Iris scan: Technical description, characteristics, strengths, weaknesses and deployment. Hand scan: Technical description, characteristics, strengths, weaknesses and deployment.	**15**
3	**BEHAVIORAL BIOMETRIC TECHNOLOGIES** Handprint Biometrics, Signature and handwriting technology: Technical description, classification, keyboard /keystroke dynamics, Voice: data acquisition, feature extraction, characteristics, strengths, weaknesses, deployment	**10**
4	**MULTI BIOMETRICS** Basic concept of Multi-modal biometric Systems, Advantages of Multimodal over Unimodal Biometric Systems, Multimodal fusion techniques.	**5**
5	**BIOMETRIC SECURITY MODALS** Introduction to Biometric Security Modals, Various attack vectors and there remedial solutions, Template Security techniques.	**5**

List of Experiments:		**Number of Turns**
1	Basis hands on practice on image processing toolbox in matlab	1
2	To Develop a fingerprint verification system with following stages a. Data Accusation. b. Image Enhancement c. Image Segmentation d. Minutia Extraction e. Fingerprint Alignment. f. Fingerprint Matching	2
3	Image Enhancement Techniques for Forensic Crime Scene Investigations or Latent prints	1
4	Implement atleast one of the Face recognition techniques like PCA, LDA and ICA	2
5	Design and implement the various stages for iris recognition like localization, segmentation, matching.	2
6	Design and implement the various stages for signature recognition such as segmentation, thinning etc.	2
7	Design and implement the various stages for voice recognition such as MFCC computations.	2
8	Testing and implementing one of the fusion strategies of multimodal biometrics such as score level, decision level etc.	1

Course Outcomes: At the end of the course, students will be able to:	
1	Understand Design and Implement Modern biometric technologies and the generic components of a biometric system.
2	Implement Pattern recognition and feature extraction in biometrics systems.
3	Select the most appropriate biometric for a given application.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Anil K. Jain, Michigan State University, USA, Patrick Flynn University of Notre Dame, USA, Arun A. Ross West Virginia University, USA , "Handbook of Biometrics".	2008
2	Biometrics, Identity Verification in a Networked World, By Samir Nanavati, Michael Thieme and Raj Nanavati , Wiley	2011
3	Anil K. Jain Michigan State University, E. Lansing, Michigan and Ruud Bolle and Sharath Pankanti IBM, T.J. Watson Research Center Yorktown Heights, New York Kluwer Academic ," Biometrics Personal Identification in Networked Society", Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.	2002
4	Biometrics for Network Security, By Paul Reid, Pearson	2012
5	Biometrics: Concepts and Applications By G.R. Sinha, Sandeep Patil, Wiley	2013

Course Name	**:**	**Advanced Computer Networks**
Course Code	**:**	**CSN415**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should have a deeper insight into the advanced topics of computer networks and crucial protocols in computer networks. They should develop an understanding of the underlying structure of networks and how they operate as client/server architecture, network scalability. They should be able to analyze simple protocols and independently study literature concerning computer networks

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Overview of computer networks; seven-layer architecture; TCP/IP suite of protocols.	**3**
2	**MEDIUM ACCESS** MAC protocols for high-speed networks -Gigabit Ethernet,RPR etc.	**4**
3	**INTERNETWORKING AND ROUTING** Internetworking problem – packet switching; Delivery and Forwarding of IPpackets; Brief introduction to IPv4, scaling IP address space, Unicast routing protocols, IPv6 protocol	**7**
4	**RESOURCE MANAGEMENT** Data traffic – traffic descriptor, traffic profiles; Congestion – definition, network performance; Congestion control techniques – open loop congestion control and closed loop congestion control; Congestion Control in TCP.	**5**
5	**QUALITY OF SERVICE** Introduction; Flow characteristics; Flow classes; Techniques to improve QoS – Scheduling, Traffic shaping, Resource Reservation, Admission control; Internet QoS models – Integrated services, Differentiated services.	**4**
6	**GROUP COMMUNICATION** Introduction; IP Multicast addresses; IGMP – group management, messages, operation;	**6**

	Multicast Routing and Transport, Multicast routing protocols – MOSPF, DVMRP, CBT, PIM, MBONE.	
7	**TRANSPORT LAYER PROTOCOLS** TCP protocol dynamics; new options in TCP; brief introduction to SCTP, T/TCP.	**6**
8	**WIRELESS NETWORKS** Wireless PAN, LAN, MAN, WAN;Mobile network layer; Mobile transport layer.	**7**

List of Experiments:		**Number of Turns**
1	Implementation of various protocols	3
2	Programs related to resource management	3
3	Programs related to group communication	3
4	Projects	4

Course Outcomes: At the end of the course, students will be able to:	
1	Independently understand basic computer network technology.
2	Familiarize with MAC protocols for high speed networks.
3	Identify concepts underlying Internet protocol, their main characteristics and functionality and their extension.
4	Understand various traffic parameters and congestion control techniques.
5	Explain current QoS architectures and mechanisms, and the QoS support challenges in future networks.
6	Understand the principles and functionality of various multicast and transport protocols.
7	Understand the needs of wireless networks and some extensions to mobility at various layers.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Andrew Tenenbaum. Computer Networks, PHI	1993
2	Forouzan, Local Area Networks, TMH	2002
3	Forouzan, TCP/IP Protocols, TMH	2010
4	Forouzan, Data Communication and Networking, TMH	2013
5	Computer Networking, A Top-Down Approach Featuring the Internet - J. Kurose and K. Ross, 6th Ed. (Pearson).	2012
6	Schiller J., Mobile Communications, Addison Wesley.	2000
7	G. Keiser, "Local Area Networks", 2nd Edition, TMH.	2002
8	D. Bertesekas and R. Gallager, "Data Networks", 2nd Edition, PHI.	2000
9	William Stallings, "Data & Computer Communication", PHI, 6th Edition	2002

Course Name	**:**	**ADVANCED WIRELESS AND MOBILE NETWORKS**
Course Code	**:**	**CSN416**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should get familiar with the wireless/mobile market and the future needs and challenges. They should get familiar with key concepts of wireless networks, standards, technologies and their basic operations. They should learn how to design and analyze various medium access. They should learn how to evaluate MAC and network protocols using network simulation software tools.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**INTRODUCTION** Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies- CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modeling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy, etc.	**4**
2	**WIRELESS LOCAL AREA NETWORKS: IEEE 802.11** Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues	**10**
3	**WIRELESS CELLULAR NETWORKS:** 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies	**10**
4	WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview	**3**
5	**WIRELESS SENSOR NETWORKS** Introduction, Application, Physical, MAC layer and Network Layer,Power Management, Tiny OSOverview	**4**
6	**WIRELESS PANs** Bluetooth AND Zigbee, Introduction to Wireless Sensors, Introduction to Vehicular Adhoc Networks	**3**
7	**SECURITY** Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, IEEE 802.11x and IEEE 802.11i standards, DoS in wireless communication	**8**

List of Experiments:		Number of Turns
1	To get familiar with the following tools: Network Miner, SMAC, WEP key generator or Wepkey, IPscan, Netstumbler, xarp, wzcook, wireshark, Qualnet 4.5	2
2	To study and compare various channel models for wireless channels using Qualnet	2
3	To create a network topology, simulate it using NS2 and analyze the trace file.	1
4	To design different topologies using IEEE 802.11 and conduct Performance Analysis	2
5	To perform wireless path loss computations (Indoor & Outdoor)	1
6	Setup & Configuration of Wireless Access Point (AP), Setup and creation of an Adhoc Network, Setup and creation of Mobile Horspots and conduct Performance Analysis of the link	2
7	Practical study of WLAN : Ad Hoc & Infrastructure Mode, Study of Bluetooth Protocol and Applications, Wireless Network Security : kismet and Netstumbler	2
8	Simulations using NS3 for IEEE 802.11 (Wifi)	1

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases
2	Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
3	Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4	Design wireless networks exploring tradeoffs between wire-line and wireless links.
5	Develop mobile applications to solve some of the real world problems.

Suggested Books:		
Sr.	**Name of Book/ Authors/ Publisher**	**Year of**

No.		Publication/ Reprint
1	Schiller J., Mobile Communications, Addison Wesley	2000
2	Stallings W., Wireless Communications and Networks, Pearson Education	2005
3	Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc	2002
4	Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc	2000
5	Pandya Raj, Mobile and Personal Communications Systems and Services, PHI	2004

Course Name	**:**	**WIRELESS SENSOR NETWORKS**
Course Code	**:**	**CSN417**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should be able to have an understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers. They should learn the architecture of the sensor node and various operating systems used for sensor network design. They should learn to apply sensor network protocols, mechanisms, and algorithms to implement sensing systems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Motivation for a Network of Wireless Sensor Nodes – Definitions and Background, Challenges and constraints; Applications of wireless sensor networks.	**3**
2	**NODE ARCHITECTURE** The Sensing Subsystem - Analog-to-Digital Converter; The Processor Subsystem, Communication Interfaces, Prototypes.	**3**
3	**OPERATING SYSTEMS** Functional Aspects, Nonfunctional Aspects, Prototypes	**4**
4	**PHYSICAL LAYER** Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation	**4**
5	**MEDIUM ACCESS CONTROL** Overview, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols	**4**
6	**NETWORK LAYER** Overview, Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols	**4**
7	**TRANSPORT LAYER** Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols	**4**
8	**POWER MANAGEMENT** Local Power Management Aspects, Dynamic Power Management, Conceptual Architectu	**4**
9	**TIME SYNCHRONIZATION** Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols	**4**
10	**LOCALIZATION** Overview, Ranging Techniques, Range-Based Localization, Range-Free Localization, Event-Driven Localization	**4**

11	**SENSOR NETWORK PROGRAMMING** Challenges in Sensor Network Programming, Node-Centric Programming, Macroprogramming, Dynamic Reprogramming, Sensor Network Simulators	**4**

List of Experiments:		**Number of Turns**
1	Implement simulation experiments and projects based on Physical layer and MAC layer of wireless sensor network	3
2	Implement simulation experiments and projects based on network layer of wireless sensor network	3
3	Implement simulation experiments and projects based on transport layer of wireless sensor network	3
4	Implement simulation experiments and projects based on application layer of wireless sensor network	4

Course Outcomes: At the end of the course, students will be able to:	
1	Describe and explain radio standards and communication protocols for wireless sensor networks.
2	Explain the function of the node architecture and use of sensors for various applications.
3	Explain operating systems and programming languages for wireless sensor nodes.
4	Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.
5	Describe and analyze the specific requirements for applications in wireless sensor networks regarding energy supply, memory, processing and transmission capacity.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	W. Dargie and C. Poellabauer, "Fundemntals of Wireless Sensor Networks – Theory and Practice", Wiley.	2010
2	KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks - Technology, Protocols, and Applications", Wiley Interscience.	2007
3	Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer.	2010
4	Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", CRC press.	2003
5	C. S. Raghavendra, Krishna M. Sivalingam and TaiebZnati, "Wireless sensor networks", kluwer academic publishers.	2004
6	Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks:An Information Processing Approach", Elsevier.	2004
7	Robert Faludi, "Building Wireless Sensor Networks", O'Reilly.	2010
8	Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John wiley and sons.	2005
9	Rajeev Shorey, A. Ananda, MunChoon Chan and Wei Tsang Ooi, "Mobile, wireless, and Sensor networks - technology, applications, and future directions", IEEE press and wiley interscience.	2003

Course Name	**:**	**MOBILE COMPUTING**
Course Code	**:**	**CSN 418**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:

The students should be able to understand the concepts and principles of mobile computing. They should explore both theoretical and practical issues of mobile computing. They should develop skills of finding solutions for mobile computing applications

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**UNDERSTAND MOBILE PHONES** Mobile Phones -- The New Platform for People-Centric Sensing, Social and Personal Applications , Localization, Exploiting Mobility , Location Privacy	**8**
2	**MOBILE TECHNOLOGIES** Anatomy of a Mobile Device, Survey of Mobile Devices, Applications of Mobile Computing	**4**
3	**WIRELESS COMMUNICATION TECHNOLOGIES** Cellular networks, Wireless (802.11), TCP/IP in the mobile setting, Geolocation and GPS	**6**
4	**APPLICATION DESIGN** Context, Information Architecture, Design Elements, Mobile Web vs Native Applications	**6**
5	**SENSORS ON MOBILE PHONES** Function of sensors: Accelerometer, GPS, Gyroscope, Magnetometer, Luxmeter, Microphone, Proximity Sensor	**6**
6	**DEVELOPMENT ENVIRONMENTS** Introduction to Objective-C, The Model-View-Controller Model, The Delegate Pattern, The iPhone, Android, & Blackberry SDKs, The Application Environment, Limited Resource Computing, Memory Management, Low Power Computing, Fault Tolerance and Persistence, Security Issues	**12**

List of Experiments:		**Number of Turns**
1	Getting familiar with Mobile OS (Android platform considered here) and its Integrated Development Environment. Create single screen/activity application demonstrating the use of: Layouts, Widgets, and Menu components to compose the user interface: a. Implement a program demonstrating various possibilities for changes in the color, size and font style (of the displayed TextView content), as a result of pressing different buttons or selecting various menu options. b. Create and implement a general-purpose mathematical calculator. c. Develop some kind of multiple-choice e-learning application, that supports memorizing the correlation of predefined number of word-pairs, in two different languages (e.g. Polish and English)	04
2	• Mobile Apps be developed for different application for Android as well as IoS Platform. Theme of final Android project may be proposed by student. • Each student selects at least two of mobile technology aspects: a. mobile database (SQLite) b. built-in smartphone sensors: accelerometer, gyroscope, magnetometer, gps c. networking, data synchronization or web services d. 3D graphics or animation on mobile device e. Bluetooth communication between mobile devices	04
3	Design Loggers to perform User Localization Through Sensors of Smartphones. Collect data using the designed mobile App and present the results.	03
4	Develop Mobile Apps based upon Crowdsourcing-Data Collection and Data Analysis	02

Course Outcomes: At the end of the course, students will be able to:	
1	Grasp the concepts and features of mobile computing technologies and applications
2	Identify the important issues of developing mobile computing systems and applications
3	Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Theodore S. Rappaport, Wireless Communications: Principles and Practice, Second Edition, Prentice Hall,	2002
2	Ivan Stojmenovic, Handbook of Wireless Networks and Mobile Computing, John Wiley & Sons	2002
3	Mohd. Ilyas & Imad Mahgoub, Mobile Computing Handbook, CRC Press/Aurbach Publications, ISBN 0-8493-1971-4, Boca Raton USA.	2005
4	Reza B'Far, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Cambridge University, 2004	2004
5	Reto Meie, Professional Android Application Development (Wrox Programmer to Programmer), Wrox, 2008	2008
6	Axel Küpper, Location-Based Services: Fundamentals and Operation, Wiley, 2005.	2005

Course Name	**:**	**OBJECT ORIENTED PROGRAMMING**
Course Code	**:**	**CSN461**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand the concept of object oriented programming like classes, constructors, polymorphism, inheritance, templates and file handling.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO PROGRAMMING PARADIGMS** Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm	**2**
2	**C++ CONSTRUCTS** Tokens, Expressions and control structures, various data types and data structures, Variable declarations, Dynamic Initializations, Operators and Scope of Operators, Typecasting, Unformatted and formatted console I/O Operations	**2**
3	**FUNCTIONS, CLASSES AND OBJECTS** Prototyping, Referencing the variables in functions, Inline, static and friend functions. Memory allocation for classes and objects. Arrays of objects, pointers to member functions.	**4**
4	**CONSTRUCTORS AND DESTRUCTORS** Constructor and Destructor types, Dynamic Constructors, Applications, Order of Invocation, C++ garbage collection, dynamic memory allocation.	**5**
5	**POLYMORPHISM** Function and Operator overloading, overloading using friend Functions, type conversions from basic data types to user defined and vice versa.	**5**
6	**INHERITANCE** Base classes and Derived classes, types of inheritance, various types of classes, Invocation of Constructors and Destructors in Inheritance, aggregation, composition, classification hierarchies, metaclass/abstract classes.	**5**
7	**POINTERS** Constant pointers, Use of this Pointer, Pointer to derived and base classes, virtual functions, Bindings, Pure virtual Functions and polymorphism.	**5**
8	**I/O OPERATIONS AND FILES**	**5**

	Classes of files, Operations on file, file pointers.	
9	**GENERIC PROGRAMMING WITH TEMPLATES** Definition of class template, Function Templates, Overloading Template Functions, Class templates and member functions templates with parameters, Standard C++ classes, persistent objects, streams and files, namespaces, exception handling, generic classes, standard template library: Library organization and containers, standard containers, algorithm and Function objects, iterators and allocators, strings, streams, manipulators, user defined manipulators and vectors.	**4**
10	**ADVANCED MEMORY HANDLING** Storage types in C++, Automatic Life, Dynamic Life, Static Life, Object with special storage restrictions.	**2**
11	**CASE STUDY** Features of Different Object Oriented languages	**3**

List of Experiments:		**Number of Turns**
1	Implement various C++ constructs	**1**
2	Implement friend functions	**1**
3	Implement pointers to member functions	**2**
4	Implement constructors and destructors	**1**
5	Implement operator and function overloading	**2**
6	Implement inheritance	**1**
7	Implement run time polymorphism	**2**
8	Implement file operations	**2**
9	Implement templates	**1**

Course Outcomes: At the end of the course, students will be able to:	
1	Understand real world problem and identify object in given problem.
2	Construct C++ classes and apply various C++ concepts with proficiency

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	C++ Primer, 5th Edition, Pearson Education Inc.	2012
2	Object Oriented Programming in C++, Robert Lafore, 4th Edition, SAMS	2001
3	C++ Primer Plus By Prata, Pearson Education	2012
4	C++:The Complete Reference, By Schildt, McGraw-Hill	2003
5	Object Oriented Programming with C++, Balaguruswamy, Tata Mc Graw Hill	2008

Course Name	**:**	**OPERATING SYSTEMS**
Course Code	**:**	**CSN462**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able to describe the services provided by and the design of an operating system. They should be able to understand the structure and organization of the file system, processes synchronization, process scheduling, system calls and different approaches to memory management.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**CONCEPTS OF OPERATING SYSTEMS** Computer system overview, concept of an operating system, batch system, multiprogramming, multiprocessing, multi user, time sharing, personal system, parallel system, real time system, simple monitors, general system architecture, System components, operating system services, system calls, system programs, system structure, Approaches to OS design and implementation: Microkernel, Layered, Kernel Approach	**8**
2	**PROCESSES AND THREADS** Concept of process, process states, process state transitions, process control block, operations on processes, threads, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, Inter process synchronization, Inter process communication, Linux, IPC Mechanism, Remote procedure calls, RPC exception handling, security issues	**8**
3	**MEMORY MANAGEMENT** Logical and physical address space, storage allocation and management techniques, swapping concepts of multi programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithm, thrashing	**8**
4	**INPUT/OUTPUT AND DATA MANAGEMENT** File organization, record blocking, access method, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels	**8**
5	**OS SECURITY** Types of Threats in OS, Basic OS Security Mechanisms, Understanding the Threats: Malware Taxonomy: Viruses, Worms, Rootkits, Defense -- An Overview, Logging, Auditing, and Recovery, OS-level Memory Protection	**4**
6	**CASE STUDIES** Linux/Unix OS design and architecture, Unix shell, Unix operating system services, user perspective, representation of files in Unix system processes and their structure, input-output system, memory management in Unix	**4**
7	**OS ABSTRACTIONS** Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace Files: open, close, read, write, lseek, stat, sync Directories: mkdir, rmdir, link, unlink, mount, umount users + Security: chown, chmod, getuid, setuid, Inter process communication: signals, pipe Networking: socket, accept, snd, recv, connect	**2**

List of Experiments:		Number of Turns
1	To perform shell programming	2
2	Implement memory management techniques like paging or segmentation	2
3	Implement any file allocation technique (Linked, Indexed or Contiguous)	2
4	Use the system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount users +	2
5	Use the following system calls of UNIX operating system: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace, open, close, read, write, lseek, stat, sync	2
6	Use the following system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount users +, chown, chmod, getuid, setuid	2
7	Use the following system calls of UNIX operating system: signals, pipe, socket, accept, snd, recv, connect	1

Course Outcomes: At the end of the course, students will be able to:	
1	Explain about operating systems and its major components.

2	Write and/or modify concurrent programs.
3	Apply security as well as recovery feature in the design of algorithms.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Operating system, Galvin & Silberschatz, 7th Edition, John Willey	2004
2	Operating Systems-A Concept Based Approach By Dhamdhare, TMH	2006
3	Operating systems Internals and design principles By William Stallings, Pearson Education	2012
4	Operating Systems –A Design Oriented approach By Crowley, TMH	2001
5	Operating systems Design and Implementation By Andrew S. Tanenbaum, Pearson Education	2009

Course Name	**:**	**WEB TECHNOLOGIES**
Course Code	**:**	**CSN463**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should understand fundamentals of programming in Java. They should be able to design and develop Java programs using JDK environment. They should learn the basics about Client side scripts and Server side scripts.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO JAVA** Creation of Java, importance to Internet, Java applets and applications, security, portability, Java's Byte code. Understanding the java programs, compiling the program, control statements, lexical issues, Data types in Java, Java literals, variables, scope and lifetime of variables, type conversion, declaring and using arrays	4
2	**OPERATORS IN JAVA** Arithmetic, Modulus, Assignment, Bitwise, Relational, Assignment, ternary operator, Operator precedence. Control statements, classes, garbage Collection, overloading methods, overloading constructors, using objects as parameters. Argument passing by value and by reference, returning objects, static and final keywords. Inheritance in Java using super keyword, abstract classes.	6
3	**EXCEPTION HANDLING IN JAVA** Exception types, using try and catch, multiple catch classes, nested try statement, using throw, Java Built in Exceptions, creating user defined exceptions.	6
4	**MULTITHREADED PROGRAMMING IN JAVA** Java thread model, Thread priorities, synchronization, creating thread using thread class and runnable interface, creating multiple threads, deadlocks.	6
5	**APPLETS AND AWT** Applet fundamentals, Applet architecture, creating and running applets, Passing parameters in Applets. AWT : AWT Basics, AWT classes, Working with event frame windows, working with graphics, creating and selecting a font, Managing Text output using Font Metrics.	6
6	**USING AWT CONTROLS** Menus, using Labels, buttons, checkboxes, Checkbox group, choice controls, using Lists, managing scrollbars, using a textField, textArea.	4

	Layout manager FlowLayout, borderLayout, gridLayout, menubars, menus.	
7	**SCRIPTING** Client side scripting : Java script Server side scripting: Java server pages	6
8	**CONTENT MANAGEMENT SYSTEM** HTML5,CSS, Wordpress, druppal, Joomla	4

List of Experiments:		**Number of Turns**
1	Java program based on operators, loop, decision making statement and type casting.	1
2	Java program to define class, constructors and method overloading.	1
3	Java programs based on different types of inheritance.	1
4	Java program to demonstrate the use of interfaces.	1
5	Java program to demonstrate the use of packages.	1
6	Java programs based on exception handling.	1
7	Java program based on multithreading and synchronization.	1
8	Program to design simple applet using graphics class.	1
9	Program to design simple applet using AWT class.	1
10	Web based project using Applet, AWT class, client side scripting and server side scripting concepts.	4

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate object-oriented design principles including encapsulation and information hiding, inheritance.
2	Write, compile and execute Java programs to solve problems.
3	Design and develop projects using concepts like Applet, AWT class, client and server side scripting.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	The Complete Reference Java 2, 5th Edition, by Herbert Schildt, McGraw-Hill	2007
2	Programming with JAVA, by Balagurusamy, Tata McGraw-Hill publishing company limited	2009
3	Professional wordpress: design and development, 3rd Edition, by Hal Stern, David Damstra, Brad Williams, Wiley India Private Limited	2015
4	JOOMLA BIBLE,1st Edition, by RIC SHREVES, Wiley	2010
5	BEGINNING DRUPAL, 1st Edition, by Jacob Redding, Wiley	2010
6	JavaScript the complete reference, 3rd Edition, by Thomas A Powell, Fritz Schneiider, McGraw-Hill	2012

Course Name	**:**	**MACHINE LEARNING**
Course Code	**:**	**CSN421**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to understand the Machine learning system and its related issues. They should learn about theory and approaches in Machine learning. They should learn about basic techniques for Machine learning.

Total No. of Lectures – 42

Lecture wise breakup	**Number of Lectures**

1	**INTRODUCTION:** Well-posed learning problems, designing a learning system, perspectives and issues in machine learning.	2
2	**DECISION TREE LEARNING** : Decision tree representation, appropriate problems for decision tree learning, Hypothesis search space in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.	4
3	**BAYESIAN LEARNING:** Bayes Therorem, Bayes Theorem and Concept Learning, Maximum likelihood and least square error hypothesis, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Network	6
4	**INSTANCE-BASED LEARNING** : K-Nearest Neighbors Learning, Distance weighted nearest neighbor algorithm, Locally weighted regression, radial basis functions, case based learning, collaborative filtering	6
5	**ANALYTICAL LEARNING:** Inductive and analytical learning, Explanation based learning, combining inductive and analytical learning.	5
6	**SUPPORT VECTOR MACHINES** : Optimal hyperplane, margin, kernels, stability, generalization of error of support vector machines	6
7	**HIDDEN MARKOV MODELS:** Markov Modeling and apploications, dynamic programming algorithms, Hidden Markov Models, Probabilistic model, Estimation, Viterbi algorithm, Applications of Hidden Markov models.	5
8	**STATISTICAL LEARNING THEORY** : PAC learning, VC dimension, generalization error bounds. **ONLINE LEARNING** : experts, bandits, online mistake bounds. **CLUSTERING** : HAC, k-means, mixture of Gaussians.	4
9	**RECOMMENDER SYSTEMS**: Similarity based methods, matrix factorization, embeddings. **ML EXPERIMENTATION** : Hypothesis tests, cross validation, resampling estimate	4

Course Outcomes: At the end of the course, students will be able to:	
1	Perform an analysis of a given machine learning problem.
2	Use machine learning techniques in different domains.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Tom Mitchell, "Machine Learning", McGraw Hill	1997
2	Kevin Murphy, "Machine Learning - a Probabilistic Perspective", MIT Press	2012
3	Cristianini, Shawe-Taylor, "Introduction to Support Vector Machines", Cambridge University Press	2000
4	Schoelkopf, Smola, "Learning with Kernels", MIT Press	2002
5	Bishop, "Pattern Recognition and Machine Learning", Springer	2006
6	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press	2004
7	Devroye, Gyoerfi, Lugosi, "A Probabilistic Theory of Pattern Recognition", Springer	1996
8	Duda, Hart, Stork, "Pattern Classification", Wiley	2000
9	Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning", Springer	2009
10	Joachims, "Learning to Classify Text using Support Vector Machines", Kluwer	2002

Course Name	**:**	**ADVANCED DATABASE SYSTEMS**
Course Code	**:**	**CSN422**
Credits	**:**	**3 1 0**
L T P	**:**	**4**

Course Objectives:

At the end of this course, the student should be able to describe and relate a database with datawarehouse. The student will be able to analyze the distributed database processing in different scenarios. The student will be able to design and develop the optimized query for processing.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**TRANSACTION PROCESSING AND CONCURRENCY CONTROL:** Transaction processing concepts, serializability, Concurrency control techniques: Lock based protocols: two phase locking , timestamp based protocols, validation based protocols, multiple granularity.	10
2	**QUERY PROCESSING AND QUERY OPTIMIZATION:** Overview, measures of query cost, select ,join operation, other operators. Query optimization overview, transformation of relational expressions, estimating statistics of expressions results.	8
3	**DATA MINING AND DATA WAREHOUSING** : Data mining on what kind of data, data mining functionalities- what patterns can be mined, classification of data mining systems, major issues in data mining. Decision support systems, data analysis and OLAP, data warehousing, multidimensional data model, data warehouse architecture	12
4	**DATABASE SYSTEM ARCHITECTURES:** Centralized and client server architecture, server system architectures, parallel systems, distributed systems, network types.	4
5	**DISTRIBUTED DATABASES**: Homogeneous and heterogeneous databases, Distributed data storage, distributed transactions, Commit protocols, Distributed query processing, Concurrency Control in Distributed databases	8

Course Outcomes: At the end of the course, students will be able to:	
1	Identify the optimized query from the given ones.
2	Analyze Data mining functionalities
3	OLAP operations the data warehouse.
4	Differentiate in centralized and client server architecture
5	Analyze the distributed database transaction handling in different situations

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill,	2006
2	"Fundamentals of Database Systems", Elmsari and Navathe, Pearson Education	2013
3	Database Management Systems , Ramakrishnan and Gehrke, McGrawHill	2003
4	"An Introduction to Database Systems", C.J.Date, A.Kannan, S.Swamynathan, Pearson Education	2006
5	J. D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications	1999
6	Database Management Systems by A.K. Majumdar and P. Bhattacharyya, 5th edition, , Tata McGraw-Hill Publishing.	1999

Course Name	**:**	**ADVANCED SOFTWARE ENGINEERING**
Course Code	**:**	**CSN423**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to understand some modern software engineering technologies. They should be able to evaluate and select appropriate technologies relative to each software engineering task.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION AND MOTIVATION FOR SOFTWARE ENGINEERING** Overview of several basic SE methodologies with emphasis on Iterative and Increment Development and User Centered Design, Role of Software Engineering, Software Development Paradigms, Design principles and practice, Basic components of SW Engineering process.	**5**
2	**FORMAL METHODS** Basic terminology, Applying mathematical notations for formal specification, formal specification languages, Formal verification of programs, using Z to represent an example software component.	**4**
3	**OBJECT ORIENTED METHODOLOGY** Modeling of Software Requirements and Specifications with Use-Case Diagrams; Object Oriented Modeling based on UML, Establishing the Object Model, Refining classes and associations.	**6**
4	**SOFTWARE REUSE** Component Based Software Engineering (CBSE), Development for Reuse and Development with Reuse, Design Patterns, Service oriented architecture	**6**
5	**CLEANROOM SOFTWARE ENGINEERING** Agile Development, The cleanroom approach, functional specification, cleanroom design, cleanroom testing.	**4**
6	**CLIENT/SERVER SOFTWARE ENGINEERING** Structure of client / server systems, software engineering for Client / Server systems, Analysis modelling issues, Design for Client / Server systems, Testing issues	**4**
7	**WEB ENGINEERING** The attributes of web-based applications, Requirements Engineering for Web Applications, formulating/analyzing web-based systems, design for web-based applications, Problems and Restrictions in Integrated Web Design, Web Project Management, the WebE process, a framework for WebE, testing web-based applications, management issues.	**4**
8	**REENGINEERING** Software reengineering, reverse reengineering, restructuring, forward reengineering, economics of reengineering, future paradigms and methodologies in requirements engineering	**5**
9	**SOFTWARE CHANGES IMPACT ANALYSIS** Software Changes analysis, Software Clones Detection, Automated Test Cases Generation, Latest Trends, Various certifications in software engineering.	4

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate an ability to implement, test, and deploy a computer-based system applying current and emerging methodologies and technologies.
2	Recognize the limitations of current approaches and systems and identify unsolved problems in Software Engineering

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Object-Oriented Software Engineering-A Use Case Driven Approach, Ivar Jacobson, Pearson	1992

2	Formal Specification and Documentation using Z - A Case Study Approach, J. Bowan, International Thomson Computer Press	2003
3	The unified Modeling language reference Manual, J. Rumbaugh, I. Jacobson, G. Booch, Addison Wesley.	2005
4	Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications, Robert Oshana, Mark Kraeling, Newnes Publisher	2013

Course Name	**:**	**ADVANCED ALGORITHM DESIGN AND ANALYSIS**
Course Code	**:**	**CSN424**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should have the appropriate background, foundation and experience for advanced study in Computer Science. They should develop mathematical skills for algorithm design, analysis, evaluation and computational cost. They should develop the skills to design and implement efficient programming solutions to various problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Algorithm concepts, Analyzing and design, Pseudocode conventions, asymptotic efficiency of algorithms, asymptotic notations and their properties.	**2**
2	**RECURSION AND RECURRENCE RELATIONS** Recurrence equations and method of solving recurrences, substitution method, recursion tree method and master method.	**2**
3	**PROBABILISTIC ANALYSIS AND RANDOMIZED ALGORITHMS** Probabilistic analysis concepts, hiring problem and its probabilistic analysis.	**4**
4	**SORTING** Heap sort and heaps as priority queues, quick sort, randomized quick sort, sorting in linear time.	**4**
5	**SELECTION PROBLEM** Medians and order statistics.	**3**
6	**SEARCHING** Searching using hash tables, collision resolution, hash functions, open addressing using linear probing, quadratic probing and double hashing.	**5**
7	**DYNAMIC PROGRAMMING** Elements of Dynamic Programming, Longest Common Subsequence problem, Optimal Binary Search trees	**4**
8	**ADVANCED DATA STRUCTURES** B trees, B+ trees, data structures for disjoint sets.	**4**
9	**GRAPH ALGORITHMS** Breadth First and Depth First Search, minimum spanning trees, shortest path algorithms: single source and all pair, max flow problem and its solutions.	**5**
10	**STRING MATCHING** Rabin Karp algorithm, Knuth-Morris-Pratt algorithm.	**4**
11	**NP-COMPLETENESS CONCEPTS** Polynomial time verification, NP-completeness and reducibility, showing problems to be NP-complete like Clique problem, vertex cover problem etc. Approximation algorithms of these problems.	**5**

Course Outcomes: At the end of the course, students will be able to:	
1	Know in more depth some important design and analysis techniques for algorithms, in particular, ways to

	approach NP-complete problems
2	Apply such techniques to solve new problems that may arise in various applications
3	Have some practice in recognizing connections between algorithmic problems and reducing them to each other
4	Explain more complex algorithms and proofs in written form
5	Understand some pieces of current research on algorithms

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", Prentice Hall of India.	2001
2	Brassard, Bratley, "Fundamentals of algorithms", Prentice Hall of India.	2001
3	Knuth, "The Art of Computer Programming", Vol I-III, Pearson Education.	2011

Course Name	**:**	**ADVANCED COMPUTER ARCHITECTURE**
Course Code	**:**	**CSN425**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to understand computer architecture. They should study architectures exploiting instruction-level parallelism (ILP), and multiprocessors and minicomputers.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO PARALLEL PROCESSING**: Parallelism in uniprocessor system; parallel computer structure, architectural classification schemes.	**5**
2	**MEMORY MANAGEMENT AND ORGANIZATION**: Memory hierarchy, Virtual memory system, memory allocation and management, cache memory management. Mapping and management techniques, memory replacement policies.	**10**
3	**PIPELINING AND VECTOR ARCHITECTURE**: Instruction and arithmetic pipelines design, linear and non-linear pipeline processors, superscalar and super pipeline design.	**8**
4	**SIMD ARRAY ARCHITECTURE**: SIMD array processors, SIMD interconnection network, Associative array processors.	**7**
5	**MIMD MULTIPROCESSOR AND MULTICOMPUTER**: Multiprocessor architecture (loosely coupled, tightly coupled), interconnection networks, cache coherence and synchronization mechanism multiprocessor operating systems, exploiting concurrency.	**8**
6	**REVIEW OF MODERN PROCESSORS** Pentium Processor: IA 32 and P6 micro architectures, ARM Processor.	**4**

Course Outcomes: At the end of the course, students will be able to:	
1	Understand the advanced concepts of computer architecture.
2	Investigate modern design structures of Pipelined and Multiprocessors systems.
3	Understand the interaction amongst architecture, applications and technology

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**

1	Advanced Computer Architectures - A Design space approach, Dezso Sima, Terence Fountain, Peter Kacsuk, Pearson Education.	1997
2	K Hwang, Advanced Computer Architecture, Tata McGraw-Hill Education.	2003
3	David E. Culler, Jaswider Pal, Parallel computer Architecture, Gulf Professional Publishing.	1999
4	John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Third Edition, Morgan Kaufmann.	2002
5	High-performance Computer Architecture, by Harold Stone Addison Wesley, 3rd ed.	1993
6	Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann.	1998

Course Name	**:**	**DATA STRUCTURES AND ALGORITHMS**
Course Code	**:**	**CSN431**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able to understand various data structures and their application in algorithm design.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**BASIC CONCEPTS OF ALGORITHMS** Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem types, Recursion, Time and space complexity of algorithms, Asymptotic Notations.	**2**
2	**BASIC DATA STRUCTURES** Arrays, stacks, queues, Linked-lists, Circular Lists, Doubly linked lists, Garbage collection linked stacks, linked queues, infix, prefix and postfix notations, evaluation of expressions.	**12**
3	**TREES** Basic terminology, binary trees, binary tree traversal, Threaded Trees, Binary Search Tree, Height Balanced Tree and various rotations, B tree.	**10**
4	**GRAPH THEORY** Graph representations, Graph Traversals, Prim's and Kruskal's Algorithm for Minimal Spanning tree	**8**
5	**SORTING AND SEARCHING** Linear search, binary search and hash search. Insertion sort, selection sort, bubble sort, quick sort, merge sort, heap sort, bucket sort	**10**

List of Experiments:		**Number of Turns**
1	Program to implement stack and its various applications.	1
2	Program to implement queue and its various applications.	1
3	Program to implement linked list and its various applications.	2
4	Program to implement binary trees and its various applications.	2
5	Program to implement binary search tree and its various applications.	2
6	Program to implement graphs.	2
7	Program to implement various searching and sorting algorithms	2
8	Program to implement divide and conquer techniques.	1

Course Outcomes: At the end of the course, students will be able to:	
1	Analyze efficiency tradeoffs for algorithms

2	Choose appropriate data structure for a given problem
3	Implement searching and sorting techniques.
4	Implement stacks and queues.
5	Implement tree and graph based problems

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Data Structures and Program Design in C By Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education.	2007
2	Data Structures Using C & C++, By Langsam, Augenstein, Tanenbaum, Pearson Education.	2004
3	Data Structures with C, Seymour Lipschutz, Mc Graw Hill	2014
4	Fundamentals of Data Structures, By Ellis Horowitz and Sartaj Sahni, Computer Science Press.	2011
5	An introduction to data structures with applications, By J.P. Trembley & P.G. Sorensen, TMH.	2004
6	Fundamentals of Computer Algorithms, Horowitz, Sahni and Rajasekaran University Press	2010

Course Name	**:**	**COMPUTER NETWORKS**
Course Code	**:**	**CSN432**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to have an understanding of the fundamental concepts of computer networking and have a basic knowledge of the various networks models and their uses. They should understand the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks. They should be able to analyze simple protocols and independently study literature concerning computer networks.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**COMPUTER NETWORKS AND THE INTERNET** What is the Internet; network edge; network core;Delay, Loss and throughput in Packet-Switched Networks; Protocol Layers and their Service Models.	**6**
2	**APPLICATION LAYER** Principles of Network Applications; The Web and HTTP; File Transfer: FTP;Electronic Mail in the Internet; DNS - The Internet's Directory Service;Peer-to-Peer applications; Socket Programming – Creating network applications.	**8**
3	**TRANSPORT LAYER** Introduction and Transport-Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Principles of Reliable of Data Transfer; Connection-Oriented Transport: TCP; Principles of Congestion Control;TCP Congestion Control.	**10**
4	**NETWORK LAYER** Introduction; Virtual circuit and datagram networks; What is inside a router; Internet Protocol (IP): Forwarding and Addressing in the Internet; Routing Algorithms; Routing in the Internet; Broadcast and Multicast Routing.	**10**
5	**DATA LINK LAYER**	**8**

	Introduction to the link layer; Error Detection and Correction Techniques; Multiple Access links and Protocols; Switched local area networks.	

List of Experiments:		**Number of Turns**
1	Programs using TCP and UDP Sockets	2
2	Simulation of sliding window protocols	2
3	Simulation of Routing Protocols	3
4	Configure given network topologies using any network simulator software	3
5	Programs for error detecting codes, RSA algorithm	2
6	Programs for Client server Communication	1

Course Outcomes: At the end of the course, students will be able to:	
1	Independently understand basic computer network technology.
2	Understand and explain various components of computer networks.
3	Identify the different types of network topologies and protocols.
4	Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5	Identify the different types of network devices and their functions within a network.
6	Understand and build the skills of routing mechanisms.
7	Familiarize with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	James F. Kurose and Keith W. Ross, "Computer Networking: A top down approach", Pearson Education, 6th edition.	2012
2	A.S. Tanenbaum, "Computer Networks", 4th Edition, PHI	2004
3	G. Keiser, "Local Area Networks", 2nd Edition, TMH	2002
4	D. Bertesekas and R. Gallager, "Data Networks", 2nd Edition, PHI	2000
5	U. Black, "Computer Networks", PHI	1997
6	S. Keshav, "An engineering approach to computer networking", Addison Wesley	1999
7	William Stallings, "Data & Computer Communication", PHI, 6th Edition	2002
8	B.A. Forouzan, "Data communications and networking", TMH, 1st ed	2000
9	B.A. Forouzan, "Local Area Networks", TMH.	2002
10	B.A. Forouzan, "TCP/IP Protocol Suite", TMH.	2004

Course Name	**:**	**COMPUTER CRIME INVESTIGATION AND FORENSICS**
Course Code	**:**	**CSN433**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to have technical skills and competencies in the field of forensic computing. They should be able to protect the computer system during the forensic examination from any possible alteration, damage, data corruption, or virus introduction. They should understand how information is stored and used on digital devices.

Total No. of Lectures – 42

Lecture wise breakup	**Number of Lectures**

1	**INTRODUCTION** Types of computer crime, history, surveys, statistics and global connections ,Aspects of Cyber Warfare and Cyber Terrorism, Dynamic, Human and Technical Aspects of Cyber Warfare and Cyber Terrorism, Identification, Authorization and Access Control	**7**
2	**SOCIAL ENGINEERING** Spam, Phishing and Pharming	**4**
3	**MALWARE** The types, effects and investigations, DoS and Distributed DoS: The causes, mechanisms, case studies and counter-measures.	**7**
4	**NETWORK CRIMES** Hacking methodologies via the Internet and attacks to other networks	**4**
5	**COMPUTER FORENSICS & INVESTIGATION** Preparation of Investigation, Procedures, Understanding Data Recovery, Data Acquisition, Processing Crime & Incident scenes, Current Computer Forensic tools, Computer Forensic Analysis & Validations, recovery Graphic Files, Network Forensics, Email Investigations, Mobile Device Forensics	**10**
6	**LEGAL MEASURES** Computer Misuse, Criminal Damage, Software Piracy, Forgery, Investigative Powers	**4**
7	**CASE STUDIES** Investigations into hacking, cases and PC misuse, Investigations, Incident Handling and Forensic Examination, The Future: The expansion of the Internet, unsuitable material Identity Theft and Fraud	**6**

List of Experiments:		**Number of Turns**
1	Practical problems on Data and Evidence Recovery	2
2	Practical problems on Hacking Methodologies	2
3	Practical problems on Mobile Device Forensics	2
4	Practical problems on Windows Forensics	2
5	Practical using Cyber Forensic Investigation Tools	3
6	Practical problems on Web Browser Forensics and Email Tracing	2

Course Outcomes: At the end of the course, students will be able to:	
1	Demonstrate use of computer forensics tools and appropriate skills and knowledge to perform investigations
2	Analyze digital devices to establish user activity
3	Research the development of new devices and technologies and how current digital forensics methods will apply to them.
4	Gain insight knowledge to understand attack profiles, investigation tools and techniques
5	Gain ability to perform Critical analysis of data to identify evidence
6	Be able to trace malicious internet activity and analyze email trails.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Cyber Warfare and Cyber Terrorism , Andrew Colarik and Lech Janczewski, editors Dorothy E. Denning, ISBN13: 9781591409915.	2007
2	Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, CENGAGE Learning	2009
3	Information Warfare and Security, Addison-Wesley, Hedley & Aplin,	1999
4	Blackstone's Statutes on IT and E-Commerce, Oxford University Press, C. Stoll, The Cuckoo's Egg, Pan Book Publishers.	2002

Course Name	**:**	**DATA BASE SYSTEMS**
Course Code	**:**	**CSN434**
Credits	**:**	**3 0 2**
L T P	**:**	**4**

Course Objectives:
The students should be able to understand various applications of DBMS, design different databases and the need for various types of query languages.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**Introduction** Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Database Languages: DDL, DML **STORAGE AND FILE STRUCTURE** Overview of physical storage media, magnetic disks, RAID, file organization, organization of records in files, indexing and hashing **Database Models:** Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Weak and Strong entity types, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model Network model, Hierarchical model	10
2	**RELATIONAL MODE**L Introduction to relational model, basic structure, Types, Keys, views in a relational database. **SQL:** Fundamentals, basic structure, set operations, aggregate operations, DDL, DML, DCL, nested queries, complex queries, Integrity Constraints, PL/SQL Concepts, triggers	10
3	**RELATIONAL DATABASE DESIGN** Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	9
4	**TRANSACTION MANAGEMENT** Transaction concept, transaction state, ACID properties, serializability, Recoverability , Implementation of Isolation , Testing for serializability . concurrency control, Lock based concurrency control, Time stamping methods	8
5	**DISTRIBUTED DATABASES** Introduction, data mining, Big Data, No SQL, New SQL, Modern databases based on these concepts.	5

List of Experiments:		**Number of Turns**
1	For a given scenario of database application, Create the required tables using SQL Commands	1
2	Write Sql queries to apply the constraints i.e. Primary Key, Foreign key, UNIQUE to the tables.	2
3	SQL queries for Null values and different clauses	2
4	Usage of SELECT, rename, tuple operations, DELETE etc.	2
5	SQL queries for implementing various String operations, Set operations	2
6	SQL queries for implementing JOINs and types of joins with conditions.	1
7	SQL nested queries for a particular scenario.	1
8	SQL queries to create the views ,triggers	1
9	SQL queries to create indexes and apply on a database.	1

Course Outcomes: At the end of the course, students will be able to:	
1	Design a database in various environments
2	Design , implement, test and debug the SQL queries

3	Design a database with triggers for maintaining the consistency of the database

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill,	2006
2	"Fundamentals of Database Systems", Elmsari and Navathe, Pearson Education	2013
3	Database Management Systems , Ramakrishnan and Gehrke, McGrawHill	2003
4	"An Introduction to Database Systems", C.J.Date, A.Kannan, S.Swamynathan, Pearson Education	2006
5	J. D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications	1999

Course Name	**:**	**SOFTWARE ENGINEERING**
Course Code	**:**	**CSN435**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
The students should be able to understand the concept and importance of Software Engineering. They should be able to construct software that is reasonably easy to understand, modify, maintain and reliable. They should learn strengths and weaknesses of various Software Engineering Techniques used in industrial applications.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO SOFTWARE ENGINEERING** Software, Software Engineering, Myths, Software Process, Work Products, Importance of Software Engineering.	**4**
2	**SOFTWARE PROCESS MODELS** Standard for Software Process, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model, 4th Generation models, Formal Methods, Agile Development.	**6**
3	**REQUIREMENT ENGINEERING** Software Requirements, Types of Requirements, Requirement Engineering Cycle, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation.	**4**
4	**SOFTWARE PROJECT MANAGEMENT** Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Software Process and Project metrics.	**6**
5	**SOFTWARE DESIGN** Process, Data and Behavioral Modeling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document.	**6**
6	**CODING AND TESTING** Coding styles and documentation, Testing principles, Testing strategies, Black-box and White-box Testing Techniques, Levels of testing -unit, integration, system, regression, Test Plan, Test Cases Specification, Software debugging, Software Maintenance.	**6**
7	**SOFTWARE QUALITY** Software Quality Assurance (SQA), SQA tasks, Software amplification and removal, Formal Technical Reviews, Software Quality Factors, ISO 9126, SEI CMM, CMMI, Software	**4**

	Reliability. Software Availability.	
8	**CASE (COMPUTER AIDED SOFTWARE ENGINEERING)** CASE and its Scope, CASE support in Software Life Cycle, Architecture of CASE Environment, Upper CASE and Lower CASE, Exposure to CASE tools.	**3**
9	**ADVANCED TOPICS IN SOFTWARE ENGINEERING** Software Process Improvement, Component Based Software Engineering, Web Engineering, Reverse Engineering, Software Engineering challenges of Big Data, Mobile Applications.	**3**

List of Experiments:		**Number of Turns**
1	Project Development with Software Engineering practices.	3
2	Programming Exercises for software design concepts.	3
3	Programming Exercises for software testing concepts.	3
4	Programming Exercises for Project Management concepts.	2
5	Exposure to UML, Rational software Architect.	2

Course Outcomes: At the end of the course, students will be able to:	
1	Design software in various application domains
2	Design software solutions independently as well as in teams

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Software Engineering-A Practitioners Approach, By R. Pressman, McGraw Hill International edition.	2004
2	Software Engineering, Ian Sommerville, Addison-Wesley.	2010
3	An Integrated Approach to Software Engineering, Pankaj Jalote, Narosa.	2014
4	Fundamentals of Software Engineering, By Rajib Mall, PHI Learning Pvt. Ltd.	2014
5	Software Engineering (3rd ed.), By K.K Aggarwal & Yogesh Singh, New Age International Publishers	2007

GENERAL SCIENCE COURSES (GSC)

Course Name	**:**	**ENVIRONMENTAL SCIENCES**
Course Code	**:**	**GSC101**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Course Objectives:
This course aims to acquaint students with the basics of Environmental Sciences.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Multi-discipline nature of environmental studies as applied to different engineering streams - Definitions, scopes and explanations.	6
2	Types of Ecosystems – System dynamics – Understanding ecosystems, Ecosystem degradation, Resource utilization, Ecosystem diversity, Habitat classification.	6
3	Natural Resources; Renewable and non-renewable- Natural resources and associated problems, Non-renewable resources, Renewable resources	6
4	Energy and Environment- Fossil fuel, Geothermal, tidal, nuclear, solar, wind, hydropower & biomass.	6
5	Environment pollution- Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear hazards	6
6	Cleaner Production and life cycle analysis: - LCA methodology, steps and tools, EIA and Environment audit	6
7	Environment Development and Society:- Emerging technology for sustainable development and environment management, public participation and provision in management and legislation.	6

Course Outcomes:	
1	Students will be able to relate the importance of Environmental Sciences for sustainable development of society.
2	Students will be able to understand the problems and remedies of Environmental Sciences.

Text Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	Environmental Science Ceonage Learning Publication, Miller G.T. and Spool Mar
2	Environmental Studies, Tata McGraw Hill Pub., Banny Joseph

BASIC SCIENCE COURSES (BSC)

Course Name	**:**	**MATHEMATICS I**
Course Code	**:**	**MAN 101**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

To make the students understand the behavior of infinite series and their use.
To make the students learn the concepts related to functions of several variables and their applications.
To make the students learn the methods of evaluating multiple integrals and their applications to various problems.
To make the students learn the methods to formulate and solve linear differential equations and apply them to solve engineering problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INFINITE SERIES** Infinite series and convergence, alternating series, power series and convergence. Taylor's and Maclaurin's Series. (Scope as in Chapter 8, Sections 8.1, 8.3 – 8.9 of Reference Book 1).	8
2	**MULTIVARIABLE FUNCTIONS** Limit, Continuity and Partial Derivatives; Euler's Theoem for Homogeneous functions; Differentiability, Linearization and Differentials; Chain rule; Extreme values and Saddle Points; Lagrange multipliers; Taylor's Formula**.** (Scope as in Chapter 12, Sections 12.1 – 12.6, 12.8 – 12.10 of Reference Book 1).	10
3	**SOLID GEOMETRY** Cylinders and Quadric surfaces, Cylindrical and Spherical Coordinates. (Scope as in Chapter10, Sections10.6 and 10.7 of Reference Book 1)	4
4	**INTEGRAL CALCULUS** Area between plane curves; Volumes of solids of revolution; Lengths of plane curves; Areas of surfaces of revolution. Double integrals in rectangular and Polar form, Triple integrals in Rectangular, Cylindrical and Spherical coordinates, Substitutions in Multiple Integrals. (Scope as in Chapter 5, Sections 5.1, 5.3, 5.5, 5.6 and Chapter 13 .Sections 13.1, 13.3, 13.4,13.6 and 13.7 of Reference Book 1).	8
5	**ORDINARY DIFFERENTIAL EQUATIONS** First order exact differential equations, Integrating factor, Orthogonal trajectories, Second and Higher order Linear Differential Equations with constant coefficients, Differential Operators, Methods of Variation of Parameters and Undetermined Coefficients, Euler Cauchy Equation, Wronskian. (Scope as in Chapter 1, Section 1.5, 1.8 Chapter 2, 2.1-2.4, 2.6, 2.9-2.10, 2.13- 2.15 of Reference Book 2).	12

Course Outcomes:	
1	The students are able to test the behavior of infinite series.
2	The students are able to analyze functions of several variables and their applications.
3	The students are able to evaluate multiple integrals and apply them to practical problems.
4	The students are able to solve linear differential equations.

Reference Books:

Sr. No.	**Name of Book/ Authors/ Publisher**
1	G. B. Thomas, R. L. Finney. Calculus and Analytic Geometry, Ninth Edition, Pearson Education.

2	E. Kreyszig. Advanced Engineering Mathematics, Eighth Edition, John Wiley.
3	B. V. Ramana. Higher Engineering Mathematics, Tata McGraw Hill.

Course Name	**:**	**PROBABILITY AND STATISTICS**
Course Code	**:**	**MAN 103**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to use statistical methods to collect and analyze the data. The students should be able to estimate unknown parameters of populations and apply the tests of hypotheses.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS** Random variables, Discrete, Continuous and Joint Probability distributions, Marginal and Conditional distributions, Independent random variables, Expectation, Variance and Covariance, Means and variances of linear combinations of random variables, Chebyshev's inequality, Binomial, Poisson, Uniform and Normal distributions, Normal and Poisson approximations to Binomial, Moments, Moment generating function.	20
2	**SAMPLING DISTRIBUTIONS & ESTIMATION** Population, Sample, Sampling distributions, Law of large numbers, Central limit theorem, Distribution of sample mean, Difference of means, Proportions and difference of proportions, Chi-square distribution, Student's t-distribution, Estimation of parameters, Point estimate, Confidence interval for mean, difference of means and proportions.	16
3	**TESTS OF HYPOTHESES** Hypothesis, Test statistic, Critical region, Significance level, Single Sample and Two Samples tests for mean.	6

Course Outcomes: By the end of this course, the student will be able to:	
1	Collect and analyze the data statistically.
2	Describe sampling distributions of sample means and sample proportions
3	Estimate unknown parameters of the population from a sample.
4	Construct confidence intervals for mean difference of means and proportions; and perform hypothesis tests for means.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye, Pearson Education	2012
2	Introduction to Mathematical Statistics, Hogg and Craig, Pearson Education	2013
3	Miller and Freund's: Probability and Statistics for Engineers, Richard A. Johnson, Prentice	2010

	Hall	
4	John E. Freund's: Mathematical statistics with Application, Miller and Miller, Pearson Education	2012

Course Name	**:**	**VECTOR CALCULUS, FOURIER SERIES AND LAPLACE TRANSFORM**
Course Code	**:**	**MAN105**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

At the end of this course, the students should be able to use concepts of vector calculus to analyze scalar and vector fields and compute the gradient, divergence and curl. They should be able to evaluate line, surface and volume integrals. The students should be able to expand functions in a Fourier series and apply Harmonic analysis to numerical data. They should be able to evaluate Laplace transforms and inverse Laplace transform and apply Laplace transforms to solve ordinary differential equations.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**VECTOR CALCULUS** Gradient, Divergence and Curl – their physical interpretation and representation in cylindrical and spherical coordinates. Line, surface and volume integrals; Green's theorem in the plane, Stoke's theorem, Divergence theorem; Irrotational and Solenoidal Fields, Applications to Science and Engineering.	20
2	**FOURIER SERIES** Periodic functions, Trigonometric series, Fourier Series, Euler's formulae, Conditions for existence of Fourier series, Even and odd functions, Half range expansions, Complex Fourier series, Applications of Fourier series, Parseval's identity, Harmonic analysis.	12
3	**LAPLACE TRANSFORM** Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Differentiation and integration of transforms, Applications to differential equations.	10

Course Outcomes:	
1	Use vector calculus to analyze scalar and vector fields and compute the gradient, divergence and curl.
2	Evaluate line, surface and volume integrals.
3	Apply Green's Theorem, Divergence Theorem and Stoke's theorem to evaluate integrals..
4	Expand a function in terms of its Fourier series and to apply harmonic analysis to numerical data.
5	Evaluate Laplace transforms and inverse Laplace transforms of functions.
6	Apply Laplace transforms to solve ordinary differential equations arising in engineering problems.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Calculus and Analytic Geometry, G. B. Thomas and R. L. Finney, Pearson Education	2014
2	Advanced Engineering Mathematics, E. Kreyszig, John Wiley	2006

3	Advanced Engineering Mathematics, M.D. Greenberg, Pearson Education Asia	2010
4	Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill	2003

Course Name	**:**	**PARTIAL DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS**
Course Code	**:**	**MAN 106**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to formulate and solve linear and nonlinear partial differential equations and apply partial differential equations to engineering problems. The students should be able to solve ordinary differential equations using series solutions, describe special functions as solutions to differential equations and expand functions in terms of eigenfunctions and to solve Sturm Liouville's problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**PARTIAL DIFFERENTIAL EQUATIONS** Formation and solution of first order partial differential equations, Linear equations of higher order with constant coefficients, Applications to Engineering problems**.**	17
2	**SPECIAL FUNCTIONS** Series solution of differential equations, Power series methods, Series solution of Legendre's differential equation Legendre's polynomial, generating functions, Recurrence relations, Frobenius method, Series solution of Bessel's differential equation, Bessel's functions, Modified Bessel's functions, generating functions, Recurrence relations, Equations reducible to Bessel's equation, Sturm Liouville's problem, Eigen function expansions.	25

Course Outcomes: By the end of the course, the students will be able to	
1	Formulate and solve linear and nonlinear partial differential equations
2	Apply partial differential equations to engineering problems.
3	Solve differential equations using series solutions.
4	Describe special functions as solutions to differential equations**.**
5	Expand functions in terms of eigenfunctions and to solve Sturm Liouville's problems.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Advanced Engineering Mathematics, E. Kreyszig, John Wiley	2006
2	Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill	**2003**
3	Elements of Partial differential equations, Sneddon, McGraw Hill	**2006**

Course Name	**:**	**NUMERICAL ANALYSIS**

Course Code	**:**	**MAN 109**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to describe errors involved in computations and to estimate these errors. The students should be able to solve equations, apply numerical methods to interpolate, extrapolate, differentiate and integrate functions. They should be able to solve differential equation using numerical methods and solve systems of equations.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**ERRORS** Errors in numerical calculations, Absolute, relative and percentage errors, Round off and truncation errors, Error propagation, Loss of significant digits, Errors in series approximation, Speed of convergence.	5
2	**SOLUTION OF EQUATIONS** Bisection method, Fixed point iteration and its convergence, Acceleration of convergence using Aitken's method; Regula-Falsi, Newton-Raphson, Generalized Newton's, Chebyshev's and Halley's methods.	7
3	**INTERPOLATION** Lagrange Interpolation, Newton's divided difference interpolation, Finite differences, Newton's, Bessel's, Stirling's and Guass' difference formulae.	10
4	**NUMERICAL DIFFERENTIATION & INTEGRATION** Differentiation using differences, Integration using Newton-cote's formulas with errors, Gaussian Quadrature.	8
5	**SOLUTION OF LINEAR SYSTEM OF EQUATIONS** Direct methods - Gauss elimination, Partial pivoting, Complete pivoting, Gauss-Jordan and factorization methods, Iterative methods-Gauss Siedal and Jacobi's methods.	6
6	**NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS** Solution of first order differential equations using Taylor's series, Euler's, Picard's and Runge-Kutta method upto 4^{th} order, Predictor-Corrector methods (Adam's and Milne's method),	6

Course Outcomes:	
1	Describe errors involved in computations and to estimate the errors.
2	Solve algebraic and transcendental equations using Bisection method Regula-Falsi, Newton-Raphson,
3	Generalized Newton's, Chebyshev's and Halley's methods.
4	Apply numerical methods to interpolate, extrapolate differentiate and integrate functions.
5	Solve systems of equations.
6	Solve differential equation using numerical methods.(Taylor's series, Euler's, Picard's and Runge-Kutta method upto 4^{th} order, Predictor-Corrector methods)

Suggested Books:		
Sr.	**Name of Book/ Authors/ Publisher**	**Year of**

No.		Publication/ Reprint
1	Advanced Engineering Mathematics, E. Kreyszig, John Wiley	2006
2	Numerical Methods for Mathematics, Science and Engineering, Mathews, Prentice Hall	1992
3	An Introduction to Numerical Analysis, Atkinson, John Wiley	2012

Course Name	**:**	**OSCILLATIONS AND OPTICS**
Course Code	**:**	**PYN101**
Credits	**:**	**4**
L T P	**:**	**3 1/2 2/2**

Course Objectives:
To familiarize the students with Ultrasonics and their applications To acquaint the students with simple harmonic motion along with damping and driving forces To refresh the basics of interference, diffraction and polarization and familiarize the students with their applications through lectures and experiments To teach the students the basic concepts of LASER and to familiarize them various kinds of lasers To acquaint the students with fundamentals of holography

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**ULTRASONICS:** Production, detection and uses of ultrasonics, reverberation, sabine's formula (no derivation)	3
2	**SHM:** Review of basic kinematics (displacement, velocity, acceleration, time period and phase of vibration) and dynamics (restoring force and energetics) of simple harmonic motion, differential equation of SHM, superposition of two SHM in one dimension, charge oscillations in LC circuits	4
3	**DAMPED OSCILLATIONS:** Concept and cause of damping, differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor, band width. Series LCR circuit as a damped oscillator.	4
4	**FORCED OSCILLATIONS:** States of forced oscillations, differential equation of forced oscillator – its displacement, velocity and impedance, behaviour of displacement and velocity with driver's frequency, Power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, forced oscillations in series LCR circuit	5
5	**WAVE MOTION:** Wave equation and its solution, characteristic impedance of a string, reflection and transmission of waves on a string at a boundary, reflection and transmission of energy, the matching of impedances	3
6	**INTERFERENCE:** Division of wave front and amplitude; Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination of λ and $d\lambda$.	4
7	**DIFFRACTION:** Fresnel and Fraunhofer diffraction, qualitative changes in diffraction pattern on moving from single slit to double slit, plane transmission grating, dispersive power & resolving power of a grating.	5
8	**POLARIZATION:** Methods of polarization, analysis of polarized light, quarter and half wave plates, double refraction.	4
9	**LASERS:** Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein's coefficients, Helium-Neon, Ruby and semiconductor lasers, applications of lasers.	4
10	**FIBRE OPTICS:** Basics of optical fibre - its numerical aperture, coherent bundle, step index and graded index fibre, material dispersion, fibre Optics sensors, applications of optical fibre in communication systems.	4
11	**HOLOGRAPHY:** Basic principle, theory and requirements.	2

List of Experiments:	
1	To find the wavelength of sodium light using Fresnel's biprism.
2	(i) To determine the wavelength of He-Ne laser using transmission grating. (ii) To determine the slit width using the diffraction pattern.
3	To determine the wave length of sodium light by Newton's rings method.
4	To determine the wave length of sodium light using a diffraction grating.
5	To find the specific rotation of sugar solution using a Bi-quartz Polarimeter.
6	To design a hollow prism and used it find the refractive index of a given liquid

Course Outcomes:	
1	Students are aware of latest developments in certain areas of Physics which have important applications for societal needs.
2	Students learn about lasers and fibre optics which have important applications for societal needs.
3	Students are expected to develop capability to tackle problems in general and in the various areas covered in the course.

Reference Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	Physics for Engineers (Prentice Hall India) - N.K. Verma
2	Physics of Vibrations and Waves (5th Edition, John Wiley & Sons) – H.J.Pain
3	Optics – Ajoy Ghatak

Course Name	**:**	**CONDENSED MATTER PHYSICS**
Course Code	**:**	**PYN102**
Credits	**:**	**4**
L T P	**:**	**3 1/2 2/2**

Course Objectives:
To teach the students the basic concepts of crystal structure and defects To familiarize the students with the concepts of Free electron theory of metals and its applicability To acquaint the students with the concepts of Dielectric and Magnetics materials with their applications through lectures and experiments To impart to the students the concepts of superconductivity and nanotechnology To teach the students the basic concepts of crystal structure and defects

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**CRYSTAL STRUCTURE:** Space lattices and their symmetries, crystal structures (cubic and hexagonal cells), assignment of coordinates, directions and planes in crystals, linear, planer and space densities in crystals, close packed morphology (Hexagonal and cubic close packing), single and polycrystalline structures, interstitial spaces (trigonal, tetrahedral and octahedral voids, crystal Structure analysis, X-ray diffraction and Bragg's law, crystal defects, Point, line, surface and volume imperfections	(11)
2	**THEORY OF METALS:** Free electron theory, electrical properties, thermal properties, motion in magnetic field (cyclotron resonance), Zone theory. Band theory of solids, Kronig-Penney Model (qualitative), conductors, insulators and semiconductors	(6)
3	**DIELECTRIC MATERIALS:** Review of basic formulas, dielectric constant and polarizability, sources of polarizability, classical treatment of dipolar, ionic and electronic polarizability, piezoelectricity, ferroelectrcity.	(5)

4	**MAGNETIC MATERIALS:** Review of basic formulas, magnetic susceptibility, classification of materials, Langevin diamagnetism, paramagnetism (only classical treatment), magnetism in metals, ferromagnetism in insulators, anti-ferromagnetism and ferrimagnetism, ferromagnetism in metals, ferromagnetic domains, hysteresis	(8)
5	**SUPERCONDUCTIVITY:** Zero resistance, occurrence of superconductivity, Meissner effect, critical field, thermodynamics of superconducting transitions, electrodynamics of superconductors, qualitative idea of BCS theory.	(4)
6	**SEMICONDUCTORS**: p-type and n-type semiconductors, statistics of electrons and holes, Hall effect (for single as well as both type of charge carriers)	(4)
7	**NANOTECHNOLOGY:** Introduction, Synthesis of Nanoparticles: Mechanical Method, Sputtering, Chemical Vapour Deposition, Sol-gel Technique, Applications of Nanotechnology	(4)

List of Experiments:	
1	To find the energy band gap of the given semiconductor by four probe method.
2	To study the Hall Effect of a given semiconductor.
3	To determine the dielectric constant of the given materials.
4	To study the B-H curve of the ferromagnetic materials.
5	To determine the value of e/m for electron by long solenoid (helical) method.
6	To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.

Course Outcomes:	
1	Students learn about dielectric and magnetic materials which have important applications for societal needs.
2	Students learn about superconductivity and nanotechnology which have important applications.
3	Students are expected to develop capability to tackle problems in general and in the various areas covered in the course.

Suggested Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	Material science and Engineering – An Introduction by William D Callister, Jr, Sixth Edition, John Wiley and Sons.
2	Material science and Engineering – A First Course by V.Raghvan Fourth Edition, Eastern Economy Edition
3	Solid State Physics (New Age Publishers) – S.O. Pillai
4	Introduction to Solids (Tata McGraw Hill, Third Edition) - Leonid V Azaroff

Course Name	**:**	**MECHANICS**
Course Code	**:**	**PYN - 105**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
To acquaint about the engineering aspects of Mechanics To familiarize Kinematics and Kinetics of rigid body To inculcate the application of Mechanic concepts in engineering To familiarize the application of relative motion analysis in the design of energy system

Total No. of Lectures – 36

Lecture wise breakup		**Number of Lectures**
1	**KINEMATICS OF A PARTICLE**: Introduction. Rectilinear Kinematics: General	5

	Curvilinear Motion. Curvilinear Motion: Rectangular Components, Normal and Tangential Components, Cylindrical Components. Absolute Dependent Motion Analysis of Two Particles. Relative-Motion Analysis of Two Particles Using Translating Axes. Motion of a Projectile.	
2	**KINETICS OF A PARTICLE: FORCE AND ACCELERATION**: Newton's Laws of Motion. The Equation of Motion. Equation of Motion for a System of Particles. Equations of Motion: Rectangular Coordinates, Normal and Tangential Coordinates, Cylindrical Coordinates. Central-Force Motion and Space Mechanics.	4
3	**KINETICS OF A PARTICLE: WORK AND ENERGY**: The Work of a Force. Principle of Work and Energy. Principle of Work and Energy for a System of Particles. Power and Efficiency. Conservative Forces and Potential Energy. Conservation of Energy.	3
4	**KINETICS OF A PARTICLE: IMPULSE AND MOMENTUM**: Principle of Linear Impulse and Momentum. Principle of Linear Impulse and Momentum for a System of Particles. Conservation of Linear Momentum for a System of Particles. Impact. Angular Momentum. Relation Between Moment of a Force and Angular Momentum. Angular Impulse and Momentum Principles.	4
5	**PLANAR KINEMATICS OF A RIGID BODY:** Rigid-Body Motion. Translation. Rotation About a Fixed Axis. Absolute General Plane Motion Analysis. Relative-Motion Analysis: Velocity, Instantaneous Center of Zero Velocity, Acceleration. Relative-Motion Analysis using Rotating Axes.	4
6	**PLANAR KINETICS OF A RIGID BODY: FORCE AND ACCELERATION:** Moment of Inertia. Planar Kinetic Equations of Motion. Equations of Motion: Translation, Rotation About a Fixed Axis, and General Plane Motion.	4
7	**PLANAR KINETICS OF A RIGID BODY: WORK AND ENERGY:** Kinetic Energy. The Work of a Force. The Work of a Couple. Principle of Work and Energy. Conservation of Energy.	3
8	**PLANAR KINETICS OF A RIGID BODY: IMPULSE AND MOMENTUM:** Linear and Angular Momentum. Principle of Impulse and Momentum. Conservation of Momentum. Eccentric Impact.	3
9	**THREE-DIMENSIONAL KINEMATICS OF A RIGID BODY**: Rotation About a Fixed Point. The Time Derivative of a Vector Measured from a Fixed and Translating-Rotating System. General Motion. Relative-Motion Analysis using Translating and Rotating Axes.	3
10	**THREE-DIMENSIONAL KINETICS OF A RIGID BODY**: Moments and Products of Inertia. Angular Momentum. Kinetic Energy. Equations of Motion. Gyroscopic Motion. Torque-Free Motion.	3

Course Outcomes:	
1	The student will be able to understand the concepts of Mechanics.
2	The students will be able to apply the concepts of Mechanics in fluid of energy.
3	The students will be able to understand various types of motion characteristic and found characteristic of rigid body.

Suggested Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	R.C. Hibbeler, Dynamics (11th Ed) Pearson Publishers.
2	F.P. Beer et al. Dynamics (8th Ed) Mc GrawHill Publishers.
3	Merriam and Kraige; Dynamics (5th Ed) Wiley and Sons Publications Merriam and Kraige.
4	R.C. Hibbeler, Statics (11th Ed) Pearson Publishers.

Course Name	**:**	**ELECTROMAGNETIC THEORY**
Course Code	**:**	**PYN-106**

Credits	**:**	**4**
L T P	**:**	**3 1/2 2/2**

Course Objectives:
At the end of the course, the student should be able to understand the classification of the vector fields. The student should be able to apply the concepts of electrostatics and boundary value problems. The student should be able to understand concepts of electromagnetic wave propagation.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**VECTORS AND FIELDS:** Cartesian coordinate System, Cylindrical and Spherical coordinate Systems, Constant coordinate surfaces, Del operator, Gradient, Divergence of a Vector and Divergence Theorem, Curl of a vector and Stoke's theorem, Gradient, Divergence, Curl and Laplacian in the three coordinate Systems, Laplacian of a scalar, Scalar & Vector Fields, Classification of Vector field. Sinusoidally time-varying fields, Complex Numbers and Phasor technique.	10
2	**ELECTROSTATICS:** Field intensity, Gauss's law & its applications, Maxwell's 1st eqn. (Electrostatics), Electric Energy and potential, the line integral, Potential gradient, the dipole fields, Energy density in an electrostatic field. Current and current density, Continuity of current, Metallic conductors, Conductor properties and boundary conditions, the nature of Dielectric materials and related Boundary conditions, Capacitance, Capacitance of a two-wire line, Current analogies. Electrostatic boundary-value problems, Laplace's and Poisson's equations, Uniqueness theorem, General procedure for solving Laplace's and Poisson's equation , Resistance and capacitance, Method of images.	10
3	**MAGNETOSTATICS:** Biot-Savart's law, Ampere's circuital law, Applications of Ampere's law, Magnetic flux and magnetic flux density-Maxwell's eqn., Maxwell's eqn. for static electromagnetic fields, Scalar and vector magnetic potentials. Magnetic dipole, Force due to Magnetic field on a differential current element, force between two differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Inductors and inductances, Magnetic energy, Magnetic circuits, Potential energy and force on magnetic materials.	11
4	**MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVE PROPAGATION:** Faraday's law, Displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, Kirchoff's Voltage law and Kirchoff's Current law from Maxwell's equations, EM waves in general, EM wave propagation in Lossy Dielectrics, Wave propagation in lossless dielectrics, Plane waves in free space, Plane waves in Good conductors, Power & Poynting Vector, Reflection of a plane wave at normal incidence, Reflection of a plane wave at oblique incidence.	11

List of Experiments:		**Number of Turns**
1	To design a method to draw equipotential lines with various geometries of electrodes kept at different potentials	1
2	To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph	1
3	To find the energy band gap of the given semiconductor by four probe method	1
4	To study the Hall effect of a given semiconductor	1
5	To determine the dielectric constant of the given materials	1
6	To study the B-H curve of the ferromagnetic materials	1

Course Outcomes:	
1	By the end of the course, the student will be equipped with the tools of electromagnetic theory.
2	The student will be able to solve numerical problems based on vector fields, electrostatics, magnetostatics and electromagnetic wave propagation.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Engineering Electromagnetics, William H Hyat, Jr., and John A. Buck, Tata McGraw Hill	2013 / 5th edition
2	Elements of Engineering Electromagnetics, Matthew N.O. Sadiku, Oxford University Press	2012 / 4th edition
3	Introduction to Electrodynamics, D.J. Griffiths, Prentice Hall	2012 / 4th edition

Course Name	**:**	**APPLIED CHEMISTRY**
Course Code	**:**	**CHN101**
Credits	**:**	**4**
L T P	**:**	**3 0 3**

Course Objectives: Upon completion of this course, students will have fundamental knowledge of the following:
Concepts of water and its analysis, polymer chemistry, solid state chemistry, lubricants, coordination chemistry and substitution reactions as applied to various industries. Spectroscopic methods required for the characterization of engineering materials. Design and development of novel future engineering materials and processes. Experiments related to applications of analysis and chemical processes relevant to various Industries.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**WATER TREATMENT AND ITS ANALYSIS:** Boiler feed water and its problems, Water Softening techniques, Domestic Water treatment, Chemical Analysis and related numerical problems	7
2	**POLYMER CHEMISTRY:** Classification, Mechanism and methods of polymerization, preparation, properties and uses of few engineering.	5
3	**SOLID STATE CHEMISTRY**: Introduction to structure and bonding-ionic solids, crystal defects and applications of defect structure (transistors, rectifiers, photovoltaic cells and computer chips).Introduction to ceramics.	6
4	**LUBRICANTS/ FUEL CELL TECHNOLOGY/CORROSION:** Functions mechanism, classification, properties and analysis of Lubricants and related numerical problems. Introduction to electrochemistry, types of electrodes, Reference electrodes, Ion-selective electrodes, Concentration cells, Batteries, Fuel cells/ Types of corrosion, dry and wet corrosion and their mechanisms, types of electrochemical corrosion, factors influencing corrosion, Prevention of corrosion.	6
5	**ATOMIC AND MOLECULAR SPECTROSCOPY: AAS**- Principle, instrumentation and applications of UV,IR and NMR spectroscopy and related problems.	10
6	**COORDINATION CHEMISTRY:** Crystal Field Theory, Splitting of octahedral, tetrahedral and square planner complexes, Applications of crystal field theory.	4
7	**AROMATIC ELECTROPHILIC AND NUCLEOPHILIC SUBSTITUTION:** Reaction mechanisms and applications.	4

Course Outcomes: Students who complete the course will have demonstrated the ability to do the following:	
1	Apply the knowledge for water treatment and its analysis for processing and its disposal which is relevant to all Industries for efficient utilization of water as an essential industrial resource.
2	Develop and design new materials based on knowledge of polymers, solid chemistry and substitution reactions
3	Hands on experience for carrying out experiments with precision for characterization and estimation of materials by wet analysis.
4	Will be able to carry out Instrument based spectroscopic analysis of new materials and interpretation of relevant data.

Reference Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	Atkin's Physical Chemistry by Peter Atkins, Julio de Paula, 7th Edition, Oxford University Press.
2	Concise Inorganic Chemistry Vth Edition J D Lee 2003 (Chapman & Hall)
3	A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai& Co. Pvt. Ltd.
4	Introductory Polymer Chemistry by G.S.Mishra, John Wiley & Sons, New York, 1993.
5	Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and P.L. Gaus, 3rd Ed., John Wiley & Sons.
6	Puri, Sharma and Pathania : Principles of Physical Chemistry, W.H. Freeman & Co, 2008.
7	Organic Chemistry by Joseph M.Hornback Brooke/Cole Publishing Company U.S.A.
8	D. S. Pavia, G.M. Lasmpman and G.S. Kriz : Introduction to Spectroscopy, 4th Edition, Thomson learning, Indian Edition 208.
9	Chemistry for environmental engineering by C. N. Sawyer, P. McCarty, G. F. Parkin, Mc Graw Hill Inc, New York.

Course Name	**:**	**PHYSICAL CHEMISTRY**
Course Code	**:**	**CHN-102**
Credits	**:**	**4**
L T P	**:**	**3 0 3**

Course Objectives:
At the end of this course the students should be able to describe and implement concepts and principles of Physical Chemistry required for indepth understanding of Physical phenomena of materials in relation to applications in Engineering .

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**CHEMICAL EQUILIBRIUM :** General characteristics of chemical equilibrium, thermodynamic derivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between Kp, Kc and Kx. Temperature dependence of equilibrium constant-Van't Hoff equation, Le Chatelier's principle.)	4
2	**SOLUTIONS**: Ideal and non-ideal solutions, Raoults's law, change of free energy, enthalpy, and entropy on mixing of liquids, distillation of binary solutions. Partially miscible liquids such as Phenol- water, triethylamine- water, and Nicotine- water systems. Henry's law, Nernst distribution law, Colligative properties of dilute solutions. Abnormal molar mass, degree of dissociation and association of solutes.	8
3	**CHEMICAL KINETICS:** Rate equation of reactions of various orders, rate mechanism, kinetics of complex reactions. Concept of energy barrier and energy of activation. Theories of reaction rates, measurement of extent of reaction, zero order reactions. Rates of flow systems. Lindemann theory of unimolecular reactions.	8

4	**SURFACE PHENOMENA:** Adsorption of gases by solids. Types of adsorption, adsorption isotherms, Langmuir's adsorption equation, B.E.T. equation for determination of surface area of adsorbents, applications of adsorption, catalysis, kinetics of surface reactions. Introduction to micelles, emulsions and gels.	6
5	**PHASE EQUILIBRIA** : Phase rule and its thermodynamic derivation. One component systems-water, sulphur, Two component systems, construction and interpretation of general phase diagrams for liquid-vapour, liquid-liquid and liquid-solid systems. Eutectics, freezing mixtures, ultra purity, zone refining.	6
6.	**ELECTROCHEMISTRY:** Conductance of electrolytic solutions, transference number and its determination, Kohlrausch's law of independent migration of ions, Interionic attraction theory, activity and activity coefficients of strong electrolytes, ionic equilibria. Ionizaton of water, ionization constants of weak acids and weak bases, hydrolysis, pH, common ion effect, solubility product and salt effect.	5
7.	**ELECTROCHEMICAL CELLS:** Reversible and irreversible cells, e.m.f. and its measurement, cell reactions and e.m.f., thermodynamics of electrode potentials, half- cell potential and its determination, Nernst equation, concentration cells, liquid junction potential, determination of activity co-efficient from cell potential data, potentiometric titrations.	4

List of Experiments:		**Number of Turns**
1	Determination of Surface tension of liquids using Stalagmometer.	2
2	Distribution of Iodine between water and carbon tetrachloride.	2
3	Kinetics of the hydrolysis of methyl acetate in the presence of hydrochloric acid.	3
4	Adsorption of acetic acid on activated charcoal.	2
5	Conductometric and Potentiometric titrations and Colorimetry.	4

Course Outcomes: By the end of this course, the student will be able to-	
1	Understand the phenomenon of chemical equilibrium, phase equilibria and effect of change of process parameters such as T, P, C etc both quantitatively and qualitatively.
2	Understand physical properties of solutions like change of free energy, entropy of mixing as applies to heat and mass transfer in chemical processes.
3	Analyse the kinetics of chemical processes that are useful in the design of reactors and optimisation of material processing and its implementation.
4	Apply concepts of various surface phenomenons for material coatings, separate technology and in catalytic processes.
5	Design the sensors based on the concepts of electrochemistry.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Principles of Physical Chemistry by Maron, Samuel H. Prutton, ; Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.	2002
2	Textbook of Physical Chemistry by Carl F. Glasstone, Samuel ; MacMillan and Co. Ltd. London	2010
3	Principles of Physical Chemistry by B.R Puri., L.R Sharma, and Pathania, S Madan,; S. Nagin &Co Jalandhar.	2013
4	Chemical Kinetics by Laidler , J Keith ;Tata McGraw-Hill Co. Ltd., New Delhi.	2002
5	A Text Book of Physical Chemistry by P.W Atkins; Oxford University Press.	2009
6	Findlay's Practical Physical Chemistry by B.P Lavitt. ; Longman Group Ltd.	1973

Course Name	**:**	**INORGANIC CHEMISTRY**
Course Code	**:**	**CHN-103**
Credits	**:**	**4**
L T P	**:**	**3 0 3**

Course Objectives: Upon completion of this course, students will have fundamental knowledge of the following:
Concepts of structure and chemical bonding essential for understanding of molecular structure. Solid state chemistry for application in electronics, ceramics and other advanced materials. Magnetic behaviour and catalytic properties of co-ordination and organometallic compounds used in various industries. Interaction and role of metals in biological systems essential for bio-engineering applications.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**QUANTUM THEORY AND ATOMIC STRUCTURE:** Introduction to wave mechanics, the Schrodinger equation, the Schrodinger equation as applied to hydrogen atom, the origin of quantum numbers and shapes of orbitals.	4
2	**CHEMICAL BONDING:** Molecular orbital and valence bond theories of bond formation and application of molecular orbital theory to the formation of homonuclear and heteronuclear diatomic molecules.	7
3	**THE SOLID STATE:** A recapitulation of close packing of spheres, structures of NaCl, CsCl, ZnS, CaF2, crystal defects and applications of defect structures (transistors, rectifiers, photovoltaic cells and computer chips).	4
4	**COORDINATION COMPOUNDS:** Part 1:Werner's theory, effective atomic number, bonding of transition metal complexes: valence bond theory, crystal field theory, crystal field splitting in tetrahedral, octahedral and distorted octahedral (square planar) crystal fields. Thermodynamic aspects of coordination compounds (crystal field stabilization energies of octahedral and tetrahedral complexes, spectrochemical series).	6
5	**COORDINATION COMPOUNDS:** Part2: Kinetic aspects of coordination compounds (substitution reactions in complexes with coordination number 4 and 6 and their mechanism - **SN^1**, SN^2). Magnetic behaviour of complexes – Para magnetism, diamagnetism, ferromagnetism and antiferromagnetism and measurement ofmagnetic susceptibility of complexes by Guoy's method.	6
6	**ORGANOMETALLIC COMPOUNDS:** Nomenclature, types of ligands and bonding in organometallic compounds, use of organometallics in industry.	5
7	**INORGANIC POLYMERS: TYPES** of inorganic polymers, polyphosphazenes, polysiloxanes –their structures and properties.	5
8	**ROLE OF METALS IN BIOLOGICAL SYSTEMS:** Bio-inorganic Chemistry of Iron – Heme proteins & Non-Heme iron proteins; bioinorganic chemistry of cobalt-vitamin B12 and metalloenzymes.	5

Course Outcomes: Students who complete the course will have demonstrated the ability to do the following:	
1	Apply the knowledge of quantum theory, chemical bonding and solid state, to know the structure and bonding required for the development of new materials.
2	Design new inorganic materials with desired physical and chemical properties.
3	Carry out experiments with precision related to synthesis and characterization of new industrially important inorganic materials.

Reference Books:	
Sr. No.	**Name of Book/ Authors/ Publisher**
1	Sharpe, A. G. : Inorganic Chemistry, 3rd Edition, Longman Publishers ELBS, 1992.
2	Lee, J. D. : Concise: Inorganic Chemistry, 5th Edition, Chapman and Hall Publishers, 1996.
3	Cotton, F. A. & Wilkinson, G. : Advanced Inorganic Chemistry, 3rd Edition,Wiley Eastern Ltd., 1982.

4	Cotton, F. A. & Wilkinson, G. : Basic Inorganic Chemistry, Wiley EasternLtd., 1987. 12
5	Mark, J., West, R. & Allcock,H. : Inorganic Polymer, Prentice Hall, New Jersey Publishers, 1982.

Course Name	**:**	**PHYSICAL CHEMISTRY**
Course Code	**:**	**CHN-104**
Credits	**:**	**4**
L T P	**:**	**3 0 3**

Course Objectives:

Concepts of chemical equilibria, solutions, chemical kinetics and electrochemistry to the physical phenomena occurring in various chemical processes.
Surfaces modification of important industrial materials used in adsorption and separating technology.
Phase equilibria for understanding the physical behaviour of various materials such as alloys and other biphasic and triphasic systems.
Experiments related to the theoretical studies of different physical phenomena relevant to various industries.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**CHEMICAL EQUILIBRIUM:** thermodynamic derivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between Kp, Kc and Kx. Temperature dependence of equilibrium constant- Le Chatelier's principle.	5
2	**SOLUTIONS:** Raoults's law, change of free energy, enthalpy, and entropy on mixing of liquids, distillation of binary solutions. Partially miscible liquids Henry's law, Nernst distribution law, Colligative properties of dilute solutions. Abnormal molar mass, degree of dissociation and association of solutes.	8
3	**CHEMICAL KINETICS**: Rate equation of various orders, rate mechanism, kinetics of complex reactions. Theories of reaction rates, measurement of extent of reaction, Rates of flow systems. Lindemann theory of unimolecular reactions.	8
4	**SURFACE PHENOMENA**: Adsorption of gases by solids., adsorption isotherms., Langmuir's adsorption equation, B.E.T. equation for determination of surface area of adsorbents, applications of adsorption, catalysis, kinetics of surface reactions. Introduction to micelles, emulsions and gels.	6
5	**PHASE EQUILIBRIA** : Phase rule and its thermodynamic derivation. One component systems-water, sulphur, Two component systems, construction and interpretation of general phase diagrams for liquid-vapour, liquid-liquid and liquid-solid systems. Eutectics, freezing mixtures, ultra purity, zone refining.	6
6	**ELECTROCHEMISTRY:** transference number and its determination, Kohlrausch's law of independent migration of ions, Interionic attraction theory, activity and activity coefficients of strong electrolytes, ionic equilibria. Ionizaton of water, ionization constants of weak acids and weak bases, common ion effect, solubility product and salt effect.	5
7	**ELECTROCHEMICAL CELLS**: Reversible and irreversible cells, e.m.f. and its measurement, cell reactions and e.m.f., thermodynamics of electrode potentials, half- cell potential and its determination, Nernst equation, concentration cells, liquid junction potential, determination of activity co-efficient from cell potential data, potentiometric titrations.	4

Course Outcomes: Students who complete the course will have demonstrated the ability to do the following:	
1	Understand the relevance of the physical phenomena occurring in various materials and processes.
2	Modify the composition of various materials required for new technological applications.
3	Hands on experience for carry out experiments with precision related to chemical equilibria, surface phenomena and reaction kinetics required for designing various processes in Industry.

Suggested Books:	
Sr.	**Name of Book/ Authors/ Publisher**

No.	
1	Maron, Samuel H. Prutton, Principles of Physical Chemistry, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
2	Carl F. Glasstone, Samuel Textbook of Physical Chemistry, MacMillan and Co. Ltd. London.
3	Puri,B.R.,Sharma,L.R.and Pathania,Madan,S. Principles of physical chemistry, S.Nagin & co Jalandhar.
4	Laidler, Keith J. Chemical Kinetics, Tata McGraw-Hill Co. Ltd., New Delhi.
5	Atkins, P.W. A Text Book of Physical Chemistry,Oxford University Press.

HUMANITIES, SOCIAL SCIENCES AND MANAGEMENT COURSES (HSSMEC)

Course Name	**:**	**ETHICS AND SELF AWARENESS**
Course Code	**:**	**HSS 101**
Credits	**:**	**2**
L T P	**:**	**2-0-0**

Course Objectives:
To provide basic knowledge about ethics, values, norms and standards and their importance in real life. To improve the personality of students by their self-assessment

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO ETHICS** Concept of Ethics – Nature, Scope, Sources, Types, Functions and Factors influencing Ethics, Approaches to Ethics – Psychological, Philosophical and Social, Broader Ethical Issues in Society	**6**
2	**VALUES, NORMS, STANDARDS AND MORALITY** Concept and Role, Relation with Ethics, Psycho-Social Theories of Moral Development – Kohlberg and Carol Gilligan	**4**
3	**ETHICS AND BUSINESS** Concept of Business Ethics – Nature, Objectives and Factors influencing Business Ethics, 3 C's of Business Ethics, Ethics in Business Activities, Ethical Dilemmas in Business, Managing Ethics	**5**
4	**SELF-AWARENESS** Concept of Self Awareness – Need, Elements, Self Assessment – SWOT Analysis, Self Concepts – Self-Knowledge, Assertiveness and Self-Confidence, Self-Esteem	**4**
5	**SELF-DEVELOPMENT** Concept of Self-Development, Social Intelligence, Emotional Intelligence, Managing Time and Stress, Positive Human Qualities (Self-Efficacy, Empathy, Gratitude, Compassion, Forgiveness and Motivation), Personality Development Models – Johari Window, Transactional Analysis, Myers Briggs Type Indicator, Self-Awareness and Self-Development Exercises	**9**

Course Outcomes:	
1	Helps to distinguish between right and wrong in both personal and professional life
2	Students learn about their strengths, weaknesses, opportunities & threats and work enthusiastically to transform weaknesses into strengths and threats into opportunities

Reference Books:	
1	Murthy, C.S.V., "Business Ethics – Text and Cases", Himalaya Publishing House
2	Hartman, Laura P. and Chatterjee, Abha, "Business Ethics", Tata McGraw Hill
3	Rao, A.B., "Business Ethics and Professional Values", Excel Books
4	Velasquez, Manuel G., "Business Ethics – Concepts and Cases", Prentice Hall
5	Corey, G., Schneider, Corey M., and Callanan, P., "Issues and Ethics in the Helping Professions", Brooks/Cole
6	Hall, Calvin S., Lindzey, Dardner and Cambell, John B., "Theories of Personality", Hamilton Printing Company
7	Leary, M.R., "The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Oxford University Press

Course Name	**:**	**COMMUNICATION SKILLS (BASIC)**

Course Code	**:**	**HSS 102**
Credits	**:**	**2**
L T P	**:**	**1-0-2**

Course Objectives:
The main aim of the course is to build competence in English grammar and vocabulary and to enhance effective communication by developing Reading, Writing, Listening and Speaking skills of students.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**FUNDAMENTALS OF COMMUNICATION SKILLS** Scope and Significance of Communication Skills, Listening, Speaking, Reading and Writing	**3**
2	**WRITING SKILLS** Basics of Grammar – Placing of Subject and Verb, Parts of Speech, Uses of Tenses, Active-Passive, Narration	**3**
3	**VOCABULARY BUILDING AND WRITING** Word Formation & Synonyms, Antonyms, Words Often Confused, One-Word Substitutes, Idioms and Phrasal Verbs, Abbreviations of Scientific and Technical Words	**3**
4	**SPEAKING SKILLS** Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and Intonation	**3**
5	**READING AND COMPREHENSION** Two comprehensive prose passages	**2**

List of Experiments:		**Number of Turns**
1	Introducing Oneself, Exercise on Parts of Speech & Exercise on Tense	**2**
2	Exercise on Agreement, Narration, Active Passive Voice & Dialogue Conversation	**2**
3	Exercise on Writing Skills and Listening Comprehension (Audio CD)	**2**
4	Practice of Phonemes, Word Accent, Intonation, JAM Session	**2**
5	Individual Presentation, Extempore and Picture Interpretation	**2**
6	Vocabulary Building Exercises (One Word Substitute, Synonyms, Antonyms, Words Often Confused etc.) & Group Discussion	**2**
7	Reading Comprehension & Organizational Correspondence and Debate	**2**

Course Outcomes:	
1	The students will be able to perform better in their academic and professional life.
2	The student will gain self-confidence with improved command over English.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"The Essence of Effective Communication", Ludlow R. and Panton F., Pubs: Prentice Hall.	1992
2	"A University Grammar of English", Quirk R. and Sidney G., 3rd Edition, Pubs: Pearson Education.	2008
3	"High School English Grammar", Wren and Martin, Pubs: S. Chand & Company Ltd.	2007
4	"Essentials of Business Communication", Guffrey M.E., 8th Edition, Pubs: South-Western College Publishing.	2009
5	"Technical Communication: Principles and Practice", Raman M. and Sharma S., 2nd Edition, Pubs: Oxford University Press.	2012
6	"Effective Business Communication", Rodrigues M.V., Pubs: Concept Publishing Company, Delhi.	2003
7	"English Vocabulary in Use", McCarthy M. and Felicity O' Dell, 2nd Edition, Pubs:	2010

	Cambridge University Press.	
8	"The Pronunciation of English", Jones D., Pubs: Universal Book Stall.	1992

Course Name	**:**	**COMMUNICATION SKILLS (ADVANCED)**
Course Code	**:**	**HSS 103**
Credits	**:**	**2**
L T P	**:**	**1-0-2**

Course Objectives:
The main aim of the course is to enhance communication skills of students for better performance in professional life and to improve their overall personality with the use of advanced techniques in speaking and writing and also to train them in using both verbal and non-verbal communication effectively.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO COMMUNICATION PROCESS** Scope, Significance, Types and Levels, Technical Communication, Tools of Effective Communication	**3**
2	**SPEAKING SKILLS AND PERSONALITY DEVELOPMENT** Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Para linguistics and Non- Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video Conferencing)	**6**
3	**ADVANCED Technical Writing** Job Application, CV Writing, Business Letters, Memos, Minutes, Notices, Report Writing & Structure, E-mail Etiquette, Blog Writing	**4**
4	**COMMUNICATION AND MEDIA** Social and Political Context of Communication, Recent Developments in Media	**1**

List of Experiments:		**Number of Turns**
1	**ORGANIZATIONAL COMMUNICATION** Verbal and Non-Verbal Communication at different levels of organization, Role Play, Case Studies	**2**
2	**SPEAKING TECHNIQUES** Mock Interviews, Participation in Group Discussions, Making and Presenting Power Point	**4**
3	**STANDARD ENGLISH & PRACTICE SESSION** Intonation and Pronunciation, Exposure to Standard English, Sounds, Stress and Rhythm, Comprehension on British and American English	**4**
4	**PRACTICE ON TECHNICAL WRITING** Writing Letters, Memos, Minutes, CV, Job Applications, Reports and e-mails	**4**

Course Outcomes:	
1	The students will gain proficiency in English language for both professional and personal life.
2	The students will learn technical aspects of communication for better performance in extra-curricular activities, recruitment process and prospective jobs.
3	The students will be able to refine their personality through a grip over advanced techniques of language.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**

1	"Effective Technical Communication", Rizvi M.A., 5th Reprint, Pubs: McGraw Hill Education (India).	2007
2	"Technical Communication: Principles and Practice", Raman M. and Sharma, S., 2nd Edition, Pubs: Oxford University Press.	2012
3	"Business Communication Today", Bovee C.L. and Thill J.V., 9th Edition, Pubs: Pearson Education Asia, New Delhi.	2009
4	"Business Correspondence and Report Writing", Sharma R.C. and Mohan K., Pubs: McGraw Hill	1994
5	"Communication for Professional Engineers", Scott B., 2nd Edition, Pubs: Thomas Teleford Ltd.	1997
6	"Handbook for Technical Writing", McMurrey D.A. and Buckley J., Pubs: Cengage Learning.	2012
7	"Student Activities for taking charge of your Career Direction and Job Search", Lock R., 3rd Edition, Pubs: Cole Publishing	1996
8	"The Definitive Book of Body Language", Pease A. and Pease B., Pubs: Manjul Publishing House Pvt. Ltd.	2005

Course Name	**:**	**ECONOMICS**
Course Code	**:**	**HSS 201**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make students understand how society manages its scarce resources for achieving maximum satisfaction and to make them learn about economic aspects related to a consumer, firm, market and economy.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO ECONOMICS** Nature of Economics, Economic Thoughts, Economic Activities, Relationship of Economics with other Social Sciences and Engineering	**3**
2	**THEORY OF CONSUMER BEHAVIOUR** Demand: Types, Law of Demand, Demand Supply Curve, Determinants of Demand and Change in Demand (Movement of Demand and Shift of Demand) with Case Studies Elasticity of Demand: Nature, Degrees, Types, Factors Affecting Elasticity of Demand and its Application in present scenario Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility	**9**
3	**THEORY OF PRODUCTION AND COST** Cost: Concept and Types Production: Concept, Scale of Production, Law of Variable Proportion Returns to Factor and Returns to Scale: Causes and Implications Economies and Diseconomies of Scale: Concept and Types Relevance of Production and Cost Concept in present context	**5**
4	**THEORY OF MARKET** Market: Concept and Types (Perfect Competition, Monopoly and Monopolistic Competition), Nature and Relevance of different Markets in present scenario – Case Study	**5**
5	**BASIC CONCEPTS OF MACRO ECONOMICS** National Income: Concept and Measurement Methods, Determination of Equilibrium of Income	**6**

	Inflation: Concept, Causes and Effect of Inflation, Measures to Control Inflation, Case Study on Impact of Inflation	

Course Outcomes:	
1	The students are expected to apply engineering knowledge to maximize profit, satisfaction and welfare.
2	The students are able to identify the forces that affect the economy.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Modern Economics", Ahuja H. L., Pubs: Sultan Chand and Co. Ltd, New Delhi.	2012
2	"Economics For Engineers", Gupta M. L. and Gupta S.P., Pubs: ESS PEE Publications.	
3	"Business Economics", Ahuja H. L., Pubs: Sultan Chand and Co. Ltd, New Delhi.	2010
4	"Macro Economic Theory", Jhingan M.L., Pubs: Konark Publisher Pvt. Ltd., New Delhi.	1986
5	"Principles of Microeconomics", Stiglitz J.E. and Walsh C.E., 4th Edition, Pubs: W.W. Norton & Company.	2006
6	"Principles of Macroeconomics", Stiglitz J.E. and Walsh C.E., 4th Edition, Pubs: W.W. Norton & Company.	2006
7	"Principles of Economics", Mankiw N.G., 7th Edition, Pubs: Cengage Learning	2014
8	"Economics", Samuelson P.A. and Nordhaus W.D., 18th Edition, Pubs: McGraw Hill.	2004

Course Name	**:**	**PSYCHOLOGY**
Course Code	**:**	**HSS 202**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of the course is to provide knowledge and understanding about important concepts in Psychology which will help the students in learning the applications of principles of psychology in personal and professional life.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO PSYCHOLOGY** Concept, Nature and Scope Methods of Studying Human Behaviour – Introspection Method, Observation Method, Experimental Method, Case History Method, Survey Method, Psychological Test Use Relevance of these Methods in present context	**4**
2	**INTELLIGENCE** Concept and Determinants of Intelligence Theories of Intelligence and its Application: Spearman, Thurston, Guilford.	**4**
3	**PERSONALITY** Personality: Concept, Determinants of Personality, Trait Paradigm (Eysenck), Psychodynamic Paradigm (Freud), Measurement of Personality – Self Report Measures (EPQ), Projective Measures (TAT), Hypothetical Measurement of Personality	**4**
4	**MENTAL HEALTH AND STRESS** Mental Health: Concept and Factors Affecting Mental Health Stress: Nature, Rections to Stress, Outcomes of Stress, Stress Management Case Study	**4**

5	**LEARNING AND MEMORY** Learning: Concept, Reinforcement Principle and Learning, Managerial Implications Memory: Concept, Long Term Memory, Short Term Memory, Episodic Memory, Methods to Improve Memory	**3**
6	**MOTIVATION** Nature and Types of Motivation: Extrinsic and Intrinsic Theories of Motivation and its Application: Humanistic and Need Theories Factors Affecting Motivation	**3**
7	**GROUP BEHAVIOUR AND DYNAMICS** Concept and Importance, Types of Groups, Group Development, Group Performance Factors, Conflict: Nature, Conflict Resolution, Case Study	**4**
8	**LEADERSHIP** Leadership: Nature and Importance, Leadership Styles: Authoritarian, Democratic, Paternalistic, Laissez faire, Transactional, Transformational, Case Study	**2**

Course Outcomes:	
1	The students will learn the causes and dynamics of human behavior.
2	The students will be able to apply psychological principles to enhance their personal and professional life.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Psychology", Ciccarelli S.K. and Meyer G.E., Pubs: Pearson India.	2007
2	"Introduction to Psychology", Morgan C.T., Weiss J.R., King R.A. and Schopler J., 7th Edition, Pubs: McGraw-Hill Education.	2004
3	"An Introduction to Psychology", Mangal S.K., 1st Edition, Pubs: Sterling Publishers Pvt. Ltd., New Delhi.	2009
4	"Fundamentals of Social Psychology", Baron R.A., Branscombe N.R., Byrne D. and Bhardwaj G., 1st Edition, Pubs: Pearson India.	2011
5	"Organizational Behaviour", Parikh M. and Gupta R., Pubs: McGraw Hill Education.	2010
6	"Organizational Behavior", Robbins S.P., Pubs: Prentice Hall of India.	2003

Course Name	**:**	**SOCIOLOGY**	
Course Code	**:**	**HSS 203**	
Credits	**:**	**3**	
L T P	**:**	**2-1-0**	

Course Objectives:
The main aim of the course is to make the students understand the role of theory in social sciences and to explain them how social problems interact and react with the larger society. This course also intends to make them learn whether the problem is evaluated on the macro or micro perspective and their cause and effect patterns.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO SOCIOLOGY** Sociology as a Science, Impact of Industrial and French Revolution on the Emergence of Sociology, Contribution of Karl Marx, Emile Durkheim, Max Weber, Alwin Toeffler to Sociology and its Application in present scenario, Relevance of Sociology for Engineering	**5**
2	**BASIC CONCEPTS** Society, Association, Institution, Culture Relativism, Social Structure, Social System,	**2**

	Socialization, Competition, Conflict, Accommodation, Social Mobility	
3	**SOCIETY AND ECONOMY** Evolution of Society: Primitive, Agrarian, Industrial and Post-Industrial, Economic Systems of Simple and Complex Societies, Sociological Dimensions of Economic Life, Market (free) Economy and Controlled (planned) Economy	**4**
4	**INDUSTRIAL SOCIOLOGY** Nature and Scope of Industrial Sociology, Pre-Conditions and Consequences of Industrialization, Impact of Automation and Industrialization on Society with Case Study	**3**
5	**SCIENCE AND TECHNOLOGY** Ethos of Science and Social Responsibility of Science	**2**
6	**SOCIAL CHANGE** Theories of Change and its Application to Sociology, Factors of Change, Directed Social Change, Social Policy and Social Development, Social Cost Benefit Analysis, Role of Engineers in Development	**4**
7	**INDIAN SOCIETY** Traditional Hindu Social Organization, Caste System, Agrarian Society in India, Social Consequences of Land Reforms and Green Revolution, Working of the Democratic Political System in a Traditional Society, Problem of Education in India, Gender Discrimination, Economic Reforms: Liberalization, Privatization and Globalization, Strategies for Development in India, Case Studies	**6**
8	**SOCIAL PROBLEMS** Concept of AIDS, Alcoholism, Drug Addiction, Corruption with Case Study	**2**

Course Outcomes:	
1	The students will be able to identify the function and application of sociology theory in social sciences.
2	The students will be able to understand how social class affects individual life chances.
3	The students will learn about social structure and how it shapes and influences social interactions.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Sociology: Themes and Perspective", Haralambos M. and Holborn M., Pubs: Collins Educational Publications.	2008
2	"Sociology of Indian Society", Rao C.N.S., 2nd Edition, Pubs: Sultan Chand and Co., New Delhi.	2004
3	"Introduction to Sociology", Bhushan V. and Sachdeva D.R., Pubs: Kitab Mahal Publications.	2002
4	"An Introduction to Sociology", Dassgupta S. and Saha P., Pubs: Dorling Kindersley (India) Pvt. Ltd.	2012
5	"Social Change in Modern India", Srinivas M.N., 1st Edition, Pubs: Orient Longman.	2010
6	"Sociology and Modern Social Problems", Ellwood C.A., Pubs: Bastian Books.	2008
7	"Industrial Sociology", Singh N., 1st Edition, Pubs: McGraw Hill Education (India).	2012
8	"Society in India: Concepts, Theories and Recent Trends", Ahuja R., 1st Edition, Pubs: Rawat Publications.	2011

Course Name	**:**	**FRENCH**
Course Code	**:**	**HSS 204**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:

The main aim of this course is to introduce students with basics of a foreign language and make them learn how to communicate in a new language.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	Introductions: introduce yourself or someone else	**2**
2	Greetings	**2**
3	Alphabet / numbers	**3**
4	Communication in a class	**3**
5	Asking and answering basic questions: name – age – nationality – profession – family, friends, acquaintances	**3**
6	Giving the date / day / season / time / frequency of an event	**2**
7	Locating a place / describing a city or a locality / giving information about one's region, city or country	**4**
8	Expressing quantities	**2**
9	Expressing one's preferences / talk about one's leisure time activities	**3**
10	Describing a person / talking about his/her nature	**4**

Course Outcomes:	
1	The students will be able to express themselves in the foreign language.
2	The students will be able to make use of this language in their professional life in the globalized world.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Learn French Through English in 30 Days", Chopra B., 1st Edition, Pubs: Diamond Books.	2009
2	"Complete French", Graham G., Pubs: Hodder & Stoughton.	2012
3	"French Made Easy", Verma R., 1st Edition, Pubs: Goodwill Publishing House, New Delhi.	2012
4	"Learn French for Beginners", Schell R., Pubs: Maanu Graphics.	
5	"French Made Easy", Khan F., Pubs: Lotus Press.	2010
6	"French Course Grammar", Bertenshaw T.H., 1st Edition, Pubs: Orient Blackswan.	1998

Course Name	**:**	**PRINCIPLES OF MANAGEMENT**
Course Code	**:**	**HSM 401**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make students understand the management process and principles along with its application in practical life and to help them manage different jobs and situations with the help of management functions.

Total No. of Lectures – 28

Lecture wise breakup		Number of Lectures
1	**INTRODUCTION TO MANAGEMENT** Nature of Management: Art or Science, Principles and Functions of Management	3
2	**EVOLUTION OF MANAGEMENT THOUGHT** Classical Theories: Bureaucratic, Scientific and Administrative Approach Neo-Classical Theories: Human Relations and Human Behaviour Approach Modern Theories of Management Relevance of Management Thought in present scenario – Management Cases	6
3	**PLANNING** Nature of Planning, Planning Process, Application of Planning Process in a Hypothetical Situation, Types of Planning, Types of Plans, Management by Objective (MBO)	4
4	**ORGANIZING** Concept of Organization, Departmentation, Forms of Organization Structure Analysis of Organization Structure – Case Studies Hypothetical Formation of an Organization	4
5	**STAFFING** Human Resource Planning: HRP Process, Job Analysis: Job Description, Job Specifications and Used of Job Analysis Recruitment: Sources and Methods Selection: Selection Process, Role Playing and Case Study on Selection Tests and Interviews Training and Development: Techniques, Performance Appraisal: Methods Case Study on Staffing Practices	6
6	**DIRECTING** Concept, Leadership: Importance and Styles, Motivation: Theories and their relevance in present scenario, Communication: Process, Types and Barriers of Communication Management Game on Leadership, Motivation and Communication	3
7	**CONTROLLING** Nature and Process of Controlling, Requirements for Effective Controlling	2

Course Outcomes:	
1	The students will be able to apply management concepts and principles in daily life and thus, will be able to manage things efficiently and effectively.
2	The students will learn how to get work done easily by using management knowledge and functions.

Suggested Books:		
Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	"Principles and Practices of Management", Rao V.S.P. and Narayana P.S., Pubs: Konark Publishers.	1987
2	"Principles & Practice of Management", Prasad L.M., 8th Edition, Pubs: Sultan Chand & Sons.	2012
3	"Essentials of Management: International and Leadership Perspective", Weihrich H. and Koontz H., 9th Edition, Pubs: McGraw Hill.	2012
4	"The New Era of Management", Daft R.L., 11th Edition, Pubs: Cengage Learning.	2014
5	"Management: Text and Cases", Rao V.S.P. and Krishna V.H., Pubs: Excel Books.	2008
6	"Fundamentals of Management: Essential Concepts and Applications", Robbins S.P, DeCenzo D.A., Bhattacharya S. and Agarwal M.N., 6th Edition, Pubs: Pearson India.	2009

Course Name	**:**	**BUSINESS ENVIRONMENT AND BUSINESS LAWS**
Course Code	**:**	**HSM 402**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make students understand different types of environment influencing business decisions and to provide knowledge about different laws that needs to be followed for initiating and managing business.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO BUSINESS** Scope and Characteristics of Business, Classification of Business Activities Forms of Ownership of Business: Sole Proprietorship, Partnership and Company	**5**
2	**BUSINESS ENVIRONMENT** Internal Environment: Concept and Elements (Value System, Vision Mission Objectives, Management Structure, Human Resources, Company Image etc.) SWOT Analysis: Concept and Case Study External Environment: Micro Environment (Suppliers, Customers, Competitors, Market Intermediaries etc.) and Macro Environment – PESTEL Analysis (Political, Economic, Social, Technological, Ecological and Legal), Case Study on Impact of Environment on Business	**7**
3	**GLOBALIZATION** Concept, Pros and Cons of Globalization, Impact of Global Environment on Business Globalization of Company – Case Study	**4**
4	**CORPORATE SOCIAL RESPONSIBILITY** Concept, Social Responsibility towards different stakeholders, Rationale for CSR CSR – Case Studies	**2**
5	**CORPORATE GOVERNANCE** Concept, Elements and Essentials of Good Governance	**3**
6	**CONTRACT LAW** Concept, Types and Essentials Elements of Contract	**3**
7	**PARTNERSHIP LAW** Nature of Partnership, Provisions of Partnership Act, Issues Related to Partnership Firm, Hypothetical Formation of a Partnership Firm	**2**
8	**COMPANY LAW** Nature of Company, Provisions of Company Act, Issues Related to Incorporation of Company, Hypothetical Formation of a Company	**2**

Course Outcomes:	
1	The students will be able to analyze the impact of environment on business and formulate appropriate business strategies to compete in the competitive world.
2	The students will learn how companies follow corporate governance and social responsibility practices along with fulfilling economic objectives.
3	The students will gain knowledge about application and implementation of various business laws in practice.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**

1	"Business Environment: Text and Cases", Cherunilam F., 22nd Edition, Pubs: Himalaya Publications.	2013
2	"Legal Aspects of Business", Pathak A., 5th Edition, Pubs: McGraw Hill Education.	2013
3	"Essential of Business Environment: Text, Cases and Exercises", Aswathappa K., 11th Edition, Pubs: Himalaya Publication.	2011
4	"Business Law Including Company Law", Gulshan S.S. and Kapoor G.K., 15th Edition, Pubs: New Age International (p) Ltd.	2011
5	"Business Law and Corporate Laws", Tulsian P.C., 1st Edition, Pubs: Sultan Chand Publishing.	2011
6	"Fundamentals of Business Organization & Management", Bhushan Y.K., 19th Edition, Pubs: Sultan Chand & Sons.	2013
7	"Corporate Governance: Principles, Policies and Practices", Fernando A.C., 2nd Edition, Pubs: Pearson India.	2011

Course Name	**:**	**ENTREPRENEURSHIP AND PROJECT MANAGEMENT**
Course Code	**:**	**HSM 403**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make prospective engineers familiar with the concept of entrepreneurship and MSMEs and to provide knowledge about different aspects to be considered while formulating the business plan for a new entrepreneurial venture. This course also intends to create awareness among students about financial and marketing functions that is required for a new venture.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO ENTREPRENEURSHIP** Concept of Entrepreneurship, Characteristics and Functions of Entrepreneur Forms of Ownership of Business, Factors Affecting Entrepreneurship Case Studies of Entrepreneurs	**6**
2	**WOMEN ENTREPRENEURSHIP** Nature of Women Entrepreneurship, Problems of Women Entrepreneurs, Institutional Initiatives for Promotion of Women Entrepreneurs	**2**
3	**MICRO, SMALL AND MEDIUM ENTERPRISES (MSMES)** Concept of MSMEs, Schemes of MSMEs	**2**

	Functions of Entrepreneurial Development Programmes (EDPs)	
4	**PROJECT IDENTIFICATION** Idea Generation, Project Life Cycle, Concept of SWOT Analysis SWOT Analysis of Selected Project	**2**
5	**PROJECT PLANNING AND FORMULATION** Elements of Project Formulation: Product, Technical (Location, Scale, Technology, Production Process, Layout, Manpower, Resources etc.), Market, Finance and Economic Aspects Feasibility Analysis: Financial Viability and Profitability, and Socio-Economic Desirability	**7**
6	**PROJECT REPORT** Formulation of Business Plan and Project Report, Hypothetical Example of a Real-Life Project	**2**
7	**FINANCE AND MARKETING FUNCTION** Concept of Finance, Finance Related Terminologies, Sources of Finance, Cost Estimations Marketing Mix: Product, Place, Price, Promotion, People, Process and Physical Evidence Marketing Segmentation Targeting and Positioning	**5**
8	**DISCUSSIONS ON ADDITIONAL READING** (any one of the following in the semester) - The New Age Entrepreneurs - The $100 Startup: Fire your Boss, Do what you Love and Work Better to Live More - A Guide to Entrepreneurship - Dhandha: How Gujaratis Do Business - Rokda: How Baniyas Do Business - Take Me Home - Business Families of Ludhiana	**2**

Course Outcomes:	
1	The students will be able to apply engineering knowledge effectively in the field of entrepreneurship development.
2	The students can make effective use of entrepreneurial knowledge to start and manage their venture.
3	The students will learn to check the feasibility of a new project to maintain its long run sustainability.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Dynamics of Entrepreneurial Development & Management", Desai V., 5th Edition, Pubs: Himalaya Publishing House.	
2	"Projects: Planning, Analysis, Selection, Financing, Implementation and Review", Chandra P., 8th Edition, Pubs: McGraw-Hill Education (India).	2014
3	"Entrepreneur's Toolkit", Harvard Business School, Pubs: Harvard University Press.	2004
4	"Entrepreneurship", Hisrich R.D., Peters M.P. and Shepherd D.A., Pubs: McGraw Hill Education.	2006
5	"Essentials of Project Management", Ramakrishna K, Pubs: PHI Learning.	
6	"Entrepreneurship", Roy R., 2nd Edition, Pubs: Oxford University Press	2011
7	"Entrepreneurship Development in India", Gupta C.B. and Srinivasan N.P., Pubs: Sultan Chand and Sons.	2013

Course Name	**:**	**FINANCIAL MANAGEMENT**
Course Code	**:**	**HSM 404**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make students learn different financial decisions i.e. investing, financing and dividend, required to be taken by a company and provide knowledge about the functioning of the financial system (financial markets, financial institutions, financial services and financial instruments) of the country.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO FINANCIAL MANAGEMENT** Concept of Finance, Terminology Related to Finance, Financial Decisions, Factors Affecting Financial Decisions, Risk-Return Trade-Off	**3**
2	**FINANCIAL SYSTEM** Concept and Role of Financial System in Indian Economy	**2**
3	**FINANCIAL MARKETS AND INSTRUMENTS** Concept and Relevance of Money Market and Capital Market Money Market Instruments: Call Money, Treasury Bills, Commercial Papers, Certificate of Deposits Capital Market Instruments: Equity Shares, Preference Shares and Debentures Hypothetical Trading in Financial Markets	**5**
4	**FINANCIAL SERVICES** Nature and Functions of Financial Services: Merchant Banking, Mutual Funds, Factoring, Forfaiting, Credit Rating Case Study on Financial Services	**6**
5	**FINANCIAL INSTITUTIONS** Nature and Functions of Financial Institutions: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Discount and Finance House of India (DFHI)	**2**
6	**LONG TERM INVESTMENT DECISIONS** Capital Budgeting: Concept, Importance, Factors Techniques/Methods with Numerical Applications (Pay Back Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index), Case Study	**3**
7	**SHORT TERM INVESTMENT DECISIONS** Working Capital: Nature, Type and Factors Affecting the Requirement of Working Capital, Case Study	**2**
8	**FINANCING DECISIONS** Capital Structure: Essentials and Approaches of Capital Structure Sources of Finance (long-term and short-term), Financial Leverage: Concept and Numerical Application, Case Study	**3**
9	**DIVIDEND DECISIONS** Types of Dividend, Dividend Policy: Nature and Factors Affecting Dividend Policy, Case Study	**2**

Course Outcomes:	
1	The students will learn to make best combination of financial decisions by considering risk and return trade-off.
2	The students will identify how business can gain maximum through the financial system.
3	The students will understand how to manage funds effectively so as to maximize returns.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Financial Management", Shah P., 2nd Edition, Pubs: Dreamtech Press	2009
2	"Financial Markets and Services", Gordon E. and Natarajan K., 3rd Edition, Pubs: Himalaya Publishing House.	2006
3	"Financial Management: Theory and Practice", Chandra P., 8th Edition, Pubs: McGraw Hill Education (India).	2012
4	"Financial Management", Pandey I.M., 10th Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.	2010
5	"Cases in Financial Management", Pandey I.M. and Bhat R., 3rd Edition, Pubs: McGraw Hill Education (India).	2012
6	"Financial Institutions and Markets: Structure, Growth and Innovations", Bhole L.M. and Mahakud J., 5th Edition, Pubs: McGraw Hill Education (India).	2009
7	"The Indian Financial System: Markets, Institutions and Services", Pathak B.V., 3rd Edition, Pubs: Pearson India.	2010
8	"Financial Management and Policy", Horne J.C.V. and Dhamija S., 12th Edition, Pubs: Pearson India.	2011

Course Name	**:**	**MARKETING MANAGEMENT**
Course Code	**:**	**HSM 405**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to make students understand about the marketing concepts to be applied in real life and the marketing process for delivering value to customers.

Total No. of Lectures –28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO MARKETING** Concepts, Role, Scope and Types of Marketing, Case Study on Marketing Management	**3**
2	**MARKETING RESEARCH** Scope and Process of Marketing Research, Hypothetical Marketing Research Analysis	**3**
3	**CONSUMER AND BUSINESS MARKETS** Types of Markets, Building Customer Value Consumer and Business Buying Behaviour: Factors Influencing Behaviour and Buying Decision Process	**4**

4	**SELECTION OF MARKETS** Segmentation: Factors and Bases, Targeting and Positioning Preparation of STP of Selected Product	**3**
5	**MARKETING MIX** 7 P's of Marketing Mix: Product, Price, Physical Distribution, Promotion, People, Process and Physical Evidence Formulation of Marketing Mix of Selected Product	**3**
6	**PRODUCT DECISIONS** Product (Good or Service) Characteristics, Product Life-Cycle, Packaging and Branding, Product Development and Management	**3**
7	**PRICING DECISIONS** Pricing Policies and Strategies, Factors Influencing Pricing	**3**
8	**PHYSICAL DISTRIBUTION DECISIONS** Marketing Channels, Channel Players, Physical Distribution, Managing Distribution, Analysis of Supply Chain Management – Case Studies	**3**
9	**PROMOTION DECISIONS** Nature of Promotion Decisions, Managing Mass Communication and Personal Communication Analysis of Promotional Strategies – Case Studies	**3**

Course Outcomes:	
1	The students will learn how to market goods and services effectively to different segments so as to deliver value to customers.
2	The students will be able to formulate marketing mix and marketing strategies for different products and different sets of customers.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Marketing Management: Concepts, Cases, Challenges and Trends", Govindarajan M, 2nd Edition, Pubs: PHI Learning.	2009
2	"Marketing Management", Kotler P., Keller K.L., Koshy A. and Jha M., 14th Edition, Pubs: Pearson India.	2012
3	"Marketing Concepts and Strategies", Dibb S., Simkin L., Pride W.M. and Ferrell O.C., Pubs: Cengage Learning.	2012
4	"Marketing Management", Kumar A. and Meenakshi N., 2nd Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.	2011
5	"Marketing Management", Saxena R., 4th Edition, Pubs: McGraw Hill Education (India).	2013
6	"Marketing: Managerial Introduction", Gandhi J.C., 1st Edition, Pubs: McGraw Hill Education.	1987
7	"Marketing", Etzel M.J., Walker B.J., Stanton W.J. and Pandit A., 14th Edition, Pubs: McGraw Hill Education (India).	2010

8	"Super Marketwala: Secrets to Winning Consumer India", Mall D., 1st Edition, Pubs: Random House India.	2014

Course Name	**:**	**HUMAN RESOURCE MANAGEMENT**
Course Code	**:**	**HSM 406**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Course Objectives:
The main aim of this course is to provide an overview of HRM, keeping the Indian business scenario in the background and to acquaint the students with the strategic role of HRM in managing an organization.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO HUMAN RESOURCE MANAGEMENT** HRM: Nature, Scope, Functions, HRM Practices and Problems in India with Case Studies	**4**
2	**HUMAN RESOURCE PLANNING (HRP)** Concept and Process of HRP, Factors Affecting HRP	**3**
3	**JOB ANALYSIS AND DESIGNING** Uses and Process of Job Analysis, Job Description and Job Specification: Features and Hypothetical Formulation, Job Designing: Job Enrichment, Job Enlargement	**3**
4	**RECRUITMENT AND SELECTION** Recruitment: Sources and Methods Selection: Selection Process, Selection Tests, Types and Nature of Interviews Role Playing and Case Study on Selection Process, Tests and Interview	**4**
5	**INDUCTION AND INTERNAL MOBILITY** Induction Programme, Need and Scope of Internal Mobility: Transfer, Promotion, Demotion	**3**
6	**TRAINING AND DEVELOPMENT** Training: Need and Methods, Management Development: Need, Methods and Management Development Programme HRM Games for Development of Employees	**4**
7	**PERFORMANCE APPRAISAL AND COMPENSATION** Nature and Methods of Performance Appraisal, Hypothetical Performance Appraisal Compensation: Financial and Non-Financial Benefits	**4**
8	**EMPLOYEE HEALTH AND SAFETY** Concept, Issues related to Health and Safety, Workplace Health Hazards	**3**

Course Outcomes:	
1	The students will develop the ability to solve problems in area of HRM in organizations.
2	The students will become aware of latest developments in HRM practices which are essential for effective management in organization.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Human Resource Management: Text and Cases", Rao V.S.P., Pubs: Excel Books.	2002
2	"Human Resource Management", Dessler G. and Varkkey B., 12th Edition, Pubs: Pearson	2011

	India.	
3	"Human Resource Management: Text and Cases", Aswathappa K., 7th Edition, Pubs: McGraw Hill Education (India).	2013
4	"Human Resource Management: Text and Cases", Gupta C.B., 14th Edition, Pubs: Sultan Chand and Sons.	2012
5	"Human Resource Management: Text and Cases", Bedi S.P.S. and Ghai R.K., Pubs: Bharti Publications.	2012
6	"Human Resource Management Applications: Cases, Exercises, Incidents and Skill Builders", Fottler M.D., McAfee R.B. and Nkomo S.M., 7th Edition, Pubs: Cengage Learning.	2013

ENGINEERING SCIENCE COURSES

Course Name	**:**	**COMPUTER PROGRAMMING (BASIC)**
Course Code	**:**	**CSN104**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
To develop logical skills so that students should be able to solve basic computing problems. To learn the syntax and usage of C programming constructs.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO PROGRAMMING** Evolution of languages: Machine languages, Assembly languages, High-level languages. Software requirements for programming: System softwares like operating system, compiler, linker, loader; Application programs like editor. Algorithm, specification of algorithm. Flowcharts.	4
2	**PROGRAMMING IN C** Data types in C, Formatted input-output for printing integer, floating point numbers, characters and strings.	2
3	**OPERATORS AND EXPRESSION** Expressions in C and their evaluation. Precedence and associativity rules. Operators: arithmetic operators, relational operators, logical operations, bitwise operators, miscellaneous operators.	6
4	**STATEMENTS** Decision making structures: if, if-else, nested if and if-else, switch. Control structures: for, while, do-while. Role of statements like break, continue, goto.	6
5	**ARRAYS** Concept and use of arrays, declaration and usage of arrays, 2-dimensional arrays.	6
6	**FUNCTIONS** Advantage of modularizing C program into functions, function definition and function invocation. Methods of passing parameters to a function: call-by-value, call-by-reference; Passing arrays to functions, Recursion, Library functions.	4
7	**POINTERS** Pointer declaration and initialization, constant pointers, pointers to constant objects, pointer arithmetic, relationship between pointer and arrays.	4
8	**SCOPE AND LIFETIMES** Scope and lifetime of a variable, storage classes: auto and typedef.	2
	USER-DEFINED DATA TYPES Structures- definition, declaration, use, accessing structure members directly or through pointer structure, structure having arrays and pointers as members, self referential structures, passing structures to functions. Unions: definition, declaration, use, accessing union members directly or through pointer structure.	6
	FILES Concepts of files and basic file operations.	2

Course Outcomes:	
1	The student will demonstrate proficiency in C programming language.

Text Books:	
1	Let Us C, Yashwant Kanetkar, BPB Publications
2	Programming in C: A practical approach, Ajay Mittal, Pearson Education

Reference Books:

1	The C programming language, Kernighan Ritchie, Pearson Education
2	Programming in ANSI C, Balaguruswamy, Tata McRaw Hill
3	Computing Fundamentals, Peter Nortan, Tata McRaw Hill

Course Name	**:**	**COMPUTER PROGRAMMING (ADVANCED)**
Course Code	**:**	**CSN105**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
To develop logical skills so that students should be able to solve basic computing problems. To learn the syntax and usage of C programming constructs at advanced level.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO STRUCTURED PROGRAMMING** Introduction to topics: decision making, Iteration, functions: functions with variable number of arguments, multiple file programs, concept of linking.	6
2	**ARRAYS** Array declaration and use, Two-dimensional arrays and multi-dimensional arrays. Strings and Character arrays. Operations on arrays such as insertion, searching, sorting, merging.	6
3	**POINTERS** Pointer expression, pointer arithmetic, pointer to array, pointer to functions, dynamic memory allocation, dynamic allocation of arrays. Call functions through function pointers, Accessing members of arrays through pointers.	6
4	**PREPROCESSOR DIRECTIVES** Introduction, Various preprocessor directives, macros with and without arguments, conditional compilation.	6
5	**STRUCTURE, UNION, ENUMERATION AND BIT-FIELDS** Definition, declaration and initialization, structures containing arrays, array of structures, structure having structures, pointers to structures, self-referential structures, dynamic allocation of structures; Unions: Definition, declaration and initialization. Concepts of interrupts interrupt programming, enumerations and bit-fields.	8
6	**FILES** Concept of file, file operations, text mode and binary mode, command line arguments.	4
7	**INTRODUCTION TO OBJECT ORIENTED PROGRAMMING** Classes and objects, basic features of object oriented programming like encapsulation, abstraction, polymorphism, etc.	3
8	**APPLICATIONS** Projects related to the development of Terminate and Stay resident (TSRs), graphical applications, text-editors, etc.	3

Course Outcomes:	
1	The student will demonstrate proficiency in C programming language.

Text Books:	
1	Let Us C, Yashwant Kanetkar, BPB Publications
2	Programming in C: A practical approach, Ajay Mittal, Pearson Education

Reference Books:	
1	The C programming language, Kernighan Ritchie, Pearson Education
2	Programming in ANSI C, Balaguruswamy, Tata McRaw Hill

3	Computing Fundamentals, Peter Nortan, Tata McRaw Hill

Course Name	**:**	**ENGINEERING DRAWING**
Course Code	**:**	**ESC 101**
Credits	**:**	**4**
L T P	**:**	**2-0 -4**

Course Objectives:
At the end of this course, the student should be able to understand the basic concepts of Engineering Drawing. The student should be able to visualize and draw the two and three dimensional objects. The student should also be able to apply drafting softwares in various types of problems.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	Introduction to Engg. Graphics, System of Projections, Orthographic projections, Lettering, Dimensioning rules	2
2	Projections of points and lines, Projection of lines on different planes, Traces and true length of the lines	2
3	Projections of planes/laminae on reference planes, classification of Primary and secondary planes, examples	2
4	Classification of solids, Projections of solids on the basis of positions of the axis of various solids on reference planes	3
5	Sectioning of solids, True and apparent sections, sectioning on the basis of position of section planes	3
6	Developments of surfaces, Parallel line, Radial line and Triangulation methods of development of right and oblique solids	3
7	General introduction to Perspective projection, isometric views, Isometric lines & Axes, Four centre and off set method of drawing ellipse from circle, conversion of orthographic views to isometric views and vise-versa	3
8	Introduction to AutoCAD software for drawing of 2D projections, practical exercises on points, lines, planes and solids	10

List of Experiments:		**Number of Turns**
1	Exercises on projection of Points on drawing sheets	1
2	Exercises on projection of lines on drawing sheets	1
3	Exercises on projection of planes on drawing sheets	1
4	Exercises on projection of solids on drawing sheets	2
5	Exercises on sections of solids on drawing sheets	1
6	Exercises on Developments of surfaces and Isometric projections on drawing sheets	2
7	Practice of exercises on points and lines using AutoCAD software	1
8	Practice of exercises on planes using AutoCAD software	2
9	Practice of exercises on solids and developments using AutoCAD software	2
10	Practice of exercises on isometric projections using AutoCAD software	1

Course Outcomes: At the end of this course, the students will be able to:	
1	Understand the basic concepts of Engineering Graphics.
2	Visualize the actual objects and convert them in to readable drawings.
3	Understand the drawing standards, conventions and symbols that are in common usage.
4	Draw the common Engineering drawings using available drafting softwares.
5	Come up with innovative conceptual ideas by using Drafting softwares.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Engineering Drawing", P. S. Gill, S.K. Kataria & Sons	2012
2	"Engineering Drawing", D.A. Jolhe, Tata McGraw Hill	2010
3	"Engineering Graphics with Auto CAD", James Bethune, Prentice Hall, India	2003

Course Name	**:**	**FLUID MECHANICS**	
Course Code	**:**	**ESC102**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives:
To learn the basic concept of fluid mechanics. To understand the analytical method of solving fluid mechanics problem

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Fluids, Brief history of Fluid Mechanics, Properties of Fluid, Viscosity, Capillarity, Surface Tension, Compressibility, Normal and Shear Stresses in Fluid Flows, Regimes of Flow	4
2	**FLUID STATICS** Pascal's Law of measurement of pressure, Types of forces on a fluid system, manometers and gauges, forces on partially and fully submerged bodies including that on curved surfaces, Buoyancy, stability of floating bodies, centre of gravity, Metacentric height.	**6**
3	**KINEMATICS OF FLUID FLOW** Langrangian and Eulerian methods, description of properties in a moving fluid, local and convective acceleration, Streamlines, Path lines, Streak lines, Laplace equation, Stream function, velocity potential and flownets.	**4**
4	**DYNAMICS OF FLUID FLOW** Equation of conservation of mass, differential form of continuity equation. External forces, Euler's equation of motion, Bernoulli's equation, simple application to one dimensional flow, linear momentum and angular momentum, momentum theorem, moment of momentum theorem	**8**
5	**VISCOUS FLOW** Pressure gradient in steady uniform flow, flow between parallel plates, Qualitative aspects of viscous flows, Hagen-Poiseulli's flow, Transition from laminar to turbulent flow, turbulent flow in circular pipe, Navier Stokes equation (without derivation).	**5**
6	**FLOW THROUGH PIPES** Introduction, energy and hydraulics grade line, non-dimensional formulation of the pipe flow problem, head losses in pipes & pipe fittings, pipe in series & parallel, reservoir problem.	**5**
7	**DIMENSIONAL ANALYSIS AND SIMILITUDE** Buckingham's Theorem, non-dimensional groups, Geometric, Kinematic and Dynamic Similarity, Hydraulic Models.	**4**
8	**FLOW MEASUREMENT** Venturimeter, orifice meter, Pitot tube, Orifices, mouth pieces, notches, weirs, Current meter.	**6**

List of Experiments:

1	Flow Measurement by Orifice Meter
2	Flow Measurement by Venturimeter
3	Flow Measurement by V Notche
4	Computation of various coefficients involving in through orifice.
5	Determination of friction factors of pipes Minor losses in pipes
6	Determination of friction factors of pipes
7	Verification of Bernoulli's theorem
8	To determination of the metacentric height of a given vessel under unloaded condition.

Course Outcomes:	
1	To apply the learned techniques in real life problems related to fluid mechanics.

Text Books:	
1	G.L. Asawa, "Experimental Fluid Mechanics-Volume I" Nem Chand & Brothers
2	B. S. Kapoor, "Manual of Fluid Mechanics" Khanna Publishers
3	S. Singh, "Experiments in Fluid Mechanics-Second Edition" PHI Publications

Reference Books:	
1	Frank M. White, "Fluid Mechanics", McGraw Hill.
2	H. Rouse , "Elementary Mechanics of Fluids"
3	Streeter, V.L.,"Fluid Mechanics" McGraw Hill Co
4	Lewitt, E.H.,"Hydraulics and the Mechanics of Fluids" Pitman

Course Name	**:**	**INTRODUCTION TO MANUFACTURING**
Course Code	**:**	**ESC 103**
Credits	**:**	**4**
L T P	**:**	**2-0-4**

Course Objectives:
At the end of the course the students should be able to describe the properties of engineering materials and different manufacturing processes. The students should be able to select appropriate manufacturing process and manufacture a job in the different shops and areas of applications.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Classification of manufacturing processes, classification of engineering materials, comparison of material properties of metals, ceramics and plastics, crystal structures, strain hardening effects, stress-strain curves. Safety measures in workshop.	3
2	**MATERIALS AND HEAT TREATMENT** Objective of heat treatment, classification of heat treatment, annealing, normalizing, hardening & tempering, case hardening, carburizing, nitriding, flame hardening, induction hardening, applications of heat treatment.	4
3	**FOUNDRY** Pattern, properties of pattern material, types of pattern, cores. Types of sand, moulding sand ingredients. Types of moulding processes. Types of casting processes: sand casting, shell casting, investment casting and centrifugal casting. Casting defects & remedies. Case studies and applications.	4
4	**FORMING** Metal forming, types and applications, hot & cold working, forging, drawing, rolling and sheet metal operations.	3

5	**MACHINING** Metal removal processes, machines, single-point tool, cutting tool geometry, lathe - types, elements and main parts of lathe, drilling, milling and grinding machines. Applications.	3
6	**FINISHING** Surface finishing processes, principle and applications, lapping, honing, super finishing, polishing, buffing, electroplating, galvanizing.	2
7	**WELDING** Classification of welding processes, mechanism of arc formation, arc welding processes, gas welding, and resistance welding, principles and applications, welding defects, causes and remedies. Soldering and brazing. Applications and case studies in welding.	3
8	**PLASTICS MANUFACTURING** Types and properties of plastics, thermosetting and thermoplastic resins, elastomers. Fabrications of plastics, injection moulding, blow moulding, extrusion moulding etc.	2
9	**MODERN MANUFACTURING PROCESSES** Introduction, classification, electric discharge machining (EDM), electro chemical machining (ECM), laser beam machining (LBM) and Rapid Prototyping Techniques. Case studies on modern and hybrid manufacturing processes.	2
10	**CASE STUDIES** Considerations of selecting manufacturing processes for industrial products like compact disc, PCB and emerging technological applications.	2

List of Experiments:		**Number of Turns**
1	To prepare half lap T & L joint in the carpentry shop.	1
2	To prepare the pattern of half nut in carpentry shop.	1
3	To prepare cube from a piece of round bar in forging shop.	1
4	To study the lathe, milling, planer, and shaper operations.	1
5	To manufacture a multi-operational job on lathe/milling in the machining shop.	1
6	To prepare series and parallel wiring connections in the electrical shops.	1
7	To prepare the butt joint by SMAW in welding shop.	1
8	To prepare the mould of a given pattern in foundry shop.	1
9	To cast the prepared mould in foundry shop.	1
10	To prepare a square job in the fitting shop.	1
11	To prepare rectangular box in sheet-metal shops.	1
12	To prepare different joints in the sheet-metal shop.	1

Course Outcomes: By the end of this course, the students will be able to:	
1	Compare the properties of the engineering materials.
2	Select the appropriate manufacturing process for a given job/ application.
3	Identify the advantages and limitations of different manufacturing processes.
4	
5	

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Manufacturing Engineering and Technology", Serope Kalpakjian and Steven Schmid, Pearson Publications.	2009
2	"A Textbook of Production Technology: Manufacturing Processes", P. C. Sharma, S. Chand & Company Ltd.	2004
3	"Foundry, Forming and Welding", P.N. Rao, Tata M/C Graw Hill Publication.	2007
4	DeGarmo, Materials and Processes In Manufacturing, John Wiley & Sons	2011

Course Name	**:**	**THERMODYNAMICS**
Course Code	**:**	**ESC 201**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the student should be able to, Understand the basic principles of Thermodynamics and to give students a feel for how Thermodynamics is applied in Engineering practices.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**BASIC CONCEPTS :**Macroscopic and Microscopic Approach, Concept of Continuum, Thermodynamic System, Surrounding and Boundary, Thermodynamic Equilibrium, State, Path, Process, cycle, Quasi-static Process, Reversible and Irreversible Process, Working Substance. Thermodynamic Properties like Pressure, Volume and Temperature, Zeroth Law of Thermodynamics. Temperature Scales, Concept of Heat and work in Thermodynamics.	**8**
2	**FIRST LAW OF THERMODYNAMICS:** Joule's Paddle wheel Experiment; Mechanical Equivalent of Heat, First Law for a closed system undergoing a Cycle, First Law for a closed system undergoing a change of state. Different forms of stored Energy, Enthalpy, Energy of An isolated System, Perpetual Motion Machine of First kind.	**6**
3	**FIRST LAW APPLIED TO FLOW PROCESSES:** Flow Process and Control Volume, flow work, Steady and Unsteady Flow Process, Steady Flow Energy Equation, Engineering Applications of Steady Flow Energy Equation, Throttling Process, Flow Work and Non Flow work, Variable flow Processes, Limitation of First Law.	**5**
4	**SECOND and THIRD LAW OF THERMODYNAMICS:** Qualitative Difference between Heat and Work, Thermal Reservoir, Statements of 2nd Law by Max.Planck and Claussius, Equivalence between two statements, Energy Analysis of Heat Engine, Refrigerator and Heat Pump Reversibility and Irreversibility, Causes of Irreversibility Carnot Theorem, Carnot cycle, Absolute Thermodynamic Temperature, Scale, Efficiency of the Reversible Heat Engine, Equality of Ideal Gas Temperature and Kelvin Temperature.	**8**
5	**ENTROPY**: Classius Theorem, Classius Inequality and concept of Entropy, Entropy change in an Irreversible Process, Application of Entropy Principle, Entropy Transfer with Heat Flow, Entropy generation in closed and open System, Thermodynamics Equations relating properties of System, Reversible Adiabatic work in a Steady flow System. Entropy and direction, Entropy and disorder.	**5**
6	**PROPERTIES OF GASES AND GAS MIXTURE** : Equation of state of a gas, Properties of Mixture of gases, Internal Energy, Enthalpy and Specific heat of gas, mixtures, Entropy of gas Mixtures.	**3**
7	**STEAM GENERATORS:** Classification of steam generators, Boiler mountings and accessories. Principles and operations of steam accumulators. Description of Cochran, Locomotive, Lancashire, Babcock and Wilcox boiler, Modern high pressure boilers, Characteristics and advantages of high pressure boilers.	**7**
8	**BASIC CONCEPTS :**Macroscopic and Microscopic Approach, Concept of Continuum, Thermodynamic System, Surrounding and Boundary, Thermodynamic Equilibrium, State, Path, Process, cycle, Quasi-static Process, Reversible and Irreversible Process, Working Substance. Thermodynamic Properties like Pressure, Volume and Temperature, Zeroth Law of Thermodynamics. Temperature Scales, Concept of Heat and work in Thermodynamics.	**8**
9	**FIRST LAW OF THERMODYNAMICS:** Joule's Paddle wheel Experiment; Mechanical Equivalent of Heat, First Law for a closed system undergoing a Cycle, First Law for a closed system undergoing a change of state. Different forms of stored Energy, Enthalpy, Energy of An isolated System, Perpetual Motion Machine of First kind.	**6**

Course Outcomes:	
1	A fundamental understanding of various Laws of thermodynamics and their applications.
2	Understand the efficiencies of Heat Engines and other Engineering Devices.
3	Understand the working principles and applications of various types of steam generators.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	"Engineering Thermodynamics", Gordon Rogers & Yon Machew	2006
2	"Thermodynamics", Yunus Cengel and Mike Boles	2006
3	"Thermodynamics", Arora.	2005
4	"Engineering Thermodynamics", P.K. Nag	2010
5	"Thermo dynamics", Dr. D.S. Kumar	2012

Course Name	**:**	**ESSENTIALS OF INFORMATION TECHNOLOGY**
Course Code	**:**	**ESC202**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to understand the concepts of networking, RBMS, Software Engineering and Web Technology.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**NETWORKING AND COMMUNICATION** Introduction to digital communication: Signal propagation, signal types, signal parameters, Channel effect on transmission. Physical layer characterization: Types of transmission media, physical layer interfaces. Data transmission mechanisms: Communication modes, transmission modes, synchronization, introduction to packet switching, multiplexing, error control methods. Network architectures: Introduction to computer networks, Network topologies, Types of networks: LAN, WAN, MAN, layered network model. Internet Protocols: Introduction, Transport layer protocols: TCP, UDP. Application layer protocols: DNS, SMTP, POP, IMAP. Practical aspects of networking.	**12**
2	**RELATIONAL DATABASE MANAGEMENT SYSTEM** RDBMS- data processing – the database technology – data models- ER modeling concept – notations – converting ER diagram into relational schema - Logical database design - normalization (1NF, 2NF and 3NF). SQL – DDL statements – DML statements – DCL statements - Joins - Sub queries – Views - Database design Issues – SQL fine tuning.	**10**
3	**WEB TECHNOLOGIES AND INTRODUCTION TO USER INTERFACE AND WEB TECHNOLOGIES :** web fundamentals – types web content – HTML – text formatting tags in HTML – HTML form elements - and tags - text formatting using CSS : embedded CSS, inline CSS and external CSS – JavaScript and its features.	**10**
4	**SOFTWARE ENGINEERING** Software Engineering : Definition – role of software and software crisis – SDLC models : waterfall model, incremental model and spiral model – software testing – static & dynamic testing – types testing : unit testing, integration testing, system testing, performance testing and regression testing.	**10**

Course Outcomes:

1	Document artifacts using common quality standards
2	Design simple data store using RDBMS concepts

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Thomas Powell, HTML and CSS: The complete reference, 5th Edition	2010
2	Henry F Korth, Abraham Silberschatz, "Database system concepts", Second ed., McGraw-Hill International editions, Computer Science series	2006
3	A. Tanenbaum, Computer Networks, 5th Edition	2010
4	William Stallings, Data and Computer Communications, 10th Edition	2013

Course Name	**:**	**MATERIALS SCIENCE**
Course Code	**:**	**ESC 203**
Credits	**:**	**04**
L T P	**:**	**3 1 0**

Course Objectives:
The student will be able to know the concepts of atomic bonding, crystal structures, imperfections, diffusion, mechanical properties, electron energy, and dislocations as related to processing and performance of engineering material

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION** Historical perspective, Scope of Materials Science and engineering, Geometry of crystals, Structure determination by X-Ray Diffraction, Atomic structure and chemical bonding, Structure of solids	10
2	**IMPERFECTIONS IN ATOMIC AND IONIC ARRANGEMENTS** Point defects, Dislocations, Significance of Dislocations, Influence of Crystal structure, Surface defects, Importance of defects	4
3	**PHASE DIAGRAMS** Phase rule, Single component systems, Binary Phase diagrams, Microstructural changes during cooling, The lever rule, Some typical phase diagrams, Other applications of Phase diagrams	4
4	**DIFFUSION IN SOLIDS** Applications of Diffusion, Stability of atoms and ions, Mechanism for Diffusion, Activation energy for Diffusion, Rate of Diffusion (Fick's First Law), Factors affecting Diffusion, Composition Profile (Fick's Second Law), Diffusion and Materials Processing	4
5	**SOLIDIFICATION** Nucleation, Applications of Controlled Nucleation, Growth mechanisms, Solidification time and Dendrite size, Cast structure, Solidification defects, Solidification of Polymers and Inorganic glasses	4
6	**ELASTIC, ANELASTIC AND VISCOELASTIC BEHAVIOUR** Atomic model of elastic behaviour, The modulus as a parameter in design, Rubber-like elasticity, Relaxation processes, Spring-Dashpot model	4
7	**MECHANICAL BEHAVIOUR OF MATERIALS** Plastic deformations and creep in crystalline materials, Fracture	4
8	**ELECTRONIC AND MAGNETIC BEHAVIOUR OF MATERIALS** Conductivity of metals and alloys, Superconductivity, Semiconductors and their applications, Insulators and Dielectrics, Classification of magnetic materials, Magnetization,	4

	Permeability and magnetic field, Applications of magnetic materials	
9	**OVERVIEW OF MATERIALS** Metals, Ceramics, polymers and composites	4

Course Outcomes:	
1	The student will be able to develop structure-processing-properties co-relationsof materials.
2	The student will be able to describe various phenomena based on the concepts of solidification, Diffusion, mechanical behaviour of materials and compare characteristics of different types of materials such as metals, ceramics, polymers and composite

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Materials Science and Engineering-A First course/ V Raghavan/PHI	2013
2	Materials Science and Engineering, an Introduction/William D. Callister/ John Willey and Sons Inc. Singapore.	2007
3	Principles of Materials Science and Engineering/William Fortune Smith/TataMcGraw- Hill	1990
4	The Science and Engineering of Materials, Donald R Askeland&Pradeep P Phule/ Cengage Learning	2006

Course Name	**:**	**SOLID MECHANICS**
Course Code	**:**	**ESC 204**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course the student will be able to understand the basic concepts of behavior of the materials and analysis the basic structural elements like beams, columns, trusses and circular shafts. The student will be able to apply this knowledge for the design of various civil engineering structures.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**PROPERTIES OF MATERIALS** Introduction, uni-axial tension test, idealized stress- strain diagrams, isotropic, linear, elastic, visco-elastic and plastic materials, compression test, impact test, fatigue test, torsion and bending test.	4
2	**SIMPLE STRESSES & STRAINS** Concept of stresses and strains, relationship between elastic constants, extension of uniform bar & tapered bar under its own weight and due to load applied, stresses produced in compound bars due to axial loads, thermal stresses,	4
3	**COMPOUND STRESSES:** General state of stress, resultant stress and strain circle, prinicipal stresses and principal strains, Mohercircle for compound stresses and strais	4
4	**SHEAR FORCE AND BENDING MOMENT IN BEAMS** Shear force, bending moment, Relation between load, SF and BM, SFD , BMD and axial force diagram for determinate beams under various types of loading.	6
5	**BENDING AND SHEAR STRESSES IN BEAMS** Pure bending ,bending stresses, eccentric loading combined bending and direct stresses , Middle Third rule, composite beams, Variation of shear stresses for various cross-sections of a beam.	5

6	**ANALYSIS OF PLANE TRUSSES** Different types of trusses, Analysis of plane trusses by method of joints and method of sections.	5
7	**TORSION** Torsion equation for circular shaft , shafts under action of varying torque, torsion of composite shafts.	4
8	**COLUMNS & STRUTS** Criteria for stability of columns, Buckling of columns, Euler's theory for various end restraints, Rankine's formula, eccentrically loaded struts, struts with initial curvature, struts with lateral loading.	5
9	**DEFLECTION OF BEAMS** Slope and Deflection in beams by double integration method, Macaulay's method, Moment area method under the action of various loading conditions; slope and deflection in built in and propped beams.	5

Course Outcomes: By the end of this course the student will be able to:	
1	Analysis the simple civil engineering structures under different loading conditions.
2	Understand the behaviour of basic structural elements.
3	Apply this knowledge for the design of various civil engineering structures.
4	
5	

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"An introduction to the Mechanics of Solids", Crandall & Dahi, McGrawHill.	1978
2	"Strength of Material", G.H. Ryder, MacMillan.	2002
3	"Mechanics of Solids", E.P. Popov, Pearson Education.	1978
4	"Mechanics of Materials", E.J. Hearn, Elsevier Publications.	2001
5	"Mechanics of Materials", Punmia and Jain, Laxmi Publications (P) Ltd.	2013
6	"Mechanics of Materials", R.C.Hibbeler, Pearson Higher education.	2013
7	"Strength of Materials", S. Ramammurtham and R. Narayanan, Dhanpat Rai Publishing Comp	2014

Course Name	**:**	**INTRODUCTION TO ELECTRONICS**
Course Code	**:**	**ESC 205**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

At the end of this course, the student should be able to

1. Identify active and passive components and to solve simple electronic circuits.
2. Explain the fundamental concepts of basic semiconductor devices & digital electronics.
3. Describe the basic principle of operational amplifier along with its applications, A/D, D/A conversion and architecture of 8085 microprocessor.
4. Define the communication system and list the various modulation techniques.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO ELECTRONICS:** Need and application of electronics in different areas, Basic elements of electronic system (Active and Passive elements, Sources,	3

	Dependent Sources), KVL and KCL	
2	**SEMICONDUCTOR DEVICES:** Concept of active and passive devices, Semiconductor Devices: Structure, principle of operation, characteristics and applications of PN-Junction (Rectifier, Clipper and Clamper), BJT, Current Components in BJT, Input & Output characteristics Common Emitter (CE), Common Base (CB), Common Collector (CC) configurations, BJT as an amplifier, Construction, working principle and characteristics of FET and MOSFET, Concept of feedback amplifier, Barkhuasen criteria, Oscillators, 555 timer as multivibrator, Four layer devices- SCR, DIAC and TRIAC (Construction, operation and characteristics)	15
3	**DIGITAL PRINCIPLES:** Digital waveforms, digital logic, moving and storing digital information, digital operations, digital integrated circuits	3
4	**OPERATIONAL AMPLIFIER AND ITS APPLICATIONS:** Block diagram, characteristics, inverting and non inverting configurations, Opamp as summing amplifier, difference amplifier, integrator, differentiator	5
5	**A/D AND D/A CONVERTERS:** Basic principle and characteristics, Weighted resistor D/A converter, Binary ladder D/A converter, counter ramp type A/D Converter	4
6	**INTRODUCTION TO MICROPROCESSOR:** Pin diagram, Architecture of 8085 Microprocessor, Concept of Microcontroller and its applications	3
7	**COMMUNICATION SYSTEMS**: Introduction to communication system, communication time line, Various frequency bands used for communication, Block diagram of Analog and Digital communication, need of modulation, Analog modulation techniques (Amplitude and frequency), Digital modulation techniques (PCM,PWM,PPM, PAM, ASK,FSK,PSK, QAM), Introduction to advanced communication systems (Optical and wireless).	9

Course Outcomes: By the end of the course the students will be able to	
1	Identify the various electronic devices and predict their behavior in an electronic system.
2	Draw the architecture of Microprocessor.
3	Differentiate between various modulation techniques in a communication system and relate them to practical systems.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Electronics Devices & Circuit Theory, RL Boylestead & L Nashelsky (PHI)	2009
2	Digital principles & applications, Malvino Leach, TMH	2011
3	Microprocessor Architecture programming and Applications with 8085 by R Gaonkar, Penram International Publishing Pvt ltd.	2002
4	Circuits and Networks: Analysis and Synthesis, Sudhakar and ShyamMohan, TMH	2009
5	Electronic Communication Systems by G. Kennedy, Mc Graw Hill, 4th Edition	2008
6	Electronic Communications, 4th Edition, Roddy & Coolen.	2009

Course Name	**:**	**BASIC ELECTRICAL SCIENCES**
Course Code	**:**	**ESC 206**
Credits	**:**	**04**
L T P	**:**	**3- 0-2**

Course Objectives:

At the end of this course, the student should be able to acquire knowledge of analytical techniques to solve electrical circuits, basic electrical machines, and electrical measuring instruments.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**BASIC DEFINITIONS AND NETWORK THEOREMS** Basic definitions of voltage, current, power and energy. Nodes, branches, loops, mesh, Kirchhoff 's laws, nodal & mesh analysis. Circuit theorems: linearity, superposition, Norton, thevenin, max power transfer.	8
2	**AC CIRCUITS** Introduction, Generation of alternating voltage, sinusoidal waveform, phasor diagram, power relations in AC circuits, single phase AC circuits, Steady State Analysis: Nodal and Mesh analysis, Thevenin's, Norton's, Maximum Power Transfer theorems. AC Power Analysis: Instantaneous and average power, max average power transfer, RMS value, apparent power and power factor, complex power, conservation of AC power. THREE PHASE CIRCUITS**:** Phase sequence, Star and delta connection, Relation between line and phase voltages and currents in balanced systems, Analysis of balanced and Unbalanced three phase circuits, Measurement of active and reactive power.	10
3	**MAGNETICALLY COUPLED CIRCUITS** Mutual Inductance, Energy in a coupled circuit. Transformer : construction, equivalent circuit, voltage regulation, efficiency, OC and SC tests.	5
4	**DC MACHINES** Construction, emf and torque equations, circuit model, methods of excitation, characteristics of generators and motors, starting and speed control of dc motors, starters, losses, efficiency.	5
5	**AC MACHINES** Rotating magnetic field theory, three phase induction machines: General construction features, per phase equivalent circuit, approximate equivalent circuit, production of torque, slip, torque speed characteristics, no load and blocked rotor test to determine performance parameters, Starting: rotor rheostat starter, reduced voltage starting, star delta starting, centrifugal start. Synchronous motors: types, salient pole and cylindrical rotor, emf equation. Principle of operation of single phase induction motor, types and applications.	10
6	**BASIC MEASURING INSTRUMENTS** Introduction, Classification of instruments, essential features and operating principles, moving coil and moving iron instruments.	4

List of Experiments:		Number of Turns
1	Verification KCL and KVL	01
2	Verification of Ohm's Law	01
3	Verification of the principle of , superposition with ac and dc sources	01
4	Verification of Thevenin, and Nortan theorems.	01
5	Verification of maximum power transfer theorem in dc circuit.	01
6	To study resonance in series and parallel RLC circuits and plot various responses.	01
7	To verify the line voltage and phase voltage , and line current and phase current relationship in a star and delta three phase balanced circuit.	01
8	Measurement of active and reactive power in single-phase ac circuit.	01
9	To perform open and short circuit test on a 1-phase transformer and determine its equivalent circuit and efficiency	01
10	To study dc machine and determine open circuit characteristic.	02
11	To perform open circuit test and block rotor test on a 3 phase IM to draw equivalent circuit.	01
12	To perform load test on D.C. shunt motor.	01

Course Outcomes: By the end of this course, the student will be able to:	
1	Apply different techniques to solve electrical circuits.
2	Acquire the knowledge of electrical machines and electrical measuring instruments.
3	Design and conduct experiments, as well as analyze and interpret data.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	Fundamentals of Electric Circuits by Charles K Alexander and Matthew N O Sadiku, Mc Graw Hill Higher Education, 5th edition, ISBN 0073380571.	2012
2	Network Analysis & Synthesis by FF Kuo, Wiley International	1966
3	Electric Machinery and Transformers by Bhag S Guru & Huseyin R Hiziroglu, Oxford University Press, ISBN 0195138902.	1988
4	Semiconductor Physics and Devices: Basic Principles by Donald A Neamen, Irwin Professional Publishing, 3rd Revised edition, ISBN 0256242143	2006

Course Name	**:**	**MECHATRONICS**
Course Code	**:**	**ESC 207**
Credits	**:**	**04**
L T P	**:**	**3-1-0**

Course Objectives:

At the end of this course the student should be able to have basic knowledge of mechatronics and its interdisciplinary applications i.e. integration of Mechanical engineering with Electrical& Electronics Engineering and Computer Technology. He should be able to design and conduct experiments as well as to analyze and interpret data.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	**INTRODUCTION TO MECHATRONICS** Understanding Mechatronics. Key Elements of Mechatronics, Components of Mechatronics ,Human Being and Mechatronic System, Conventional and Mechatronic Approach, Advantages of Mechatronic Systems. Definition of System, Classification of System, Mechanistic System, Mechatronic System Intelligence.	04
2	**SENSOR AND TRANSDUCERS: PRINCIPLES AND APPLICATIONS** Role of Sensors and transducers in Mechatronics System , selection of sensors based on performance characteristics, static and dynamic characteristics); calibration; types of sensors , resistive transducers, inductive ,capacitive ,optical , thermal Transducer and their applications ,Measurement of : linear , angular position, displacement, rotational speed, force, pressure, strain, flow rate, temperature etc..	08
3	**SIGNAL CONDITIONING DEVICES** Role of signal conditioning **Processes** and devices in mechatronics, passive elements (RLC), semiconductors devices (PN junction diodes, AC rectification, Zener diode, Power supplies, transistors, Transistor (common emitter characteristics, emitter, follower circuit, FET); thyristor, TRIAC,DIAC, operational amplifiers (inverting, unity gain, non-inverting, C/V and V/C amplifiers, differential amplifier, instrumentation amplifier).Filters types of filters. **SIGNAL CONVERTING DEVICES**: Digital to analog converter (DAC) and Analog to Digital Converter (ADC), multiplexer.	09
4	**DIGITAL ELECTRONICS** Boolean algebra; digital electronic gates; combination logic systems (simple gates, NAND and NOR gates, latches, positive and negative logic, tri-state logic); sequential logic systems (J-K flip-flop, registers and counter, timers and pulse circuits).	05
5	**MICROPROCESSORS , MICROCONTROLLERS AND PLC'S** Fundamentals of microprocessor , the 8085, concept of interfacing memory, input /output devices , fundamentals of Microcontroller, T he 8051, PLC Hardware, PLC Memory structure, application	07

6	**ACTUATORS** Role of actuators in mechatronics, types of actuators, electrical actuators Physical principles; solenoid-type devices; DC machines; AC machines; stepper motors .Drive Technology Applications: Linear motors; voice coil motors; electro-pneumatic and electro-hydraulic actuators. Mechanical actuators :Rotary to linear motion conversion; power transmission, Electromechanical System Applications, Coupling, gearing, belts, pulleys, bearings.	07
7	**CASE STUDIES** Washing Machines, auto focusing camera, pick and place robot.	02

List of Experiments:		**Number of Turns**
1	To study various types of Resistors, Inductors, Capacitors, Diodes, Transistors, LED.	01
2	To study CRO, Function generator, Power Supply.	01
3	To study various components of Induction Machine and Synchronous Machine	01
4	To study various components of DC Machines and Transformers.	01
5	To obtain output voltage waveforms of half wave and full wave uncontrolled rectifier with and without filter capacitor.	02
6	To design a voltage regulator using Zener Diode and analyze the performance of the regulator for various loads. Also compare the performance with a linear voltage regulator.	02
7	To verify truth-tables of various flip-flops (J-K, D, Toggle etc.)	01
8	To study the characteristics of LVDT using linear displacement trainer Kit & compare with ideal characteristics.	01
9	To measure the strain of the metal strip using strain gauge trainer kit & compare with ideal characteristics.	01
10	To measure the angular displacement of resistive & capacitive transducer using angular displacement trainer kit & compare with ideal characteristics.	01
11	To obtain the characteristics of RTD, Thermistor, thermocouple with hot and cold junction thermal trainer kit & compare with ideal characteristics.	01

Course Outcomes: By the end of this course, the student will be able to:	
1	Students were able to have basic knowledge of mechatronics and its interdisciplinary applications i.e. integration of Mechanical engineering with Electronics
2	Students were able to design and conduct experiments

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Mechatronics, fourth edition, by W Bolton. ISBN 978-81-317-3253-3	2013
2	Dan Necsulescu Mechatronics published by Pearson Education (Singapore) Pvt. Ltd., Indian Branch, 482 FIE, Patparganj, Delhi India.	2001
3	Book by H M T Limited, Mechatronics Tata McGraw Hill Publishing Company Limited, New Delhi.	1988
4	Mechatronics Principles, Concepts & Applications by Nitaigour P Mahalik published by TMH	2003

Course Name	**:**	**MECHANICAL ENGINEERING DRAWING**
Course Code	**:**	**ESC**
Credits	**:**	**4**
L T P	**:**	**2-0-4**

Course Objectives:

At the end of this course, the student should be able to visualize objects and their graphical representations, understand the various engineering drawing symbols, conventions and other requirements of assembly and dis-assembly of mechanical engineering parts and materials and should be able to draw clear and understandable production drawings.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO ENGINEERING GRAPHICS:** System of Projections. Technical lettering. Drawing conventions, Orthographic projections. 3-views. Projection of oblique areas. Circular features. Dimensioning, Rules of dimensioning.	3
2	**ISOMETRIC PROJECTIONS:** General introduction to Isometric Projections. Conversion from orthographic to isometric projections and vice-versa. Freehand sketching.	3
3	Projections of Points, Lines and Planes. Geometrical Constructions.	5
4	Projection of Solids, sectioning. Auxiliary planes and views.	3
5	**REQUIREMENTS OF MECHANICAL ENGINEERING DRAWINGS:** Conventional representation, Layout of drawing sheet, symbols of standard tolerances, machining symbols. Introduction and familiarization of the code IS:296.	3
6	**FASTENERS:** Temporary and Permanent fasteners. Various types of screw threads, nuts and bolts, screws, welding joints and riveted joints.	3
7	**INTRODUCTION TO AUTOCAD:** Basic commands and features, simple exercises of points, lines, planes and solids on AutoCAD.	3
8	**ASSEMBLY AND DIS-ASSEMBLY DRAWING EXERCISES ON SOME OF THE FOLLOWING USING DRAWING SHEETS AS WELL AS AUTOCAD:** Couplings, Clutches, Knuckle and cotter joints, Pipe and pipe fittings, IC engine parts, Machine tool parts, Bearings, Screw Jack, Drill press vice.	5

List of Experiments:		**Number of Turns**
1	Drawing exercises on lettering, dimensioning, points, lines and planes	3
2	Drawing exercises on solids, sectioning and auxiliary planes	3
3	Drawing exercises on isometric and orthographic projections	2
4	Introduction to AutoCAD, familiarization with basic commands and features	2
5	Simple exercises of points, lines, planes, solids and sectioning of solids on AutoCAD	2
6	Drawing of machine parts on AutoCAD	2

Course Outcomes: By the end of this course, student will be able to	
1	Have knowledge of drawing symbols, conventions and methods of graphical representations.
2	Understand various machine components, their working and functions.
3	Able to read and understand mechanical engineering drawings.
4	Have working knowledge of the drafting package AutoCAD.
5	Able to understand and draw mechanical engineering drawings on AutoCAD.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Engineering Drawing by R. K. Dhawan	2012
2	Machine Drawing by R. K. Dhawan	2012
3	Engineering Drawing by P. S. Gill	2013
4	Machine Drawing by P. S. Gill	2013
5	Fundamentals of Engineering Drawing by Luzadder and Duff	2009
6	Engineering Graphics with AutoCAD by James D. Bethune	2011

TECHNICAL COMMUNICATION

Course Name	**:**	**TECHNICAL COMMUNICATION**
Course Code	**:**	**XXX-205**
Credits	**:**	**2**
L T P	**:**	**0-0-3**

Course Objectives:
At the end of the course the students should be able to effectively communicate as per their professional requirements.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Need for Effective Communication, Overview of Technical and Professional communication	**3**
2	Listening Skills, Reading Skills, Writing Skills	**3**
3	Writing Letters, Official E-mails, Job Applications, Resumes, Cover Letters, Notes. Case Studies	**6**
4	Overview of Research Writing. Information Gathering; Using the Library and Internet Modes, Organizing and Presenting According to Audience and Purpose. Writing Research Proposals, Project Technical Report/ Dissertation/Theses Writing. Case Studies.	**12**
5	Presentation Skills, Interview Skills, Group Discussion skills, Case Studies.	**9**
6	Technology Based Communication- Use of Visuals and Audio to Communicate Effectively.	**3**
7	Ethics, Attitude and Team Communication	**3**
8	Social Media/ Online Communication, Public Speaking; Developing an Authorial Voice	**3**

Course Outcomes: By the end of this course the student will be able to	
1	Develop effective technical communication.
2	Write technical documents in a professional manner.
3	Present professional requirements in an effective manner

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Meenakshi Raman and Sangeeta Sharma, "Fundamentals of Technical Communication", Oxford University Press, India	2014
2	Barun K Mitra, "Effective Technical Communication- A Guide for Scientists and Engineers" ,Oxford University Press, India	2006
3	David f Beer and David McMurrey, " Guide to Writing as an Engineer" ,2nd ed., Wiley	2004
4	Diane Hacker, " Pocket Style Manual", Bedford/St martin's.	2003

Course Name	**:**	**OPERATIONS RESEARCH**
Course Code	**:**	**MAN 401**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course , the students should be able to describe the need of Operations Research, develop the ability to form Mathematical models of Optimization problems, identify and solve linear models of Optimization problems, apply and to describe the limitations of classical methods to solve non-linear models of Optimization problems, apply and to describe the limitations of The Transportation Model ,Decision theory, Queuing Model.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Development of Operations Research, Definition of Operations Research, Characteristics of Operations Research, Scientific method in Operations Research, Necessity of Operations Research in industry, Scope of Operations Research	6
2	Formulation of Linear Programming problem , Graphical Solution, Simplex Method, Unrestricted variables, Artificial variables, M-Method, Dual Phase method	12
3	Introduction to the Transportation model, Assumption in the Transportation Model, Definition of the Transportation Model, Matrix terminology, Formulation and solution of Transportation Model	6
4	Decision theory, Steps in Decision theory approach, Decision making environments, Decision making under conditions of certainty, Decision making under conditions of uncertainty, Decision making under conditions of risk, Maximum likelihood criterion	6
5	Queuing Model, Introduction, Application of Queuing Model, Elements of Queuing System, Operating characteristics of Queuing System, Waiting time and idle time costs.	6
6	Non – Linear Programming, Introduction , Local and Global optimum, Concave and Convex functions, Types of non-linear programming problems.	6

Course Outcomes: By the end of this course, the students will be able to :	
1	Form Mathematical model of Optimization problems
2	Distinguish between linear and non-linear models
3	Solve simple problems of The Transportation Model
4	Solve simple problems of Decision theory
5	Solve simple problems of Queuing Model

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Operations Research" , Ravindran , Phillips , and Solberg , 2nd edition, John Wiley & sons .	2000
2	"Engineering Optimization" , S S Rao , 3nd edition, New Age .	2000
3	"Operations Research", Kantiswarup, Gupta P.K. & Sultan Chand & Sons .	2007
4	"Operations Research", Sharma S.D., Kedarnath, Ramnath & Company .	1994
5	"Operations Research", Bronson R, Shaum's Outline Series .	1997

Course Name	**:**	**OPTIMIZATION TECHNIQUES**
Course Code	**:**	**MAN 402**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the student shoule be able to describe the need of Optimization Techniques , develop the ability to form mathematical model of optimization problems , identify and solve linear models of optimization problems , apply and to describe the limitations of classical methods to solve nonlinear models for optimization problems , apply and to describe the limitations of gradient based and direct iterative methods to solve nonlinear problems.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**LINEAR PROGRAMMING** Formulation, Graphical solution, Simplex method , Relation between Graphical and Simplex method, Unrestricted variables, Artificial variables, M-Method and Dual Phase method	**(14)**
2	**OPTIMIZATION TECHNIQUES** **UNCONSTRAINED PROBLEMS -** (Single and multivariable optimization) Necessary and sufficient conditions for extreme points **CONSTRAINED PROBLEMS - (**multivariable optimization) Equality constraints , Jacobian and Lagrangean methods , Application of Jacobian method to linear problems	**(12)**
3	**NON-LINEAR PROGRAMMING PROBLEMS** Geometric Programming **UNCONSTRAINED ALGORITHMS –** Direct methods, Dichotomous and Golden search ; Univariate and Hooke and Jeeves search methods ; Gradient methods , Cauchy's steepest ascent method and Newton's method.	**(12)**
4	**PROGRAMMING TECHNIQUES** Separable programming ,Geometric Programming	**(4)**

Course Outcomes:	
1	Form mathematical model of optimization problems
2	Distinguish between linear and nonlinear models .
3	Solve simple problems using classical / iterative methods .

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Operations Research , Ravindran , Phillips , and Solberg, 2nd edition 2000 , John Wiley & sons .	2000
2	Operations Research by Hamady Taha, 8th edition	
3	Engineering Optimization , S S Rao , 3rd edition 2000 , New Age .	2000
4	Operations Research 9th Edition, Kantiswarup, Gupta P.K. & Sultan Chand & Sons .	
5	Operations Research 8th Edition, Sharma S.D., Kedarnath, Ramnath & Company .	
6	Operations Research 2nd Edition, Bronson R, Shaum's Outline Series .	
7	P. Sankara Iyer, "Operations Research", Tata McGraw-Hill, 2008.	2008
8	J K Sharma., "Operations Research Theory & Applications , 3e", Macmillan India Ltd, 2007	2007
9	P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.	2007

Course Name	**:**	**ADVANCED PHYSICS**
Course Code	**:**	**PYN-401**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course the students should be able to describe and implement concepts and principles of Quantum Mechanics required for in depth understanding of Physical phenomena of materials in relation to applications in Engineering. The students should be able to solve numerical problems in Nuclear and Solid State physics.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Quantum theory of light, X-rays - production, spectrum & diffraction(Bragg's Law), photoelectric effect, compton effect, pair production, photons & gravity, black holes, de-Broglie hypothesis, particle diffraction, uncertainty principle and applications. Postulates of quantum mechanics, Schrodinger theory, time-dependent and time-independent Schrodinger equation, wave function, Born interpretation and normalization, expectation values.	10
2	Particle in a box (infinite well potential), finite potential step and barrier problems, tunneling, linear harmonic oscillator (one-dimensional). Hydrogen atom, radiative transitions and selection rules, electron spin, Stern-Gerlach experiment, Spin-orbit coupling, exclusion principle, symmetric and anti-symmetric wave functions. Alpha decay, Zeeman Effect, Correspondence Principle, Angular Momentum in Quantum Mechanics.	10
3	Natural radioactivity, successive radioactive transformations, radioactive equilibrium, radioactive series, radiometric dating. Nuclear force and its characteristics, Elementary description of shell model, explanation of magic numbers, liquid drop model and semi-empirical binding energy formula. Nuclear fission, fission products, mass and energy distribution of fission products, neutron emission and energy distribution of neutrons emitted in fission, theory of fission process, nuclear reactors - classification, neutron cycle in thermal reactors and four-factor formula for neutron reproduction, nuclear fission - controlled thermonuclear reactions. Artificial radioactivity and its application, Beta-decay (energy spectrum & discovery of neutrino), fusion reactions in stars.	10
4	Band theory of solids, Kronig-Penney Model (qualitative), conductors, insulators and semiconductors, p-type and n-type semiconductors, statistics of electrons and holes, Hall effect (for single as well as both type of charge carriers).	6
5	Occurrence of superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, heat capacity, isotope effect, thermodynamical considerations, London equations & penetration depth, coherence length, BCS theory (elementary description), applications of superconductors. High temperature superconductivity, Josephson junctions.	6

Course Outcomes: By the end of this course:	
1	Students will be able to solve numerical problems in Quantum Mechanics, Nuclear and Solid State Physics.
2	Students will be aware of latest developments in certain areas of Physics like condensed matter physics, superconductivity etc. which have important applications for societal needs.
3	Students will be able to correlate the various phenomena with quantum mechanical concepts.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Concepts of Modern Physics", Arthur Beiser, McGraw Hill Education (India) Pvt. Ltd., New Delhi.	2013
2	"Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Robert Eisberg and	2013

	Robert Resnick, Wiley India Pvt. Ltd., New Delhi	
3	"Introductary Nuclear Physics", Kenneth S Krane, Wiley India Pvt. Ltd., New Delhi	2014
4	"Modern Physics", J. Bernstein, P.M. Fishbane and S.G. Gasiorowicz, Pearson, Education India Pvt. Ltd., New Delhi	2009

Course Name	**:**	**CRYSTAL PHYSICS**
Course Code	**:**	**PYN-402**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
During this course students will understand basics of crystal structure and correlate the same with different material properties. They will be able to describe the concepts of lattice dynamics and crystal binding forces and correlate the same with thermal properties.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**CRYSTAL STRUCTURES** - Periodic array of atoms, Lattice, basis, primitive cell, two and three dimensional lattice types, miller indices, examples of crystal structures (NaCl, CsCl structures), Hexagonal closed packed, diamond, zinc sulfide structures, x-ray diffraction of crystal, Bragg's Law, reciprocal lattice, diffraction condition, Laue equation, structure factor, atomic form factor.	12
2	**CRYSTAL BINDING** - van der waals interaction, repulsive interaction, equilibrium lattice constant, cohesive energy, ionic crystals, covalent crystals, electrostatic energy, Madelung constant.	10
3	**PHONONS AND CRYSTAL VIBRATIONS** - monoatomic basis, first Brillouin zone, dispersion relation, two atoms per primitive basis, quantization of elastic waves, phonon momentum, inelastic scattering by phonon.	10
4	**THERMAL PROPERTIES** - phonon heat capacity, density of states, Einstein model, Debye model of heat capacity, inharmonic crystal interaction, thermal expansion. Thermal conductivity, Umklapp Processes.	10

Course Outcomes: By the end of the course	
1	Students will be able to solve the problems based on crystal structure and thermal properties of solids
2	Understand and apply the basic concepts of crystal binding and crystal vibrations in different phenomena.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Introduction to Solid State Physics", Charles Kittel, Wiley India Pvt. Ltd., New Delhi	2012
2	"Solid State Physics", S.O. Pillai, New Age International (P) Limited, New Delhi	2010
3	"Crystallography Applied to Solid State Physics", Verma and Srivastava, New Age International (P) Limited, New Delhi	2012

Course Name	**:**	**SOLID STATE PHYSICS**
Course Code	**:**	**PYN-403**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
During this course students will understand basics of free electron theory. They will study the origin of energy gaps on the basis of quantum mechanics approach. They will cover advance topics in dielectrics. Superconductivity will also be covered and student's interest will be created in possibility of high temperature superconductivity.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Free electron theory, energy levels in one dimension, free electron gas in three dimension, heat capacity of electron gas, electrical conductivity and ohm's law, experimental electrical resistivity of metals, Hall Effect.	12
2	Energy bands, origin of energy gap, bloch functions, Kronig-Penny model, brillouin zones, metals and insulators.	10
3	Dielectric function of the electron gas, plasma optics, dispersion relation of electromagnetic wave, transverse optical modes in plasma, longitudinal plasma oscillations, polaritons, electron-phonon interaction polarons, optical processes and excitons.	12
4	Occurrence of superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, heat capacity, isotope effect, thermodynamical considerations, London equations & penetration depth, coherence length, BCS theory (elementary description), applications of superconductors. High temperature superconductivity, Josephson junctions.	8

Course Outcomes: By the end of the course, student will be able to	
1	Solve the problems based on free electron theory and band theory of solids.
2	Understand and apply the basic concepts of plasma optics and superconductivity in different phenomena.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Introduction to Solid State Physics", Charles Kittel, Wiley India Pvt. Ltd., New Delhi	2012
2	"Solid State Physics", S.O. Pillai, New Age International (P) Limited, New Delhi	2010
3	"Crystallography Applied to Solid State Physics", Verma and Srivastava, New Age International (P) Limited, New Delhi	2012

Course Name	**:**	**MODERN INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**
Course Code	**:**	**CHN 401**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course, the student should be able to introduce the principles of chemical analysis, matrix effects, detailed instrumentation, operation and interpretation of data, error analysis and statistical methods of data handling.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**SPECTROSCOPIC TECHNIQUES:** UV – Visible, Infra red, NMR, and Mass Spectroscopy-Principles Instrumentation and Applications	10
2	**ATOMIC ABSORPTION SPECTROMETRY AND EMISSION SPECTROMETRY:**	8

	Inductively coupled plasma atomic emission spectroscopy (ICP-AES) - Principles Instrumentation and Applications	
3	**OPTICAL MICROSCOPY**: Scanning Electron Microscopy (SEM),Transmission Electron Microscopy (TEM) and Scanning Transmission Electron Microcopy (STEM) -Principles and Applications	6
4	**X-RAY TECHNIQUES**: XRD, XRF, XPS-Principles and Applications	8
5	**THERMAL ANALYSIS**: DTA, TGA- Principles Instrumentation and Applications	5
6	**CHROMATOGRAPHIC ANALYSIS**: GC, HPLC- Principles Instrumentation and Applications	5

Course Outcomes: By the end of this course, the student will be able to:	
1	Handle the analysis of mg, ppm and ppb levels of analyte by appropriate instrumental methods.
2	Carry out Chemical analysis of hazardous materials, environmental samples, inorganic, organic and biomaterials at trace and ultra trace quantities.
3	Differentiate among molecular absorption, atomic absorption and atomic emission spectrometry.
4	Carry out hands on experiments in the field related to analysis of materials required for technological developments and in advanced research in Engineering.
5	Differentiate between classical and instrumental methods of Chemical analysis.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Interpretation of Mass Spectra", McLafferty F.W., 3rd Edition, Pubs: W.A. Benzamine, New York.	1993
2	"Spectrometric Identification of Organic Compounds", Silverstein R.M. and Bassler G.S., 5th Edition, Pubs: John Wiley.	1991
3	"Instrumental Analysis", Willard H.H., Merritt L.L. and Dean J.A., 7th Edition, Pubs: Van Nostran Reinhold.	1998
4	"Instrumental Analysis", Skooq D.A. Holler F. J. and Crouch S. R., Pubs: Brooks/Cole.	2007
5	"Analytical Chemistry", Christian G.D., 5th Edition, Pubs: John Wiley.	1994
6	"X-ray structure determination a practical guide", Stout G.H. and Jeansen L.H., Pubs: John Wiley & Sons, New York.	1989
7	"Crystal structure analysis for chemists and biologists", Glusker J.P., Lewis M, Pubs: VCH Publisher inc., New York.	1994
8	"Structure Determination by X-ray crystallography", Ladd, M.F.C. and Palmer R.A., Pubs: Plenum Press, New York.	1994

Course Name	**:**	**PRINCIPLES OF MANAGEMENT**
Course Code	**:**	**HSM 401**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:

The main aim of this course is to make students understand the management process and principles along with its application in practical life and to help them manage different jobs and situations with the help of management functions.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO MANAGEMENT** Nature of Management: Art or Science, Principles and Functions of Management	**3**
2	**EVOLUTION OF MANAGEMENT THOUGHT**	**6**

	Classical Theories: Bureaucratic, Scientific and Administrative Approach Neo-Classical Theories: Human Relations and Human Behaviour Approach Modern Theories of Management Relevance of Management Thought in present scenario – Management Cases	
3	**PLANNING** Nature of Planning, Planning Process, Application of Planning Process in a Hypothetical Situation, Types of Planning, Types of Plans, Management by Objective (MBO)	**4**
4	**ORGANIZING** Concept of Organization, Departmentation, Forms of Organization Structure Analysis of Organization Structure – Case Studies Hypothetical Formation of an Organization	**4**
5	**STAFFING** Human Resource Planning: HRP Process, Job Analysis: Job Description, Job Specifications and Used of Job Analysis Recruitment: Sources and Methods Selection: Selection Process, Role Playing and Case Study on Selection Tests and Interviews Training and Development: Techniques, Performance Appraisal: Methods Case Study on Staffing Practices	**6**
6	**DIRECTING** Concept, Leadership: Importance and Styles, Motivation: Theories and their relevance in present scenario, Communication: Process, Types and Barriers of Communication Management Game on Leadership, Motivation and Communication	**3**
7	**CONTROLLING** Nature and Process of Controlling, Requirements for Effective Controlling	**2**

Course Outcomes:	
1	The students will be able to apply management concepts and principles in daily life and thus, will be able to manage things efficiently and effectively.
2	The students will learn how to get work done easily by using management knowledge and functions.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Principles and Practices of Management", Rao V.S.P. and Narayana P.S., Pubs: Konark Publishers.	1987
2	"Principles & Practice of Management", Prasad L.M., 8th Edition, Pubs: Sultan Chand & Sons.	2012
3	"Essentials of Management: International and Leadership Perspective", Weihrich H. and Koontz H., 9th Edition, Pubs: McGraw Hill.	2012
4	"The New Era of Management", Daft R.L., 11th Edition, Pubs: Cengage Learning.	2014
5	"Management: Text and Cases", Rao V.S.P. and Krishna V.H., Pubs: Excel Books.	2008
6	"Fundamentals of Management: Essential Concepts and Applications", Robbins S.P, DeCenzo D.A., Bhattacharya S. and Agarwal M.N., 6th Edition, Pubs: Pearson India.	2009

Course Name	**:**	**BUSINESS ENVIRONMENT AND BUSINESS LAWS**
Course Code	**:**	**HSM 402**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to make students understand different types of environment influencing business decisions and to provide knowledge about different laws that needs to be followed for initiating and managing business.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO BUSINESS** Scope and Characteristics of Business, Classification of Business Activities Forms of Ownership of Business: Sole Proprietorship, Partnership and Company	**5**
2	**BUSINESS ENVIRONMENT** Internal Environment: Concept and Elements (Value System, Vision Mission Objectives, Management Structure, Human Resources, Company Image etc.) SWOT Analysis: Concept and Case Study External Environment: Micro Environment (Suppliers, Customers, Competitors, Market Intermediaries etc.) and Macro Environment – PESTEL Analysis (Political, Economic, Social, Technological, Ecological and Legal), Case Study on Impact of Environment on Business	**7**
3	**GLOBALIZATION** Concept, Pros and Cons of Globalization, Impact of Global Environment on Business Globalization of Company – Case Study	**4**
4	**CORPORATE SOCIAL RESPONSIBILITY** Concept, Social Responsibility towards different stakeholders, Rationale for CSR CSR – Case Studies	**2**
5	**CORPORATE GOVERNANCE** Concept, Elements and Essentials of Good Governance	**3**
6	**CONTRACT LAW** Concept, Types and Essentials Elements of Contract	**3**
7	**PARTNERSHIP LAW** Nature of Partnership, Provisions of Partnership Act, Issues Related to Partnership Firm, Hypothetical Formation of a Partnership Firm	**2**
8	**COMPANY LAW** Nature of Company, Provisions of Company Act, Issues Related to Incorporation of Company, Hypothetical Formation of a Company	**2**

Course Outcomes:	
1	The students will be able to analyze the impact of environment on business and formulate appropriate business strategies to compete in the competitive world.
2	The students will learn how companies follow corporate governance and social responsibility practices along with fulfilling economic objectives.
3	The students will gain knowledge about application and implementation of various business laws in practice.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Business Environment: Text and Cases", Cherunilam F., 22nd Edition, Pubs: Himalaya Publications.	2013
2	"Legal Aspects of Business", Pathak A., 5th Edition, Pubs: McGraw Hill Education.	2013

3	"Essential of Business Environment: Text, Cases and Exercises", Aswathappa K., 11th Edition, Pubs: Himalaya Publication.	2011
4	"Business Law Including Company Law", Gulshan S.S. and Kapoor G.K., 15th Edition, Pubs: New Age International (p) Ltd.	2011
5	"Business Law and Corporate Laws", Tulsian P.C., 1st Edition, Pubs: Sultan Chand Publishing.	2011
6	"Fundamentals of Business Organization & Management", Bhushan Y.K., 19th Edition, Pubs: Sultan Chand & Sons.	2013
7	"Corporate Governance: Principles, Policies and Practices", Fernando A.C., 2nd Edition, Pubs: Pearson India.	2011

Course Name	**:**	**FINANCIAL MANAGEMENT**
Course Code	**:**	**HSM 404**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to make students learn different financial decisions i.e. investing, financing and dividend, required to be taken by a company and provide knowledge about the functioning of the financial system (financial markets, financial institutions, financial services and financial instruments) of the country.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO FINANCIAL MANAGEMENT** Concept of Finance, Terminology Related to Finance, Financial Decisions, Factors Affecting Financial Decisions, Risk-Return Trade-Off	**3**
2	**FINANCIAL SYSTEM** Concept and Role of Financial System in Indian Economy	**2**
3	**FINANCIAL MARKETS AND INSTRUMENTS** Concept and Relevance of Money Market and Capital Market Money Market Instruments: Call Money, Treasury Bills, Commercial Papers, Certificate of Deposits Capital Market Instruments: Equity Shares, Preference Shares and Debentures Hypothetical Trading in Financial Markets	**5**
4	**FINANCIAL SERVICES** Nature and Functions of Financial Services: Merchant Banking, Mutual Funds, Factoring, Forfaiting, Credit Rating Case Study on Financial Services	**6**
5	**FINANCIAL INSTITUTIONS**	**2**

	Nature and Functions of Financial Institutions: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Discount and Finance House of India (DFHI)	
6	**LONG TERM INVESTMENT DECISIONS** Capital Budgeting: Concept, Importance, Factors Techniques/Methods with Numerical Applications (Pay Back Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index), Case Study	**3**
7	**SHORT TERM INVESTMENT DECISIONS** Working Capital: Nature, Type and Factors Affecting the Requirement of Working Capital, Case Study	**2**
8	**FINANCING DECISIONS** Capital Structure: Essentials and Approaches of Capital Structure Sources of Finance (long-term and short-term), Financial Leverage: Concept and Numerical Application, Case Study	**3**
9	**DIVIDEND DECISIONS** Types of Dividend, Dividend Policy: Nature and Factors Affecting Dividend Policy, Case Study	**2**

Course Outcomes:	
1	The students will learn to make best combination of financial decisions by considering risk and return trade-off.
2	The students will identify how business can gain maximum through the financial system.
3	The students will understand how to manage funds effectively so as to maximize returns.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Financial Management", Shah P., 2nd Edition, Pubs: Dreamtech Press	2009
2	"Financial Markets and Services", Gordon E. and Natarajan K., 3rd Edition, Pubs: Himalaya Publishing House.	2006
3	"Financial Management: Theory and Practice", Chandra P., 8th Edition, Pubs: McGraw Hill Education (India).	2012
4	"Financial Management", Pandey I.M., 10th Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.	2010
5	"Cases in Financial Management", Pandey I.M. and Bhat R., 3rd Edition, Pubs: McGraw Hill Education (India).	2012
6	"Financial Institutions and Markets: Structure, Growth and Innovations", Bhole L.M. and Mahakud J., 5th Edition, Pubs: McGraw Hill Education (India).	2009
7	"The Indian Financial System: Markets, Institutions and Services", Pathak B.V., 3rd Edition, Pubs: Pearson India.	2010
8	"Financial Management and Policy", Horne J.C.V. and Dhamija S., 12th Edition, Pubs: Pearson India.	2011

Course Name	**:**	**MARKETING MANAGEMENT**
Course Code	**:**	**HSM 405**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to make students understand about the marketing concepts to be applied in real life and the marketing process for delivering value to customers.

Total No. of Lectures –28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO MARKETING** Concepts, Role, Scope and Types of Marketing, Case Study on Marketing Management	**3**
2	**MARKETING RESEARCH** Scope and Process of Marketing Research, Hypothetical Marketing Research Analysis	**3**
3	**CONSUMER AND BUSINESS MARKETS** Types of Markets, Building Customer Value Consumer and Business Buying Behaviour: Factors Influencing Behaviour and Buying Decision Process	**4**
4	**SELECTION OF MARKETS** Segmentation: Factors and Bases, Targeting and Positioning Preparation of STP of Selected Product	**3**
5	**MARKETING MIX** 7 P's of Marketing Mix: Product, Price, Physical Distribution, Promotion, People, Process and Physical Evidence Formulation of Marketing Mix of Selected Product	**3**
6	**PRODUCT DECISIONS** Product (Good or Service) Characteristics, Product Life-Cycle, Packaging and Branding, Product Development and Management	**3**
7	**PRICING DECISIONS** Pricing Policies and Strategies, Factors Influencing Pricing	**3**
8	**PHYSICAL DISTRIBUTION DECISIONS** Marketing Channels, Channel Players, Physical Distribution, Managing Distribution, Analysis of Supply Chain Management – Case Studies	**3**
9	**PROMOTION DECISIONS** Nature of Promotion Decisions, Managing Mass Communication and Personal Communication Analysis of Promotional Strategies – Case Studies	**3**

Course Outcomes:	
1	The students will learn how to market goods and services effectively to different segments so as to deliver value to customers.
2	The students will be able to formulate marketing mix and marketing strategies for different products and different sets of customers.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Marketing Management: Concepts, Cases, Challenges and Trends", Govindarajan M, 2nd Edition, Pubs: PHI Learning.	2009
2	"Marketing Management", Kotler P., Keller K.L., Koshy A. and Jha M., 14th Edition, Pubs:	2012

	Pearson India.	
3	"Marketing Concepts and Strategies", Dibb S., Simkin L., Pride W.M. and Ferrell O.C., Pubs: Cengage Learning.	2012
4	"Marketing Management", Kumar A. and Meenakshi N., 2nd Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.	2011
5	"Marketing Management", Saxena R., 4th Edition, Pubs: McGraw Hill Education (India).	2013
6	"Marketing: Managerial Introduction", Gandhi J.C., 1st Edition, Pubs: McGraw Hill Education.	1987
7	"Marketing", Etzel M.J., Walker B.J., Stanton W.J. and Pandit A., 14th Edition, Pubs: McGraw Hill Education (India).	2010
8	"Super Marketwala: Secrets to Winning Consumer India", Mall D., 1st Edition, Pubs: Random House India.	2014

Course Name	**:**	**HUMAN RESOURCE MANAGEMENT**
Course Code	**:**	**HSM 406**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to provide an overview of HRM, keeping the Indian business scenario in the background and to acquaint the students with the strategic role of HRM in managing an organization.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO HUMAN RESOURCE MANAGEMENT** HRM: Nature, Scope, Functions, HRM Practices and Problems in India with Case Studies	**4**
2	**HUMAN RESOURCE PLANNING (HRP)** Concept and Process of HRP, Factors Affecting HRP	**3**
3	**JOB ANALYSIS AND DESIGNING** Uses and Process of Job Analysis, Job Description and Job Specification: Features and Hypothetical Formulation, Job Designing: Job Enrichment, Job Enlargement	**3**
4	**RECRUITMENT AND SELECTION** Recruitment: Sources and Methods Selection: Selection Process, Selection Tests, Types and Nature of Interviews Role Playing and Case Study on Selection Process, Tests and Interview	**4**
5	**INDUCTION AND INTERNAL MOBILITY** Induction Programme, Need and Scope of Internal Mobility: Transfer, Promotion, Demotion	**3**
6	**TRAINING AND DEVELOPMENT** Training: Need and Methods, Management Development: Need, Methods and Management Development Programme	**4**

	HRM Games for Development of Employees	
7	**PERFORMANCE APPRAISAL AND COMPENSATION** Nature and Methods of Performance Appraisal, Hypothetical Performance Appraisal Compensation: Financial and Non-Financial Benefits	**4**
8	**EMPLOYEE HEALTH AND SAFETY** Concept, Issues related to Health and Safety, Workplace Health Hazards	**3**

Course Outcomes:	
1	The students will develop the ability to solve problems in area of HRM in organizations.
2	The students will become aware of latest developments in HRM practices which are essential for effective management in organization.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Human Resource Management: Text and Cases", Rao V.S.P., Pubs: Excel Books.	2002
2	"Human Resource Management", Dessler G. and Varkkey B., 12th Edition, Pubs: Pearson India.	2011
3	"Human Resource Management: Text and Cases", Aswathappa K., 7th Edition, Pubs: McGraw Hill Education (India).	2013
4	"Human Resource Management: Text and Cases", Gupta C.B., 14th Edition, Pubs: Sultan Chand and Sons.	2012
5	"Human Resource Management: Text and Cases", Bedi S.P.S. and Ghai R.K., Pubs: Bharti Publications.	2012
6	"Human Resource Management Applications: Cases, Exercises, Incidents and Skill Builders", Fottler M.D., McAfee R.B. and Nkomo S.M., 7th Edition, Pubs: Cengage Learning.	2013

Course Name	**:**	**MANAGING INNOVATION AND CHANGE**
Course Code	**:**	**HSM 431**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to make students learn how to manage innovation and change in organizations and understand how innovation and change can contribute to business success.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO INNOVATION AND CHANGE** Concept, Types, Sources, Components, Invention vs. Innovation	4

2	**INNOVATION IN ORGANIZATION** Innovation in Managerial Functions (Planning, Organizing, Staffing, Directing and Controlling), Innovation in Operational Functions (Marketing, Human Resource and Finance) Case Studies and Brainstorming Sessions	3
3	**INNOVATION POLICY** Innovation Cluster, National Innovation Systems	3
4	**INNOVATION MANAGEMENT** Innovation Management: Innovation Strategies, Models, Processes and Structures Case Study on Innovation Management	4
5	**REACTIONS TO CHANGE** Process of Planned Change, Responses to Change, Reasons for Resistance to Change, Change Agents, Stages in Reaction to Change	5
6	**CHANGE MANAGEMENT** Key Dimensions and Factors, Organizational Change, Approaches to Change Management Case Study on Change Management	4
7	**INTELLECTUAL PROPERTY RIGHT (IPR)** Patents, Copyrights and Trademarks	3
8	**DISCUSSIONS ON ADDITIONAL READING** (any one of the following in the semester) - 8 Steps to Innovation – Going from Jugaad to Excellence - Innovation Secrets of Indian CEOs - Jugaad Innovation: A Frugal and Flexible Approach to Innovation for the 21st Century - The Ten Faces of Innovation	2

Course Outcomes:	
1	The student will learn the technological, human, economic, organizational, social and other dimensions of innovation.
2	The students will understand how to encourage, manage and implement innovation and change in organization and how to take a new idea to the stage where it can be implemented.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Managing Change and Transition", Harvard Business School, Pubs: Harvard University Press.	2003
2	"Managing Creativity and Innovation", Harvard Business School, Pubs: Harvard University Press.	2003
3	"Managing Change, Creativity and Innovation", Dawson P. and Andriopoulos C., Pubs: Sage Publications.	2014
4	"Managing Strategic Innovation and Change", Tushman M.L. and Anderson P., 2nd Edition, Pubs: Oxford University Press.	2004
5	"The International Handbook of Innovation", Larisa V.S., Pubs: Elsevier Science.	2003
6	"Managing Innovation and Change", Mayle D., 3rd Edition, Pubs: Sage Publications.	2006
7	"Managing Technology and Innovation for Competitive Advantage", Narayanan V.K., Pubs:	2002

	Pearson India.	
8	"Managing Technological Innovation, Competitive Advantage from Change", Betz F., Pubs: Wiley.	2011

Course Name	**:**	**BUSINESS RESEARCH**
Course Code	**:**	**HSM 432**
Credits	**:**	**4**
L T P	**:**	**2-2-0**

Course Objectives:
The main aim of this course is to make students understand the concepts of business research and learn the methods to formulate, analyze and interpret the business problems.

Total No. of Lectures – 28

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO BUSINESS RESEARCH** Concept and Types of Business Research	3
2	**PROBLEM IDENTIFICATION** Defining Problem, Literature Review: Essentials of Literature Review and Writing of Review, Research Objectives: Essentials of Research Objectives and its Formulation	3
3	**FRAMEWORK FOR BUSINESS RESEARCH** Research Questions, Hypothesis: Essentials of Hypothesis and its Formulation, Types of Variables	2
4	**INTRODUCTION TO RESEARCH DESIGN** Purpose and Scope of Research Design, Research Proposal: Elements and Framing a Research Proposal	2
5	**MEASUREMENT SCALES** Rating Scales, Ranking Scales, Reliability, Validity, Questionnaire: Essentials of Questionnaire, Developing a Questionnaire on a Hypothetical Research Problem	4
6	**SAMPLING DESIGN** Concept, Process and Techniques of Sampling, Framing of Sampling Design	3
7	**DATA COLLECTION** Sources and Methods of Data Collection	3
8	**PRESENTATION AND ANALYSIS OF DATA** Tabular, Graphic and Diagrammatic Presentation of Data, Statistical Data Analysis, Presentations and Analysis of Data using MS Excel	5
9	**RESEARCH REPORT** Contents and Characteristics of Project Report, Formulation of Project Report	3

Course Outcomes:	
1	The students will develop ability to tackle problems in business by following research techniques.
2	The students will learn to collect the right data and to analyze and present the data in the right way.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Research Methods for Business: A Skill Building Approach", Sekaran U. and Bougie R., 5th Edition, Pubs: Wiley India Pvt. Ltd., New Delhi.	2011

2	"Research Methodology: Methods and Techniques", Kothari C.R. and Garg G., 3rd Edition, Pubs: New Age International.	2014
3	"Business Research Methods", Bryman A. and Bell E., 2nd Edition, Pubs: Oxford University Press.	2010
4	"Business Statistics", Beri G.C., 3rd Edition, Pubs: McGraw Hill Education (India).	2009
5	"Statistics for Management", Levin R.I., Rubin D.S., Rastogi S. and Siddiqui M.H., 7th Edition, Pubs: Pearson India.	2012
6	"Business Research Methods and Statistics using SPSS", Burns R.P. and Burns R., 1st Edition, Pubs: Sage Publications.	2008
7	"Statistics for Management", Srivastava T.N. and Rego S., 2nd Edition, Pubs: McGraw Hill Education (India).	2012

Course Name	**:**	**ALGEBRA - I**
Course Code	**:**	**MAN 431**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to describe the basic results of Group Theory. They should be able to recognise examples of groups. They should know the definitions of basic terms and should be able to write elements of the symmetric group as cycles or products of transpositions, should know simple uses of Lagrange's Theorem, quotients and products of groups. They should know difference between finding a proof from the axioms that works for all groups, and finding a counter example.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Definition of a group, examples, some preliminary lemmas, Subgroups, examples, Cosets, Order of a group, Lagrange's Theorem,Euler's Theorem, A counting principle.	10
2	Normal subgroups and quotient groups, Homomorphism, Cauchy's Theorem, Sylows Theorem, Automorphism, Cayley's Theorem, Permutation groups, Conjugacy classes, Sylow subgroups and Sylow's Theorem,	16
3	Direct products, Finite abelian groups.	6
4	Vector Spaces: Elementary basic concepts, Linear independence and bases, Dual Spaces.	10

Course Outcomes:	
1	By the end of the course, the students will be able to describe the basic results of Group Theory, recognise examples of groups, know the definitions of basic terms, such as: order of a group, order of an element, subgroup, cyclic group and isomorphism. They will also be able to prove simple consequences, write

	elements of the symmetric group as cycles or products of transpositions, describe quotients and products of groups.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Topics in Algebra", Herstein, I.N., Wiley Eastern Limited, New Delhi.	1981
2	"Modern Algebra", Singh, S and Zameeruddin, Q ,Vikas Publishing House, New Delhi	2015
3	"Rings and Modules", Musili, C, Narosa Publishing House, (Second Revised Edition),New Delhi.	1994.
4	"Algebra", Artin, M. Prentice Hall of India, New Delhi.	1994
5	"The Theory of Groups of Finite Order", Burnside, W. (2nd Ed.), Dover, New York.	1955

Course Name	**:**	**NUMBER THEORY**
Course Code	**:**	**MAN 432**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to describe the fundamental properties of integers and to prove basic theorems. They should be able to solve congruences and Diophantine equations. They should also be able to approximate reals by rationals.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Introduction, Divisibility, Greatest common divisor, The Euclidean algorithm, primes, Fundamental theorem of Arithmetic,	8
2	Congruences, Residue classes and reduced residue classes, Fermat's theorem, Euler's theorem, Wilson Theorem, Solution of congruences , congruences of degree1, Chinese Remainder theorem with applications. Euler's φ-function,	12
3	Congruences of higher degree, prime power modulii, prime modulus, Primitive roots, Indices and their applications, power residues, Quadratic residues, Quadratic reciprocity, Legendre Symbol, Euler's criterion, Gauss's Lemma, Quadratic reciprocity law, Jacobi symbol,	10
4	Greatest integer function, arithmetic function, Mobius inversion formula, Diophantine equations Farey sequences,Continued fractions, approximations of reals by rationals.	12

Course Outcomes: By the end of the course, the students will be able to	
1	Describe the fundamental properties of integers.
2	Prove basic theorems.
3	Solve congruences.
4	Sove Diophantine equations
5	Approximate reals by rationals

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/**

		Reprint
1	"An introduction to theory of numbers", Niven I., Zuckerman S. H. and Montgomary L. H.John Wiley and Sons .	1991
2	"Theory of Numbers", Hardy and Wright W. H.Oxford University Press	1979
3	"Higher arithmetic", Davenport H.Cambridge University Press .	1999.
4	"Elementary Number Theory", David M. Burton, Wm.C.brown Publishers, Dubuque, Ivova .	1989

Course Name	**:**	**FOURIER SERIES AND INTEGRAL TRANSFORMS**
Course Code	**:**	**MAN 433**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to expand functions in Fourier series, Fourier Integrals and learn Fourier sine and cosine Transforms, Harmonic analysis and their applications. The students should be able to evaluate Laplace transforms and Inverse Laplace transform. The students should be able to apply Laplace transforms to solve ordinary differential equations.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Periodic functions, Trigonometric series, Fourier Series, Euler's formulae, Conditions for existence of Fourier series, Functions of any period p = 2L, Even and odd functions, Half range expansions, Complex Fourier series, Applications of Fourier series, Parseval's identity, Harmonic analysis. Approximation by Trigonometric Polynomials	12
2	Fourier Integral, Fourier Sine and Cosine Integrals ,Evaluation of Integrals, Fourier Transforms, Fourier Cosine Transform, Fourier Sine Transform, Properties of Fourier Transform, Linearity ,Symmetry, change of Time Scale, Time Shifting , Frequency Shifting , Fourier Transform of derivatives, integrals, convolution , Properties of Fourier cosine and sine Transforms, Parseval Identity for Fourier Transform , Finite Fourier Cosine and Sine Transform	18
3	Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals, s-Shifting ,t-Shifting, Unit step function, Dirac's delta function, Differentiation and integration of transforms, Applications to differential equations. Convolution Theorem ,Integral Equations	12

Course Outcomes:	
1	By the end of this course the students will be able to expand a function in terms of its Fourier Series ,Fourier Integrals, Fourier Transforms and apply harmonic analysis to numerical data.
2	The students will be able to evaluate Laplace transforms and inverse Laplace transforms.
3	The students will be able to use Laplace transform to solve ordinary differential equations arising in engineering problems.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Higher Engineering Mathematics", B V Ramana, Tata McGraw -Hill	2006
2	"Advanced Engineering Mathematics", E. Kreyszig, John Wiley.	2006
3	"Advanced Engineering Mathematics", Wylie and Barrett, McGraw Hill.	2003

Course Name	**:**	**CALCULUS OF VARIATIONS**
Course Code	**:**	**MAN 434**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of the course the students should be able to understand the concept of functional, extremum, Euler's equations, the concepts of transversality conditions, Weirstress-Endmann corner condition and canonical form of Euler equations, canonical transformations and Rayleigh Ritz method,They should be able to apply direct methods in calculus of variations Euler's finite difference methods, use Rayleigh Ritz method and Sturm-Liouville to solve differential equations.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Variation of a functional. A necessary condition for an extremum, Euler's equation. Some classical problems. Fixed end point problems for unknown functions. Variational problems with subsidary conditions.	10
2	General variation of a functional. Variable end point problems, transversality conditions. Transversal theorem. Weirstress-Endmann corner condition. Canonical form of Euler equations and their first integrals. Canonical transformations. Weather's theorem. The principle of the least action. Censervation laws. Hamilton-Jacobi equations. Jacobi's theorem.	14
3	The second variation of a functional and the formula for second variation. Legendre's necessary condition. Iaoobi's necessary condition. Conjugate points, Sufficient condition for a weak extremum. General definition of a field and field of a functional. Hilberts invariant integral. The weierstrass E-functional. Sufficient conditions for a strong minimum. Direct methods in calculus of variations Euler's finite difference methods and the Rayleigh Ritz method. Applications to sturm-Liouville problem.	18

Course Outcomes:	
1	At the end of the course the students will be able to understand the concept of functional, extremum, Euler's equations.
2	They will be able to learn the concepts of transversality conditions, Weirstress-Endmann corner condition and to evaluate canonical form of Euler equations, canonical transformations and Rayleigh Ritz method.
3	They will be able to apply direct methods in calculus of variations Euler's finite difference methods, use Rayleigh Ritz method and Sturm-Liouville to solve differential equations.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Calculus of variations", I M. Gelfand and S. V. Fomin	1963
2	"Calculus of variations", L.E. Elsgolc.	1962

Course Name	**:**	**ALGEBRAIC CODING THEORY**
Course Code	**:**	**MAN 435**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
At the end of this course, the students should be able to translate fundamental problems of coding theory into mathematical problems and then solve them by using the theory of finite fields, polynomial rings and finite groups.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**INTRODUCTION TO CODING THEORY** Source and Channel coding, Error detecting and error correcting codes	2
2	**ERROR DETECTION, ERROR CORRECTION AND DECODING** Communication Channels, maximum likelihood decoding, Hamming distance, Nearest neighbour/ minimum distance decoding, distance of a code	6
3	**FINITE FIELDS** Fields, Polynomial rings, Structure of finite fields, Minimal polynomials	10
4	**LINEAR CODES** Vector spaces over finite fields, Linear Codes, Hamming weight, Bases for linear codes Generator matrix and parity check matrix, Equivalence of linear codes, Encoding with a linear code, Decoding of linear codes, Cosets, Nearest neighbor decoding for linear codes, Syndrome Decoding, Weight Enumerator of a Code, Macwilliam's Identity,	16
5	**CYCLIC CODES** Definition, Generator polynomials, Generator matrix and parity check matrix, Decoding of linear codes.	8

Course Outcomes: By the end of the course, the students will be able to	
1	Translate fundamental problems of coding theory into mathematical problems and then solve them by using the theory of finite fields, polynomial rings and finite groups.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Coding Theory", San Ling & Chaoping Xing , Cambridge University Press	2004
2	"Introduction to the 'Theory of Error Correcting Codes", Vera Pless, Cambridge University Press	2003
3	"Introduction to Error Correcting Codes", Raymond Hill, Clarendon Press, Oxford	1986
4	"Theory of Error Correcting Codes Part I & II", F.J.Macwilliams & NJA Sloane	1977

Course Name	**:**	**QUANTUM MECHANICS**
Course Code	**:**	**PYN-431**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course the students should be able to describe and implement concepts and principles of Quantum Mechanics required for in depth understanding of Physical phenomena of materials in relation to applications in Engineering. The students should be able to solve numerical problems related to hydrogen atom.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	Blackbody radiation, photoelectric effect, X-rays, X-ray diffraction, Compton effect, Pair production	7
2	Inadequacy of classical physics, Bohr-Sommerfield quantization rules, Quantum-Mechanical viewpoint.	4
3	De Broglie waves, phase and group velocities, particle diffraction, Uncertainty Principle, limitations on experiment, wave packets.	7
4	One-dimensional Schrodinger wave equation, extension to three dimensional statistical interpretation of wave function, Normalization, expectation value.	6
5	Separation of wave equation, one-dimensional square well potential, perfectly rigid wall, finite potential step, tunnel effect.	8
6	Linear harmonic oscillator, three-dimensional square well potential, the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number, magnetic quantum number, Zeeman effect.	10

Course Outcomes: By the end of the course, student will be able to	
1	Solve the problems based on Quantum Mechanics.
2	Apply the concepts of Quantum Mechanics in different phenomena.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Concepts of Modern Physics", Arthur Beiser, McGraw Hill Education (India) Pvt. Ltd., New Delhi.	2013
2	"Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Robert Eisberg and Robert Resnick, Wiley India Pvt. Ltd., New Delhi	2013
3	"Modern Physics", J. Bernstein, P.M. Fishbane and S.G. Gasiorowicz, Pearson, Education India Pvt. Ltd., New Delhi	2009

Course Name	**:**	**STATISTICAL PHYSICS**
Course Code	**:**	**PYN-432**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students will be able to describe and implement concepts and principles of Statistical Mechanics required for in depth understanding of Physical phenomena in solid state, nuclear physics.

Total No. of Lectures – 42

Lecture wise breakup		Number of Lectures
1	Laws of Thermodynamics - First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Third Law of Thermodynamics. Phase Transitions, Kinetic Theory, Vander waal equation of state, Boltzmann transport equation, Maxwell-Boltzman Distribution, the method of most probable distribution.	6 8
2	Classical Statistical Mechanics, Microcanonical ensemble, Cnonical ensemble, Grand Canonical ensemble, Chemical Potential.	7

	Distribution function, Ideal Fermi Gas, Degenerate and non-degenerate states, Theory of white dwarf stars, Landau Diamagnetism.	7
3	Equation of state for ideal Fermi gas, quantized Hall effect, Pauli paramagnetism, Ideal Bose gas, Bose-Einstein distribution, Derivation of Planck's Law. Phonons, Specific heat, superfluids, Landau's theory, superfuid flow, superfluid velocity, Bose-Einstein Condensation.	7 7

Course Outcomes:	
1	Solve the problems based on Statistical Mechanics.
2	Understand the importance of statistical physics in describing various natural phenomena.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Statistical Mechanics" , K. Huang, Wiley India Private Ltd., New Delhi	2013
2	"Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Robert Eisberg and Robert Resnick, Wiley India Pvt. Ltd., New Delhi	2013
3	"Concepts of Modern Physics", Arthur Beiser, McGraw Hill Education (India) Pvt. Ltd., New Delhi.	2013

Course Name	**:**	**NUCLEAR PHYSICS**
Course Code	**:**	**PYN-433**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
The students should be able to describe and implement concepts and principles of Quantum Mechanics required for in depth understanding of Physical phenomena of materials in relation to applications in Engineering. The students should be able to solve numerical problems related to hydrogen atom.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Mass, charge and constituents of nucleus, Nuclear size and distribution of nucleons, Energies of Nucleons, Nucleus as a quantum system, nuclear force, properties of nucleus.	10
2	Particle in a one-dimensional square well, particle in a three-dimensional square well, vector model for addition of angular momentum.	10
3	Bound states of two nucleons - Deuteron nucleus, Meson theory of nuclear forces. Shell theory of nucleus, shell theory potential, allowed orbits, filling of allowed orbits, non-spherical nucleus.	10
4	Natural radioactivity, successive radioactive transformations, radioactive equilibrium, radioactive series, radiometric dating. Nuclear force and its characteristics, Elementary description of shell model, explanation of magic numbers, liquid drop model and semi-empirical binding energy formula. Nuclear fission, fission products, mass and energy distribution of fission products, neutron emission and energy distribution of neutrons emitted in fission, theory of fission process, nuclear reactors - classification, neutron cycle in thermal reactors and four-factor formula for neutron reproduction, nuclear fission - controlled thermonuclear reactions.	12

Course Outcomes: By the end of the course, student will be able to

1	Solve the problems based on Nuclear Physics.
2	Understand and apply the basic concepts of nuclear physics in different nuclear phenomena.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Concepts of Nuclear Physics" , B.L. Cohen, Tata Mcgraw Hill, New Delhi	2013
2	"Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Robert Eisberg and Robert Resnick, Wiley India Pvt. Ltd., New Delhi	2013
3	"Introductary Nuclear Physics", Kenneth S Krane, Wiley India Pvt. Ltd., New Delhi	2014

Course Name	**:**	**EXPERIMENTAL NUCLEAR PHYSICS**
Course Code	**:**	**PYN-434**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of this course the students should be able to describe and implement concepts and principles of Quantum Mechanics required for in depth understanding of Physical phenomena of materials in relation to applications in Engineering. The students should be able to solve numerical problems related to hydrogen atom.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**Experimental Nuclear Physics** Binding energies of nuclei, semi-empirical mass formula, magnetic dipole moment, electric quadrupole moment, Beta decay, nucleon emission, decay laws.	10
2	Experimental method in nuclear physics, interaction of charged particle with matter, detectors for energetic charged particles, detectors which make tracks visually observable, scintillation detectors, charge collection detectors, mass spectrometer.	10
3	Accelerators, linear accelerator, cyclic accelerator, synchrocyclotron.	10
4	Natural radioactivity, successive radioactive transformations, radioactive equilibrium, radioactive series, radiometric dating. Nuclear force and its characteristics, Elementary description of shell model, explanation of magic numbers, liquid drop model and semi-empirical binding energy formula. Nuclear fission, fission products, mass and energy distribution of fission products, neutron emission and energy distribution of neutrons emitted in fission, theory of fission process, nuclear reactors - classification, neutron cycle in thermal reactors and four-factor formula for neutron reproduction, nuclear fission - controlled thermonuclear reactions.	12

Course Outcomes: By the end of the course, student will be able to	
1	Solve the problems based on experimental Nuclear Physics.
2	Predict that which type of detector or accelerator is suitable for particular application.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Concepts of Nuclear Physics" , B.L. Cohen, Tata Mcgraw Hill, New Delhi	2013
2	"Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Robert Eisberg and Robert Resnick, Wiley India Pvt. Ltd., New Delhi	2013
3	"Introductary Nuclear Physics", Kenneth S Krane, Wiley India Pvt. Ltd., New Delhi	2014

Course Name	**:**	**X-Ray Crystallography**
Course Code	**:**	**PYN-435**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:
At the end of the course, student will become familiar with the applications of X-ray crystallography in the determination of molecular structure. On the basis of structure, student will be able to explain the experimental observed properties.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	Bonding in Solids, Ionic bonding, Covalent, metallic bonding, intermolecular bond, dispersion bond, hydrogen bond. General features of crystals, basis and crystal structure, unit cell and lattice parameters, external symmetry of crystals, seven crystal systems, thirty two crystal classes, Miller indices, space lattice, symmetry elements, space group.	12
2	General description of scattering process, Thomson scattering, Compton scattering, scattering of X-rays by atoms.	10
3	Diffraction from one-dimensional and three-dimensional array of atoms, reciprocal lattice, Ewald sphere, Laue equation, structure factor, Diffraction by periodic distribution, electron-density equation, Patterson method. Powder camera, oscillation camera, Weissenberg camera.	10
4	Relevance of crystallography in the studies of theory of solids, influence of translational periodicity on the physical behavior of solids, tight binding approximation, density of states,	10

Course Outcomes:	
1	Solve the problems based on crystal systems.
2	Apply X-ray crystallography in the determination of molecular structure.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"An introduction to X-Ray Crystallography" by M.M. Woolfson Vikas Publishing House, Cambridge University Press, New Delhi	2012
2	"Solid State Physics", S.O. Pillai, New Age International (P) Limited, New Delhi	2010
3	"Crystallography Applied to Solid State Physics", Verma and Srivastava, New Age International (P) Limited, New Delhi	2012

Course Name	**:**	**INORGANIC CHEMISTRY**
Course Code	**:**	**CHN-431**
Credits	**:**	**4**
L T P	**:**	**3 0 3**

Course Objectives:
At the end of this course, the students should be able to describe concepts of Inorganic chemistry related to structure, properties & applications of inorganic and organometallic compounds.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**QUANTUM THEORY AND ATOMIC STRUCTURE:** Introduction to wave mechanics, the Schrodinger equation, the Schrodinger equation as applied to hydrogen atom, the origin of quantum numbers and shapes of orbitals.	4
2	**CHEMICAL BONDING:** Molecular orbital and valence bond theories of bond formation and application of molecular orbital theory to the formation of homonuclear and heteronuclear diatomic molecules.	7
3	**THE SOLID STATE:** A recapitulation of close packing of spheres, structures of NaCl, CsCl, ZnS, CaF2, crystal defects and applications of defect structures (transistors, rectifiers, photovoltaic cells and computer chips).	4
4	**COORDINATION COMPOUNDS:** Part 1: Werner's theory, effective atomic number, bonding of transition metal complexes: valence bond theory, crystal field theory, crystal field splitting in tetrahedral, octahedral and distorted octahedral (square planar) crystal fields. Thermodynamic aspects of coordination compounds (crystal field stabilization energies of octahedral and tetrahedral complexes, spectrochemical series).	6
5	**COORDINATION COMPOUNDS:** Part2: Kinetic aspects of coordination compounds (substitution reactions in complexes with coordination number 4 and 6 and their mechanism - SN^1, SN^2). Magnetic behaviour of complexes – Para magnetism, diamagnetism, ferromagnetism and antiferromagnetism	6
6	**ORGANOMETALLIC COMPOUNDS:** Nomenclature, types of ligands and bonding in organometallic compounds, use of organometallics in industry.	5
7	**INORGANIC POLYMERS:** Types of inorganic polymers, polyphosphazenes, polysiloxanes –their structures and properties.	5
8	**ROLE OF METALS IN BIOLOGICAL SYSTEMS:** Bio-inorganic Chemistry of Iron – Heme proteins & Non-Heme iron proteins; bioinorganic chemistry of cobalt-vitamin B12 and metalloenzymes.	5

List of Experiments:		**Number of Turns**
1	Estimation of oxalate using potassium permagnate.	1
2	Estimation of Fe^{2+} and Fe^{3+} using potassium dichromate.	1
3	Estimation of Cu^{2+} and AsO_3^{3-} iodimetrically.	2
4	Determination of Zn by EDTA titration.	1
5	Estimation of Ba^{2+}/SO_4^{2-} by as $BaSO_4$ gravimetrically.	1
6	Estimation of Fe^{2+} and Fe^{3+} as Fe_2O_3 gravimetrically.	2
7	Preparation and characterization of inorganic complexes (2 nos.).	2
8	Preparation and characterization of organometallic compound.	1
9	Crystallization techniques for purification of inorganic complexes.	1
10	Melting point determination of few inorganic compounds.	1

Course Outcomes: By the end of this course, the student will be able to:	
1	Understand the structure of atom based on quantum theory, concept of chemical bonding in homo- and hetro-atomic molecules & structure of advanced materials along with their applications in electronic fields.
2	Apply the thermodynamic, kinetic, magnetic and mechanistic aspects to coordination compounds.
3	Develope organometallic compounds to study the interaction and role of metals in biological systems essential for bio-engineering applications.
4	Design new inorganic materials with in-depth understanding of their structures and properties.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Inorganic Chemistry", A. G. Sharpe., 3rd Edition, Longman Publishers ELBS.	1992
2	"Inorganic Chemistry", J. D. Lee, 5th Edition, Chapman and Hall Publishers.	1996
3	"Advanced Inorganic Chemistry", F. A. Cotton & G. Wilkinson,3rd Edition, Wiley Eastern Ltd.	1982
4	"Basic Inorganic Chemistry", F. A. Cotton & G. Wilkinson; Wiley Eastern Ltd.	1987
5	"Inorganic Polymer", J. Mark, R. West & H. Allcock, Prentice Hall, New Jersey Publishers.	1982
6	"Vogel's Qualitative Inorganic Analysis", G. Svehla, 7th Edition Pearson Education.	2002

Course Name	**:**	
Course Code	**:**	
Credits	**:**	
L T P	**:**	

Course Objectives:

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**Ultrasonics** Production, detection and uses of ultrasonics, reverberation, sabine's formula (no derivation)	(3)
2		
3		
4		

List of Experiments:		**Number of Turns**
1		
2		
3		
4		
5		

Course Outcomes:	
1	
2	
3	
4	
5	

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	" Computer Graphics", Donald Hearn and M. Pauline Baker, Pearson Education	2012
2		

3		
4		
5		

Course Name	**:**	**ANALYTICAL CHEMISTRY**
Course Code	**:**	**CHN-433**
Credits	**:**	**4**
L T P	**:**	**310**

Course Objectives:
At the end of this course, the student should be able to develop sufficient knowledge about the major instrumental methods of chemical analysis so that they can determine what technique should be used for study of structural aspects of all kinds of materials. The student will be able to analyze the advances in instrumentation which have been made, especially those made as a result of problems encountered with the method. Students will gain practical knowledge of experimental methods and analytical instrumentation for carrying out analytical separations using gas and liquid chromatography.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**COMPLEXOMETRIC TITRATIONS :** Complexes-formation constants; chelates – EDTA, Chelon Effect, EDTA equilibria, effect of pH on EDTA equilibria, EDTA titration curves, endpoint – detection and indicators; Importance of complexometric titrations.	4
2	**SOLVENT EXTRACTION :** Distribution law, extraction process, factors effecting extraction, technique for extraction, quantitative treatment of solvent extraction equilibria, and classification of solvent extraction systems. Advantages and applications of solvent extraction.	6
3	**CHROMATOGRAPHY:** Introduction to chromatography, principles, classification of chromatographic techniques, thin layer and paper chromatography – principle and technique. Column Chromatography – Factors affecting column efficiency and applications. Gas – liquid chromatography – theory, instrumentation and applications. HPLC – instrumentation, method, column efficiency and applications.	8
4	**THERMOANALYTICAL METHODS :** Principle, classification of methods. TGA –Instrumentation, factors affecting results and analysis of data. Applications. DTG – Instrumentation, analysis of data and applications. DTA – Principle, Instrumentation and applications.	8
5	**SPECTROSCOPIC TECHNIQUES:** UV Introduction to spectroscopy, Lambert Beer s law, instrumentation and applications ,IR Introduction, basic principles, factors affecting IR group frequencies , Instrumentation and Applications ,NMR Basic principles, elementary ideas and instrumentation chemical shifts, spin-spin coupling.	10
6	**ELECTRON MICROSCOPY:** Scanning electron microscopy (SEM), Transmission Electron Microscopy (TEM) and Scanning Transmission Electron Microcopy (STEM) Principles and Applications	6

Course Outcomes: By the end of this course, the student will be able to:	
1	Address the problems of analyzing complex samples. This would include defining the problem, determining any constraints, choosing the best methodology, and determining how to test the methodology to prove its merits. Where there are alternatives the student should be able to define the advantages and

	disadvantages of each.
2	Interpret data from analytical separation methods and will understand approaches for the validation of these analytical.
3	Carry out hands on experiments in the field related to analysis of materials required for technological developments and in advanced research in Engineering.
4	Apply various analytical techniques for analysis of organic and inorganic materials.

Suggested Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Principles of Instrumental Analysis", by Skoog, D. A. & West D. M., 5th Edition, Saunders College Publishers, USA.	1998
2	"Fundamentals of Analytical Chemistry", Skoog, D. A. & West D. M., 7th Edition, Saunders College Publishers, USA.	2000
3	"Industrial Methods of Analysis", Willard, Merritt, Dean &Settle, 7th Edition.	1989
4	"Industrial Methods of Chemical Analysis", Galen W. Ewing, 5th Edition.	1985
5	"Spectrometric identification of Organic Compounds", Silverstein R. M. &Webster F.X., 6th Edition, John Wiley and Sons, Inc., USA	2005
6	"Quantitative Inorganic Analysis", A.I, Vogel, 5th Edition.	1989

Course Name	**:**	**ENVIRONMENTAL CHEMISTRY**	
Course Code	**:**	**CHN-434**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
At the end of this course, the student should be able to understand the basic knowledge of environmental chemistry, such as chemistry of atmosphere, hydrosphere, pedosphere and biosphere. The student will be able to apply basic theories and methods of chemistry to study the environmental issues caused by chemical substances (pollutants).

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	CHEMICAL COMPOSITION OF AIR : Classification of elements, chemical speciation. Particles, ions, and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Sources of trace gases in the atmosphere; Thermo-chemical and photochemical reactions in the atmosphere. Tropospheric oxidation chemistry; Oxygen and ozone chemistry. Chemistry of air pollutants. Role of hydrocarbons; Sulphur chemistry; Halogen Chemistry in the atmosphere.	8
2	WATER CHEMISTRY: Chemistry of water, dissolution / precipitation reactions; complexation reactions; concept of DO, BOD, COD; concept of salinity; composition of sea water and physic-chemical speciation in oceans; Suspended particles; concept of sedimentation, coagulation, filtration,	8
3	SOIL POLLUTION : Pollutants in soil, Agricultural Pollution, Role of Micro nutrients in soil, Ion exchange reaction in soil, Pesticide (Classifications & Degradation), Path of Pesticides in Environment, Monitoring techniques.	8
4	ENVIRONMENTAL TOXICOLOGY AND ITS EVALUATION: Emergence as a science; concepts and definitions; Factors affecting toxicity, Evaluation of LC50, LD50, LCIC and IT.	5

5	TOXIC CHEMICAL IN THE ENVIRONMENT : Metals and other inorganic contaminants; Organic contaminants; Fate of organic contaminants; Pesticides; Biochemical aspects of arsenic, cadmium, lead, mercury, carbon monoxide, ozone and PAN Pesticides; Insecticides, MIC, carcinogens in the air. Photochemistry of Brominated Flame Retardants (BFR) Gene toxicity of toxic chemicals.	8
6	GREEN CHEMISTRY FOR SUSTAINABLE FUTURE : Reagents, Media, Special Importance of Solvents, Water the Greenest Solvents, Synthetic and Processing Pathways, Role of Catalyst, Biological Alternatives, Biopolymers, Principles and Application of Green Chemistry.	5

Course Outcomes: By the end of this course, the student will be able to:	
1	Describe the chemical composition (and the main elements' occurrence forms) of the geosphere, the atmosphere, the hydrosphere, and the biosphere and to explain how interactions between these spheres and the techno sphere affect the environment.
2	Know the basic chemical features of some environmental concerns of today and their societal origin, with specific focus on acidification, eutrophication, ozone, nuclear wastes, heavy metals, organic pollutants, and climate change issues.
3	Develop integrated technologies to support the recycling of carbon and plant nutrients from agricultural crops, bio-based industries and municipal water treatment plants.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Environmental Chemistry", Banerji, S.K, 2nd Edition, Prentice-Hall, New Delhi, India.	1999
2	"Environmental Chemistry", A. K. De, 4th Edition, New Age International (P) Ltd., New Delhi, India.	2000
3	"Introductory Chemistry for the Environment Science", Harrison, R. M. and de Mora, S. J. 2nd Edition, Cambridge University Press, New Delhi.	1996
4	"Introduction to Atmospheric Chemistry", Hobbes, P.B. Cambridge University Press, UK.	2000
5	"Principles of Environmental Chemistry", Kothandaaman, H. and Swaminathan, G. B.I. Publications, Chennai, India.	1997
6	"Fundamentals of Environmental Chemistry", Manahan, S. E. 2nd Edition, CRC Press, Inc., USA.	2001

Course Name	**:**	**RECENT ADVANCES IN CHEMICAL SCIENCES**
Course Code	**:**	**CHN-435**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:

At the end of this course, the student should be able to use molecular building blocks to design functional supramolecular constructs and nano-structured materials by using the principles of Supramolecular Chemistry. The student will be able to understand chemical and physical phenomena particular to surfaces and interfaces and reduce chemical pollutants flowing to the environment by using principles of Green Chemistry.

Total No. of Lectures – 42

Lecture wise breakup		**Number of Lectures**
1	**SUPRAMOLECULES:** Concepts of supramolecular chemistry- Thermodymanics of molecular recognition,	8

	solvation, multivalency, Molecular Recognition: Cations,Anions and Neutral guests, Self processes - Self-assembly, Supramolecular -devices and Sensors, Molecular logic, photo switching materials, Supramolecular -material Chemistry Crystal engineering, MOFs and coordination polymers, templates for biomineralisation	
2	**CHEMISTRY OF NANOMATERIALS:** Synthesis of nanoparticles by chemical routes and characterization techniques: Thermodynamics and kinetics of nucleation; Growth of polyhedral particles by surface reaction, Ostwald ripening, size distribution; Properties of nanostructured materials : Optical properties; magnetic properties;	9
3	**HOMOGENEOUS CATALYSIS :** Stoichiometric reaction for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reations involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction) oxopalladation reactions, activation of C-H bond.	8
4	**SURFACTANT AGGREGATION:** Micelles, Surface active agents, Classification of surface active agents, Micellization, Hydrophobic interaction, Critical micellar concentration (cmc), Factors affecting the concentration of surfactants, Counter-ion binding of micelle, Thermodynamics of micellization, Phase separation and Mass action models, Solubilization Emulsions, Mechanism of formation of microemulsion and their stability, Phase maps, Physical techniques, Applications..	9
5	**GREEN CHEMICAL PROCESSES:** An introduction to the tools of green chemistry and its fundamental principles. Use of Renewable Raw Materials. Evaluating feedstock and starting materials -commodity chemicals from glucose Greener Solvents: The use of supercritical fluids, and aqueous systems Greener reagents and products. Methods of designing safer chemicals Examples of greener reagents replacement of phosgene, methylations using dimethylcarbonate,	8

Course Outcomes: By the end of this course, the student will be able to:	
1	Exploit supramolecular engineering to design structures with adapted morphologies and properties.
2	Initiate self-assembly processes in bimolecular systems and the basis of bio-inspired chemistry.
3	Understand the interactions between surfaces and gases, liquids or solutions, and how interfaces are important in many technological a biological processes..
4	Identify the new advancements and approaches of chemical sciences for technological leads in various fields of sciences and Engineering.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"The Organometallic Chemistry of the Transition Metals", Crabtree, R.G. 4th Edition, John Wiley.	2005
2	"Wilkinson Advanced Inorganic Chemistry", Cotton, F.A.; 6th Edition, John Wiley.	1999
3	"Supramolecular Chemistry",Steed J. W. and Atwood J. L., John Wiley and Sons, Ltd.	2000
4	"Green Chemistry and Catalysis",Roger Arthur Sheldon, Dr. Isabel W. C. E. Arends, Dr. Ulf Hanefeld, Wiley-VCH Verlag GmbH & Co. KGaA.	2007
5	"Physical Chemistry of Surfaces", Adamson A.W., Pubs: John Willey, New York.	1982
6	"Surfactant Science and Technology", Myers D., Pubs: VCH Publishers.	1988