COURSE STRUCTURE (R20)

I - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE01	Professional Communication-I	2	0	0	2	30	70	100
2	20FE03	Differential Equations	2	1	0	3	30	70	100
3	20FE06	Engineering Chemistry	3	0	0	3	30	70	100
4	20AD01	Computational Programming	3	0	0	3	30	70	100
5	20CS02	Digital Logic Design	3	0	0	3	30	70	100
Laboratory Courses									
6	20FE53	Engineering Chemistry Lab	0	0	3	1.5	15	35	50
7	20AD51	Computational Programming Lab	0	0	3	1.5	15	35	50
8	20CS52	Digital Logic Design Lab	0	0	2	1	15	35	50
9	20IT51	IT Workshop	0	0	3	1.5	15	35	50
		Total	**13**	**1**	**11**	**19.5**	**210**	**490**	**700**

II - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE02	Professional Communication-II	2	0	0	2	30	70	100
2	20FE04	Linear Algebra and Transformation Techniques	2	1	0	3	30	70	100
3	20FE07	Applied Physics	2	1	0	3	30	70	100
4	20CS03	Data Structures	3	0	0	3	30	70	100
5	20CS04	Discrete Mathematical Structures	3	0	0	3	30	70	100
6	20MC01	Constitution of India	2	0	0	0	30	70	100
Laboratory Courses									
7	20FE51	Professional Communication Skills Lab	0	0	2	1	15	35	50
8	20FE54	Applied Physics Lab	0	0	3	1.5	15	35	50
9	20CS53	Data Structures Lab	0	0	3	1.5	15	35	50
10	20ME53	Computer Aided Engineering Drawing	0	0	3	1.5	15	35	50
		Total	**14**	**2**	**11**	**19.5**	**240**	**560**	**800**

III SEMESTER

S.No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE09	Probability and Statistics	3	0	0	3	30	70	100
2	20MC02	Environmental Science	2	0	0	0	30	70	100
3	20AD02	Computer Architecture	3	0	0	3	30	70	100
4	20CS05	Python Programming	3	0	0	3	30	70	100
5	20CS07	Database Management Systems	3	0	0	3	30	70	100
6	20CS09	Object Oriented Programming	3	0	0	3	30	70	100
Laboratory Courses									
7	20CS54	Python Programming Lab	0	0	3	1.5	15	35	50
8	20CS56	Database Management Systems Lab	0	0	3	1.5	15	35	50
9	20CS57	Object Oriented Programming Lab	0	0	3	1.5	15	35	50
10	20CSS1	Web Application Development using Full Stack - Module-I (Frontend Development)	1	0	2	2	-	50	50
Total			17	0	13	21.5	225	575	800

IV SEMESTER

S.No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20CS06	Design & Analysis of Algorithms	3	0	0	3	30	70	100
2	20HS01	Universal Human values 2: Understanding Harmony	3	0	0	3	30	70	100
3	20AD03	Introduction to Artificial Intelligence and Data Science	3	0	0	3	30	70	100
4	20CS10	Data Warehousing & Data Mining	3	0	0	3	30	70	100
5	20CS11	Operating Systems	3	0	0	3	30	70	100
Laboratory Courses									
6	20AD52	Introduction to Artificial Intelligence and Data Science Lab	0	0	3	1.5	15	35	50
7	20IT53	R Programming Lab	0	0	3	1.5	15	35	50
8	20CS58	Data Mining Using Python Lab	0	0	3	1.5	15	35	50
9	20CSS2	Web Application Development using Full Stack- Module-II (Backend Development)	1	0	2	2	-	50	50
Total			15	0	13	21.5	195	505	700

V - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20CS12	Computer Networks	3	0	0	3	30	70	100
2	20AD04	Machine Learning	3	0	0	3	30	70	100
3	20AD05	Automata and Compiler Design	3	0	0	3	30	70	100
4		**PROGRAM ELECTIVE – I**	3	0	0	3	30	70	100
	20CS14	Computer Graphics							
	20AD06	Artificial Neural Networks							
	20CS24	Cloud Computing							
5		**OPEN ELECTIVE – I**	3	0	0	3	30	70	100
Laboratory Courses									
6	20CS60	Computer Networks Lab	0	0	3	1.5	15	35	50
7	20AD54	Machine Learning Lab	0	0	3	1.5	15	35	50
8	20CSS3	Mean Stack Technologies	1	0	2	2	-	50	50
9	20PI01	Summer Internship	-	-	-	1.5	-	50	50
		TOTAL	**16**	**0**	**8**	**21.5**	**180**	**520**	**700**

VI - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20CS20	Pattern Recognition	3	0	0	3	30	70	100
2	20CS19	Big Data Analytics	3	0	0	3	30	70	100
3	20AD07	Deep Learning	3	0	0	3	30	70	100
4		**PROGRAM ELECTIVE – II**	3	0	0	3	30	70	100
	20AD08	Speech Processing							
	20CS28	Computer Vision							
	20IT01	Software Engineering							
5		**OPEN ELECTIVE-II**	3	0	0	3	30	70	100
Laboratory Courses									
6	20AD55	CASE Tools Lab	0	0	3	1.5	15	35	50
7	20CS62	Data Analytics and Visualization Lab	0	0	3	1.5	15	35	50
8	20AD56	Deep Learning with Tensor Flow	0	0	3	1.5	15	35	50
9	20HSS1	Soft Skills Course	1	0	2	2	-	50	50
		TOTAL	**16**	**0**	**11**	**21.5**	**195**	**505**	**700**

VII - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1		**PROGRAM ELECTIVE - III**	3	0	0	3	30	70	100
	20AD09	Natural Language Processing							
	20AD10	Recommender Systems							
	20CS22	Distributed Operating Systems							
2		**PROGRAM ELECTIVE - IV**	3	0	0	3	30	70	100
	20CS21	Information Retrieval System							
	20CS25	Software Project Management							
	20CS29	Block Chain Technology							
3		**PROGRAM ELECTIVE - V**	3	0	0	3	30	70	100
	20CS27	Social Network Analysis							
	20AD11	Reinforcement Learning							
	20CS17	Information Security							
		OPEN ELECTIVE - III	3	0	0	3	30	70	100
5		**OPEN ELECTIVE - IV**	3	0	0	3	30	70	100
6	20PI02	Industrial/Research Internship				3		50	50
7	20CSS4	Continuous Integration and Delivery using DevOps	1	0	2	2	-	50	50
8	20HS02	Management Science for Engineers	3	0	0	3	30	70	100
		TOTAL	**19**	**0**	**2**	**23**	**180**	**520**	**700**

VIII - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Laboratory Courses									
1	20PI03	ProjectWork	0	0	24	12	60	140	200

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
20AD81	Introduction to Artificial Intelligence	ASE, CE, ECE, EEE, & ME
20AD82	Introductionto Data Science	ASE, CE, ECE, EEE, & ME
20AD83	Introduction to Machine Learning	ASE, CE, ECE, EEE, & ME
20AD84	Fundamentals of Deep Learning	ASE, CE, ECE, EEE, & ME
20AE81	Principles of Flight	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE82	Space Science	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE83	Aircraft Systems	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE84	Air Transportation Systems	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE81	Basics of Civil Engineering	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE82	Disaster Management	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE83	Fundamentals of Geospatial Technologies	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE84	Environmental Sanitation	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CS81	Unix and Shell Programming	ASE, CE, ECE, EEE, & ME
20CS82	Introduction to Algorithm Techniques	ASE, CE, ECE, EEE, & ME
20CS83	Principles of Computer Architecture	ASE, CE, ECE, EEE, & ME
20CS84	PHP Programming	ASE, CE, ECE, EEE, & ME
20CS85	Object Oriented Software Engineering	ASE, CE, ECE, EEE, & ME
20EC81	Satellite Technology	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC82	Elements of Communication Systems	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC83	Microprocessors and Interfacing	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC84	Analog and Digital Communications	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC85	Systems and Signal Processing	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC86	Cellular Technology	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
20EE81	Linear Control Systems	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE82	Basics of Electrical Measurements	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE83	Utilization of Electrical Energy	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE84	Electric Vehicles	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20IT81	OOP through JAVA	ASE, CE, ECE, EEE, & ME
20IT82	Web Technologies using PHP	ASE, CE, ECE, EEE, & ME
20IT83	Mobile Application Development	ASE, CE, ECE, EEE, & ME
20IT84	Cyber Security & Digital Forensics	ASE, CE, ECE, EEE, & ME
20ME81	Renewable Energy Sources	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME82	Robotics in Automation	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME83	Operations Research Techniques	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME84	Elements of Automobile Engineering	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT

	L	T	P	Cr.
B.Tech (I-Sem.) 20FE01 -PROFESSIONAL COMMUNICATION - I	2	0	0	2

Pre-requisites: Nil

Course Educational Objectives: To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

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

CO1	Write sentences and paragraphs using proper grammatical structures and word forms (**Remember – L1**)
CO2	Comprehend the given text by employing suitable strategies for skimming and scanning and draw inferences (**Understand – L2**)
CO3	Write summaries of reading texts using correct tense forms & appropriate structures (**Remember – L1**)
CO4	Write Formal Letters, Memos & E-Mails (**Apply – L3**)
CO5	Edit the sentences/short texts by identifying basic errors of grammar/vocabulary/syntax (**Understand – L2**)

Unit - I
Exploration - 'A Proposal to Girdle the Earth – Nellie Bly'; Reading: Skimming for main idea; Scanning for specific information; Grammar & Vocabulary: Content Words; Function Words; Word Forms: verbs, nouns, adjectives and adverbs; Nouns: Countable and Uncountable, Singular and Plural forms; Wh - Questions; Word Order in Sentences; Writing: Paragraph Analysis; Paragraph Writing; Punctuation and Capital Letters

Unit – II
On Campus- 'The District School as it Was by One Who Went to it – Warren Burton'; Reading: Identifying Sequence of Ideas; Grammar & Vocabulary: Cohesive Devices: Linkers/Signposts/Transition signals, Synonyms, Meanings of Words/Phrases in the context; Writing: Memo Drafting.

Unit – III
Working Together-'The Future of Work'
Reading: Making basic inferences; Strategies to use text clues for comprehension; Summarizing; Grammar & Vocabulary: Verbs: Tenses; Reporting Verbs for Academic Purpose; Writing**:** Rephrasing what is read; Avoiding redundancies and repetitions; Abstract Writing/ Summarizing.

Unit – IV
'A.P.J.Abdul Kalam'; Grammar & Vocabulary: Direct & Indirect Speech; Articles and their Omission; Writing: E-Mail Drafting.

Unit – V
'C.V.Raman'; Grammar & Vocabulary: Subject-Verb Agreement; Prepositions; Writing: Formal Letter Writing.

Text Books:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient BlackSwan, Hyderabad, 2019.
2. "Panorama – A Course on Reading", A collection of prose selections, Oxford University Press, New Delhi, 2016.

Reference Books:

1. Swan, M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. Baradwaj Kumkum, "Professional Communication", I.K. International Publishing House Pvt. Ltd., New Delhi, 2008.
5. Wood, F.T., "Remedial English Grammar", Macmillan, 2007.

L	T	P	Cr.
2	1	0	3

B.Tech.(ISem.)   **20FE03 - DIFFERENTIAL EQUATIONS**

Pre-requisites: Nil

Course Educational Objective: The objective of this course is to introduce the first order and higher order differential equations, functions of several variables. The students also learn solving of first order partial differential equations.

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

CO1; Apply first order and first-degree differential equations to find orthogonal trajectories (**Apply – L3**)
CO2: Distinguish between the structure and methodology of solving higher order differential equations with constant coefficients (**Understand – L2**)
CO3: Apply various Numerical methods to solve initial value problem (**Apply – L3**)
CO4: Generate the infinite series for continuous functions and investigate the functional Dependence (**Understand – L2**)
CO5: Solve partial differential equations using Lagrange's method (**Apply – L3**)

UNIT –I
Differential Equations of First Order and First Degree
Differential equations of first order and first degree –Exact and Non Exact Differential Equations, Applications of differential equations – Orthogonal Trajectories.

UNIT – II
Linear Differential Equations of Higher Order
Homogeneous and Non Homogeneous Linear differential equations of second and higher order with constant coefficients with R.H.S. functions e^{ax}, sin $(ax+b)$, cos $(ax+b)$, x^m, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters.

UNIT – III
Numerical solution of Ordinary Differential Equations
Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive approximations.
Euler's Method - Runge- Kutta Methods.

UNIT –IV
Functions of several variables
Generalized Mean Value Theorem (without proof), Maclaurin's series, Functions of several variables, Jacobians (Cartesian and polar coordinates), Functional dependence. Maxima and Minima of function with two variables.

UNIT – V
Partial Differential Equations
Formation ofPartial Differential Equations by elimination of arbitrary constants and arbitrary functions.Solution of first order and first degree linear partial differential equation – Lagrange's method.

TEST BOOKS:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42ndEdition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1stEdition, TMH Publications, New Delhi, 2010.

REFERENCE BOOKS:

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi, 2011.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"* , 8th Edition, John Wiley & sons, New Delhi,2011.
3. W.E. Boyce and R. C. Diprima, " *Elementary Differential Equations"* , 7th Edition, John Wiley &sons, New Delhi,2011.
4. S. S. Sastry, *"Introductory Methods of Numerical Analysis"* 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

	L	T	P	Cr.
B.Tech (I Sem.) **20FE06 - ENGINEERING CHEMISTRY**	3	0	0	3

Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts of chemistry and to provide them with the knowledge of industrial problems and finding the solutions. It helps to strengthen thebasic concepts ofelectrochemistry, corrosion, nanotechnology, polymers, liquid crystals and analytical techniques.

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

CO1: Apply Nernst Equation for calculating electrode cell potentials and compare batteries for different applications. (**Apply - L3**)

   CO2: Apply principles of corrosion for design and effective maintenance of variousequipment. (**Apply- L3**)

CO3: Analyse the suitability of advanced materials like nano materials in electronics and medicine. (**Understand - L2**)

CO4: Identify the importance of liquid crystals, polymers in advanced technologies. (**Understand - L2**)

CO5: Apply the principles of analytical techniques in chemical analysis. (**Apply - L3**)

UNIT – I
Electro Chemistry & Batteries
Types of Electrodes -Calomel Electrode, Glass Electrode, Calculation of EMF of Cell, Applications of Nernst Equation & Electro chemical Series, Batteries -Lead-acid Battery, Lithium ion Battery, H_2 – O_2 Fuel Cell, Mg - Cu reserve battery.

UNIT – II
Science of Corrosion
Dry Corrosion (Direct Chemical corrosion) - Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases and liquid metal corrosion; Wet Corrosion (Electro Chemical corrosion) - Mechanism- oxygen absorption, hydrogen evolution, types of wet corrosion, Galvanic Corrosion, Concentration Cell Corrosion, passivity and Galvanic series; Factors Influencing Corrosion - Nature of metal (Purity, position in galvanic series, relative area of cathode & anode, nature of surface film) and nature of environment (temperature, humidity, atmospheric pollution and nature of ions in the medium); Control of Corrosion: Cathodic Protection - Sacrificial anode and impressed current methods, electro plating and metal cladding.

UNIT – III
Chemistry of Engineering Materials
Nano Materials - Extraordinary changes observed at nano size of materials and reasons, types of nano-materials, Gas-Phase Synthesis of nanomaterials, Applications; Materials in Electronic devices: Very brief note on raw materials that make IC units of CPU, GPU, RAM, PCBs, hard disks and other electronic devices with special reference to polymers;
Molecular Switches - Characteristics of Molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, molecular elevator, automated light-powered molecular motor.

UNIT – IV
Liquid Crystals & Polymers
Liquid crystals -Identification and structural aspects of molecules to form liquid crystals; Classification of liquid crystals -Thermo tropic liquid crystals and types, lyotropic liquid crystals. Mechanism of working of liquid crystals and applications; Polymers - Differences between thermoplasts and thermosets, Types of polymerization with examples; Plastics - Preparation properties and engineering applications of P.M.M.A, Teflon, Polycarbonate; Rubbers - Structure of raw rubber and vulcanized rubber, Preparation properties and engineering applications of Polyurethane, Buna-S, conducting polymers; Bio-degradable polymers - PLA & PGA (Polylactic Acid and Polyglycolic Acid).

UNIT – V
Analytical Techniques
Types of analysis; Physical analysis: Analysis of physical characteristics; Chemical analysis: Gravimetric and volumetric analysis (basic concept only);Instrumental analysis: Electro analytical techniques – Introduction; Conductometric techniques: strong acid-strong base and strong acid-weak base, weak acid -strong base and weak acid -weak base & advantages; Potentiometric techniques: Acid-base and oxidation-reduction titrations-advantages; Colorimetric techniques: Principle and determination of iron by using thiocynate as a reagent.

TEXT BOOKS
1. Shikha Agarwal, "A Text book of Engineering Chemistry", Cambridge University Press, New Delhi, 1st Edition, 2015.
2. Jain, Jain, "A textbook of Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 16th Edition, 2015.

REFERENCE BOOKS
1. Shashi Chawla, "A Text book of Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 3rd Edition, 2003.
2. S.S. Dara, S.S. Umare, "A Text book of Engineering Chemistry", S. Chand Publications, New Delhi, 12th Edition, 2010.
3. PrasantaRath, B. Rama Devi, Ch. VenkataRamana Reddy, SubhenduChakroborty, "Engineering Chemistry", Cengage Learning India, 1st Edition, 2019.

	L	T	P	Cr.
B.Tech. (I Sem.) **20AD01 - COMPUTATIONAL PROGRAMMING**	3	0	0	3

Pre-requisites: NIL

Course Educational Objective:
The objective of this course is to provide a sound understanding of the fundamentals of C programming language and how to apply them effectively. The course is designed to acquaint the learners with the concepts such as algorithms, Looping statements, functions, pointers and files. After learning the rudiments of program writing, learners will be able to design efficient programs for solving real time problems.

Course Outcomes: At the end of the course, the student will be able to
CO1: Understand the syntax and semantics of programming language constructs.**(Understand - L2)**
  CO2: Understand the text processing using strings and arrays.**(Understand - L2)**
  CO3: Apply user defined functions to solve a given problem.**(Apply - L3)**
  CO4:Analyze the storage representation using the derived data types such as structures and unions**(Analyze - L3)**
  CO5: Create permanent storage to data processed in a program using files**(Apply - L3)**

UNIT – I
Introduction: Problem Specification, Algorithm/Pseudo Code, Flowchart, examples. Structure of a C Program, Writing the First C Program, Files Used in a C Program, Identifiers, Data Types, Variables, Constants, Input/output Statements in C, Operators in C, Type Conversion and Typecasting, Scope of Variables, Storage Classes.
Decision Control and Looping Statements: Conditional Branching Statements, Iterative Statements, Nested Loops, The Break and Continue Statements, goto Statement.

UNIT – II
Arrays: Declaration of Arrays, Accessing the Elements of an Arrays, Storing Values in Arrays, Operations on Arrays, Passing Arrays to Functions, Two-Dimensional Arrays, Operations on Two-Dimensional Arrays, Multidimensional Arrays, Sparse Matrices, Applications of Arrays.
Strings: Suppressing Input, String Taxonomy, Operations on Strings, Miscellaneous String and Character Functions, Arrays of Strings.

UNIT – III
Functions: Introduction, Function Declaration/Function Prototype, Function Definition, Function Call, Return Statement, Passing Parameters to Functions, Built-in Functions.
Recursion: Recursive Functions, Types of Recursion, Recursion versus Iteration
Pointers: Introduction to Pointers, Declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Null Pointers, Generic Pointers, Passing Arguments to Function Using Pointers, Pointers and Arrays, Arrays of Pointers, Pointers to Pointers, Dynamic Memory Allocation.

UNIT – IV
Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, Enumerated Data Type.

UNIT – V
Files: Introduction to Files, Using Files in C, Read Data from Files, Writing Data to Files, Error Handling During File Operations, Functions for Selecting a Record Randomly.
Algorithms: Time and Space Complexity, Big O Notation, Omega Notation, Theta Notation, Searching Algorithms-Linear search, Binary Search.

TEXT BOOK

1.ReemaThareja, Programming in C, Oxford University Press, AICTE Edition, 2018

REFERENCE BOOKS

1. Herbert Schildt, C: The Complete Reference, McGraw Hall Education, 4th Edition, 2017
2. E Balagurusamy, Computer Programming, McGraw Hill Education, 8th Edition, 2019
3. Jeri R.Hanly, Elliot B.Koffman, Problem Solving and Program Design in C, Pearson Publishers, 8th Edition, 2015
4. Stephen G.Kochan, Programming in C, Pearson Education, 4th Edition, 2015
5. PradeepDey,ManasGhosh, Programming in C, Oxford University Press, 2nd Edition, 2013

	L	T	P	Cr.
B.Tech. (I Sem.) **20CS02 - DIGITAL LOGIC DESIGN**	3	0	0	3

Pre-requisite: Basic Mathematics

Course Educational Objective: The objective of the course is to learn the basic building blocks of the logic circuits of the computer system.

Course Outcomes: At the end of this course, the student will be able to*:*
  CO1: Explain the digital number systems, Boolean algebra theorems, properties, and canonical forms for digital logic circuit design. **(Understand-L2)**
  CO2: Apply Boolean algebra concepts and K-Maps for minimization of Boolean expressions. **(Apply -L3)**
  CO3: Construct the combinational circuits using Adders, Sub tractors, Decoders, Multiplexers and Magnitude Comparators. **(Apply-L3)**
  CO4: Demonstrate the sequential circuits using Flip-flops, Shift registers, and Counters & Memory unit. **(Understand-L2)**
  CO5: Construct programmable logic devices (PROM, PAL, and PLA). **(Apply-L3)**

UNIT - I
Number Systems: Binary, Octal, Decimal, Hexadecimal Number Systems, Conversion of Numbers from One Radix to another Radix, r's Complement and (r-1)'s Complement, Subtraction of Unsigned Binary Numbers and Signed Binary Numbers, Binary Codes,
Logic gates: Basic Gates: NOT, AND, OR Universal Gates: NAND, NOR, Special Gates: EX-OR and EX-NOR Gates. Error detection and Correction, Hamming Code. Logic families

UNIT - II
Boolean algebra: Fundamental postulates of Boolean algebra, Basic theorems, and properties, Complement, Dual of Logical Expressions, Standard forms: SOP, POS, and Minimizations of Logic Functions Using Boolean Theorems.
Karnaugh Map Method (K-Map): Minimization of Boolean Functions maximum up to Four Variables, Simplifications with Do not Care Conditions Using K-Map, Prime Implicants, Essential Prime Implicants, Quine-McCluskey Method.

UNIT - III
Arithmetic Circuits: Design of Half Adder, Full Adder, Half Subtractor, Full Subtractors, Ripple Carry Adder, Magnitude Comparator. Design of Multiplexers, Demultiplexers, Decoders, Encoders, Priority Encoder, Code Converter (including A/DC and D/AC)

UNIT - IV
Sequential Logic Circuits: Latch and Flip-Flop, RS- Latch Using NAND and NOR Gates, RS, JK, T and D Flip-flops, Truth and Excitation Tables, Conversion of Flip Flops, Master-Slave Flip-flops.
Registers and Counters: Introduction, Shift Register and its types, Bi-directional Shift Registers, Universal Shift Register, Design of Ripple Counters, Synchronous Counters, Modulus Counters, Ring Counter, Johnson Counter.

UNIT - V
Memory unit: RAM and ROM, **Programmable Logic Devices:** PLA, PAL, PROM, Realization of Switching Functions Using PROM, PAL and PLA, Comparison of PLA, PAL and PROM.

Textbook:
1. Digital Design, 4/e, Morris Mano, Michael D Ciletti, PEA

Reference books:
  1. Fundamentals of Logic Design, 5/e, Roth, Cengage
  2. Digital Logic Design, Leach, Malvino, Saha, TMH
  3. Modern Digital Electronics, R.P. Jain, TMH

	B.Tech. (I Sem.)	**20FE53 - ENGINEERING CHEMISTRY LAB**

L	T	P	Cr.
0	0	3	1.5

Pre-requisites: Nil

Course Educational Objectives: This course enables the students to analyze water samples and perform different types of volumetric titrations. It provides them with an overview of preparation of polymers and analytical techniques.

Course Outcomes: At the end of the course, the student shall be able to

CO1: Assess alkalinity of water based on the procedure given (**Understand – L2**).

CO2: Distinguish different types of titrations in volumetric analysis after performing the

experiments listed in the syllabus (**Understand – L2**).

CO3: Acquire practical knowledge related to preparation of polymers. (**Understand – L2**).

CO4: Exhibit skills in performing experiments based on theoretical fundamentals.(**Understand – L2**).

List of Experiments
(Any of the 10 experiments are required to be conducted)

Model Experiment
1. Determination of Na_2CO_3 using standard HCl solution.

Water Analysis
2. Determination of alkalinity of water sample.

Complexometric Titrations
3. Estimation of $Mg^{+2}/Zn^{+2}/Ca^{+2}$ in given solution by using standard EDTA solution.

Preparation of Polymers (only demonstration)
4. Nylon Fibers
5. Bakelite

Redox Titrations
6. Estimation of Mohr's salt by using potassium permanganate.
7. Estimation of Mohr's salt by using potassium dichromate.
8. Estimation of copper (II) ion using standard hypo solution.

Conductometric Measurements
9. Estimation of amount of HClconductometrically using standard NaOH solution.
10. Estimation of amount of HClconductometrically using NH_4OH solution.

Potentiometric Measurements
11. Estimation of amount of HClpotentiometrically using NaOH solution.

Estimations
12. Measuring pH of the given sample solution using pH meter (demonstration only).
13. Estimation of Vitamin C in a given sample.

Colorimetric Analysis
14. Determination of Iron (III) by colorimetric method.

REFERENCES
1. LAB Manual

	L	T	P	Cr.
B.Tech. (I Sem.) 20AD51 - COMPUTATIONAL PROGRAMMING LAB	0	0	3	1.5

Pre-requisites: NIL

Course Educational Objective:
The objective of the course is to practice and develop computer programs to solve the computational problems by using the basic elements of C Programming such as Data Types, Expressions, Control Statements and Various I/O Functions. After practicing the rudiments of program writing, learners will be able to design and test efficient programs for solving real world problems.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Apply control structures of C in solving computational problems.(**Apply - L3**)
CO2: Implement functions and use modular programming in problem solving.(**Apply - L3**)
CO3: create user defined datatypes and perform file operations.(**Apply - L3**)

List of Experiments
(Any of the 10 experiments are required to be conducted)

List of Experiments:

1 Introduction to Raptor Tool.
2 Problem solving using Raptor Tool
3 Programs on Basics of C-Program.
   a. Usage of various preliminaryData types
4 Programs on Mathematical Operations using Operators.
   a. usage of various Operators available in C Language.
   b. illustrate the order of evaluation.
5 Programs on Decision Making using Control Structures.
   a. To check whether the given year is leap year (or) not
   b. Convert the given two-digit number into words using switch statement
6 Programs on Pattern Printing using Loops & nesting of Loops.
   a. To check whether given number is Prime (or) not
   b. To display the following Pattern:

```
            *
      *           *
 *           *           *
      *           *
            *
```

7 Programs on Data representation using Arrays (One and Two dimensional)
   a. Addition, subtraction and multiplication of Matrices
   b. Transpose of a given matrix
8 Programs on Text Processing using Strings.
   a. To accept line of text and find the number of characters, number of vowels and number of blank spaces in it
   b. illustrate the use of string handling functions
9 Programs on Modular Programming using Functions.
   a. Swap two numbers using Call by Value
   b. Swap two numbers using Call by Reference
   c. Recursive function to solve Towers of Hanoi problem

10 Programs on Memory management using Pointers.
   a. illustrate use of extern &static storage classes
   b. illustrate the usage of command line arguments

      c. usage of dynamic memory management functions.

11   Programs on Data storage using user defined data types.
   a. To store the data of 10 Employees (Name, Designation, Company) using array of stuructures.
   b. To read data of 10 Students(Name, Roll No, Branch, Year of Study, College address and Residential Address) using array of structures & Nested structures concepts. (Hint: Address is a nested structure).

12   Programs on Permanent Data storage using Files
   a. Accessing content from files and writing content in to it.
   b. Copy the contents of one file into another

13   Program for Library Information System using files with the following modules:
   a. Student Registration
   b. Book Entry
   c. Search book
   d. Issue book
   e. Return book

14   Program for Examination System using files with the following modules:
   a. Student Registration
   b. Subject Entry
   c. Marks Posting
   d. Student wise Grades Calculation
   e. Result Declaration

L	T	P	Cr.
0	0	2	1

B.Tech. (I Sem.)   **20CS52 - DIGITAL LOGIC DESIGN LAB**

Pre-requisite :   Basics of Number System

Course Educational Objective: The objective of the course of this course is to learn about the use of basic gates, decoders and Multiplexers, flip-flops, Counters and Shift registers, and PLDs.

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

CO 1:   Implement basic logic gates and special logic gates using NAND and NOR gates. **(Apply-L3)**
CO 2:   Design combinational circuits like half-adders, full-adders, decoders, encoders, multiplexers .**(Apply - L3)**
CO 3:   Design sequential digital circuits like flip-flops, Shift registers, and Counters. **(Apply- L3)**
CO 4:   Improve individual / teamwork skills, communication & report writing skills with ethical values.

List of Experiments

1. a) Basic Gates Function Verification using truth tables.
        i) AND Gate using 7408 IC.
        ii) OR Gate using 7432 IC.
        iii) NOT Gate using 7404 IC.
   b) Universal Gates Functional Verification.
        i) NAND Gate using 7400 IC.
        ii) NOR Gate using 7402 IC.
   c) Special Gates Functional verification.
        i) XOR Gate using 7486 IC.
        ii) XNOR Gate using XOR followed by NOT Gate.

2. Realization of following gates using universal gates and its functional Verification. AND, OR, XOR,

    NOT.
3. a) Design Half-adder, Half-subtractor, Full-adderand Full-subtractor circuits and verify its functionality.

    b) Verify the functionality of four-bit ripple carry adder for signed and unsigned integers
        With the verification of overflow condition.

4. Design a four-bit comparator and verify its functionality (using logic gates or IC's)

5. Design a BCD to Excess-3 code converter and verify its functionality by using gates.

6. Design a BCD to Gray code converter and verify its functionality by using gates.

7. Design and verify the functionality of Decoders and multiplexers of Different inputs.

8. Verify the functionality of following Flip-Flops.
        a) SR Flip-Flop
        b) JK Flip-Flop
        c) D Flip-Flop
        d) T Flip-Flop
9. a) Design a UP-Counter & Down-Counter using JK/T Flip-Flop.
   b) Design a MOD-3 Counter.

10. Design a Bi-directional Counter using JK/T Flip-Flop.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (I Sem.)   **20IT51 - IT WORKSHOP**

Pre-requisite :   NIL

Course Educational Objective:
The objective of the course is to impart knowledge about the components of PC, Assembling PC, Installation of OS, softwares like MS-Office, LaTex and concepts related to Networking, Internet as well as antivirus.

COURSE OUTCOMES (COs): *At the end of this course, the student will be able to:*

CO1:   Identify the basic hardware components, keyboard shortcuts, assembling and disassembling of the system (PC). **(Understand- L2)**

CO2:   Demonstrate Operating System installation, apply various commands of Linux operating system, and networking. **(Apply - L3)**

CO3:   Create web pages using HTML, documents using applications like LaTeX, Google forms and use application software packages: MS-Word, MS-Excel, MS-Power Point to create documents and presentation. **(Apply- L3)**

CO4:   Improve individual / teamwork skills, communication & report writing skills with ethical values.

PC Hardware
Week 1
Task: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

PC Assembling
Week 2
Task: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. In addition, students need to go through the video, which shows the process of assembling a PC. A video would be given as part of the course content.

Operating System Installation
Week 3
Task 1: Every student should individually install MS windows and Linux/ Ubuntu OS on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
Task 2: Linux Operating System commands:
- General command syntax
- Basic help commands
- Basic File system commands
- Date and Time
- Basic Filters and Text processing
- Basic File compression commands
- Miscellaneous: apt-get, vi editor

Network & Internet
Week 4
Task 1: Networking Commands:
ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp, wget,route

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Week 5

Task 1: Internet Services:

- BrowserusageandadvancedsettingslikeLAN,proxy,content,privacy,security,cookies, extensions/ plugins
- Malicious Software: Virus,Worm,Logic Bomb,Trojan Horse
- Anti-virusinstallation,configuringa firewall,blockingpop-ups
- Mailcreationandusage,CreatingaDigitalProfileonLinkedIn

Productivity Tools
Week 6

Task 1: Basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3andits properties. Preparation ofasimplewebsite/ homepage

Every student should develop your home page using HTML Consisting of your photo, name, addressandeducation details as tableand yourskill set as alist.

Office Tools
Week 7

Task-1: DemonstrationandPracticeonTextEditorslikeNotepad,SublimeText,Atom,Brackets, Visual code, etc

Week 8

Task-1: DemonstrationandpracticeonMicrosoftWord,PowerPoint,MicrosoftExcel

Week 9

Task-1: DemonstrationandpracticeonLaTeXandproduceprofessionalpdfdocuments.

Week 10

Task-1: Creating online documents using Google docs- Create and share Bio-data form.

References:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream Tech.
2. Introduction to Information Technology, ITL Education Solutions limited, PearsonEducation.
3. ComputerFundamentals,AnitaGoel,PearsonEducation,2017
4. PCHardwareTroubleShootingMadeEasy,TMH
5. https://www.google.com/docs/about/
6. https://support.google.com/sites/answer/6372878?hl=en

L	T	P	Cr.
2	0	0	2

B.Tech.(II Sem.)   **20FE02 -PROFESSIONAL COMMUNICATION - II**

Pre-requisites: Nil

Course Educational Objective: To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

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

CO1: Produce a coherent paragraph interpreting a figure/graph/chart/table (**Understand –L2**)

CO2: Comprehend the given texts thoroughly by guessing the meanings of the words contextually (**Understand – L2**)

CO3: Use language appropriately fordescribing /comparing/contrasting/givingdirections & suggestions (**Remember – L1**)

CO4: Write formal/informal dialogues with an understanding of verbal/non-verbal features of communication. (**Understand – L2**)

CO5: Write well structured essays; Reports &Résumé (**Apply – L3**)

UNIT - I
Fabric of Change- 'H.G. Wells and the Uncertainties of Progress – Peter J. Bowler'; Reading: Studying the use of Graphic elements in texts; Grammar & Vocabulary**:** Quantifying Expressions; Adjectives and adverbs; Comparing and Contrasting; Degrees of Comparison;
Writing: Information Transfer

UNIT - II
Tools for Life - 'Leaves from the Mental Portfolio of a Eurasian – Sui Sin Far'; Reading: Global Comprehension; Detailed Comprehension; Grammar & Vocabulary**:** Active & Passive Voice; Idioms & Phrases; Writing: Structured Essays using suitable claims and evidences

UNIT - III
'Homi Jahangir Bhabha';
Grammar & Vocabulary: Words often confused; Common Errors; Writing**:** Incident & Investigation Reports

UNIT - IV
'Jagadish Chandra Bose'; Grammar & Vocabulary: Use of Antonyms; Correction of Sentences; Writing**:** Dialogue Writing

UNIT - V
'**Prafulla Chandra Ray'**; Grammar & Vocabulary: Analogy; Sentence Completion; Writing**:** Writing a Résumé

TEXT BOOKS:
1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient Black Swan, Hyderabad, 2019.
2. "The Great Indian Scientists" published by Cengage Learning India Pvt. Ltd., Delhi, 2017

REFERENCE BOOKS:
1. Swan, M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. Baradwaj Kumkum, "Professional Communication", I.K.International Publishing House Pvt.Ltd., New Delhi, 2008.
5. Wood,F.T., "Remedial English Grammar", Macmillan, 2007.

		L	T	P	Cr.
B.Tech. (II Sem.)	**20FE04 -LINEAR ALGEBRA AND TRANSFORMATION TECHNIQUES**	2	1	0	3

Pre-requisites: Nil

Course Educational Objective: In this course, students learn Matrix Algebra and introduced with transformation techniques such as Laplace Transforms and Z – Transforms.

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

CO1: Investigate the consistency of the system of equations and solve them (**Apply – L3**).
CO2: Determine the Eigen vectors and inverse, powers of a matrix using Cayley – Hamilton Theorem (**Apply – L3**).
CO3: Use the concepts of Laplace Transforms to various forms of functions (**Understand – L2**).
CO4: Solve ordinary differential equations by using Laplace Transforms (**Apply – L3**).
CO5: Apply Z - Transforms to solve difference equations (**Apply – L3**).

UNIT – I
System of Linear Equations
Matrices - Rank- Echelon form, Normal form, PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non-Homogeneous system of equations.

UNIT – II
Eigen Values and Eigen Vectors
Eigen values – Eigen Vectors – Properties – Cayley-Hamilton Theorem – Inverse and Powers of a matrix by using Cayley-Hamilton Theorem.

UNIT – III
Laplace Transforms
Laplace transforms of standard functions –Linear Property - Shifting Theorems, Change of Scale Property
Multiplication and Division by't' - Transforms of derivatives and integrals – Unit step function – Dirac's delta function.

UNIT – IV
Inverse Laplace Transforms
Inverse Laplace transforms– Linear Property - Shifting Properties - Convolution theorem, Applications of Laplace transforms to ordinary differential equations.

UNIT – V
Z-Transforms
Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z –transform - Convolution theorem – Solution of difference equation by Z-transforms.

TEXT BOOKS :
1. B.S. Grewal, "*Higher Engineering Mathematics*", 42ndEdition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1stEdition, TMH Publications, New Delhi, 2010.

REFERENCE BOOKS:
1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi,2011.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley & sons, New Delhi,2011.
3. W.E. Boyce and R. C. Diprima, "Elementary *Differential Equations"*, 7th Edition, John Wiley & sons, New Delhi,2011.

	L	T	P	Cr.
B.Tech. (II Sem.) **20FE07 - APPLIED PHYSICS**	2	1	0	3

Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts ofoptics, quantum mechanics, free electron theory of metals, semiconductors, dielectrics and their applications.

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

CO1: Define the nature of interference and diffraction (**Remember – L1**).

CO2: Apply the lasers and optical fibers in different fields (**Apply – L3**).

CO3: Estimate the electrical conductivity of metals (**Understand – L2**).

CO4: Analyze the properties of semiconducting materials (**Understand – L2**).

CO5: Classify the different types of magnetic and dielectric materials (**Understand – L2**).

UNIT – I
Wave Optics
Interference**:** Principle of super position, Conditions for Interference, Interference in thin parallel film by reflection, Newton's rings (reflection), working principle of Interferometer.
Diffraction**:** Introduction, Fraunhofer diffraction at single slit- Diffraction due to circular aperture, Diffraction Grating- Resolving power of Grating.

UNIT – II
Lasers and optical fibers
Lasers**:** Introduction - Principle of laser (absorption, spontaneous and stimulated emission of radiation), Einstein Coefficients –Nd-YAG laser, Helium Neon laser- applications.
Optical Fibers: Optical Fiber principle, Structure of optical fiber, numerical aperture and acceptance angle, types of optical fibers - applications.

UNIT – III
Principles of Quantum Mechanics &Free electron theory
Principles of quantum mechanics:de Broglie Hypothesis, Davisson - Germer experiment, Schrodinger time independent and dependent wave equations, physical significance of the wave function – particle in a box.
Free electron theory
Classical free electron theory- Postulates, Advantages and Draw backs, Fermi-Dirac distribution Function-Temperature dependence of Fermi- Dirac distribution function, Classification of Solids on the basis of Band theory.

UNIT – IV
Semiconductor physics
Conductivity of Intrinsic and Extrinsic semiconductors, Drift and Diffusion Current, Einstein relation, Hall Effect, Differences between direct and indirect Band Gap semiconductors, Solar Cell, Applications of Solar Cells.

UNIT – V
Magnetic &Dielectric materials
Magnetic parameters, Classification of magnetic Materials-Diamagnetic, paramagnetic and ferromagnetic materials, Hysteresis loop, soft and hard magnetic materials, Applications of Ferro magnetic materials

Dielectrics: polarization - Electronic and ionic polarization, orientation polarization (Qualitative), Local field, ClaussiusMosotti equation, Applications of dielectric materials.

TEXT BOOKS:
1. V. Rajendran, "*Engineering Physics*", TMH, New Delhi, 6th Edition, 2014.
2. M.N. Avadhanulu, P.G. Kshirsagar, "Engineering *Physics*", S. Chand & Co., 2nd Edition, 2014.

REFERENCE BOOKS:
1. M.N. Avadhanulu, TVS Arun Murthy, "Applied *Physics*", S. Chand & Co., 2nd Edition, 2007.
2. P.K. PalaniSamy, "*Applied Physics*", Sci. Publ. Chennai, 4thEdition, 2016.
3. P. Sreenivasa Rao, K Muralidhar, "*Applied Physics*", Him. Publi. Mumbai, 1st Edition, 2016.
4. HitendraKMallik , AK Singh " *Engineering Physics*", TMH, New Delhi, 1st Edition, 2009.

L	T	P	Cr.
3	0	0	3

B.Tech. (II Sem.)   **20CS03 – DATA STRUCTURES**

Pre-requisites: Nil

COURSE EDUCATIONAL OBJECTIVES: The objective of the course is to make students familiar with writing algorithms to implement different data structures like stacks, queues, trees and graphs, and various sorting techniques.

COURSE OUTCOMES (COs): At the end of this course, the student will be able to

CO 1: Write the algorithms for various operations on list using arrays and linked list and analyze the time complexity of its operations. **(Understand - L2)**

CO 2: Apply linear data structures like stack and queue in problem solving. (**Apply - L3**)

CO 3: Demonstrate various searching and sorting techniques and compare their computational complexities in terms of space and time. **(Understand - L2)**

CO 4: Write the algorithms for various operations on binary trees, binary search trees and AVL trees. (**Understand - L2**)

CO 5: Demonstrate graph traversal techniques and hashing techniques. (**Understand - L2**)

UNIT - I
Algorithm Analysis:
Introduction to Algorithm, Algorithm Analysis, Asymptotic Notations.
Introduction to arrays and Abstract Data Type (ADT)
Lists: List using arrays and linked list- Singly Linked List, Doubly Linked List, Circular Linked List.

UNIT – II
Stacks: Stack ADT,Implementation using arrays and linked list.
Applications of stacks: Infix to postfix expression conversion, Evaluation of Postfix expressions and balancing the symbols.
Queues: Queue: Queue ADT, Implementation of Queue using arrays and linked list, circular queue, DEQUE

UNIT - III
Sorting: Bubble sort**,** Insertion Sort, Selection sort, Merge Sort, Quick Sort & Heap Sort

UNIT - IV
Trees: Introduction, Tree traversals, Binary Trees, Binary Search Trees, Balanced Binary search tree - AVL Trees and its operations.

UNIT - V
Graphs: Fundamentals, Representation of graphs, Graph Traversals: BFS, DFS.
Hashing: Hash Table, Hash Function, Collision resolution Techniques- separate Chaining, Open addressing, rehashing.

TEXT BOOKS:
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education,2ndeditio
   [1,2,3 units]
2. ReemaThareja, Data Structures using c, Oxford Publications [3,4,5 units]
REFERENCES:
1. Langson, Augenstein&Tenenbaum, 'Data Structures using C and C++', 2nd Ed, PHI.
2. RobertL.Kruse, Leung and Tando, 'Data Structures and Program Design in C',   2ndedition, PHI

	L	**T**	**P**	**Cr.**
B.Tech. (II Sem.) 20CS04 - DISCRETE MATHEMATICAL STRUCTURES	**3**	**0**	**0**	**3**

Pre-requisite: Basic mathematical knowledge

Course Educational Objective:
The objective of the course is to perform the operations associated with relations and functions. Relate practical examples to the functions and relations and interpret the associated operations and terminology used in the context. Use formal logic proofs and/or informal but rigorous logical reasoning to, for example, predict the behavior of software or to solve problems such as puzzles.

Course Outcomes (COs): *At the end of this course, the student will be able to*

CO1 : Construct mathematical arguments using logical connectives & quantifiers and verify them.**(Understand – L2)**

CO2 : Demonstrate the basic terminology of functions, relations, lattices, and their operations.**(Understand – L2)**

CO3 : Apply the properties of graphs to solve the graph theory problems in Computer science.**(Apply – L3)**

CO4 : Illustrate the basic principles/techniques to solve different algebraic structures & combinatorial problems.**(Understand – L2)**

CO5 : Solve linear recurrence relations by recognizing homogeneity using constant coefficients characteristic roots and Generating functions. **(Understand – L2)**

UNIT – I
Mathematical Logic
Propositional logic and Predicate Calculus: Statements and Notations, Connectives, Truth Tables, Tautologies, Equivalence of Formulas, Tautological Implications, Normal Forms, Theory ofInference for Statement Calculus, Consistency of Premises, Indirect Method of Proof,Predicate Logic, Statement Functions, Variables and Quantifiers.

UNIT – II
Sets, **Relations & Functions**
Introduction to Sets, representation of Sets, Operation on Sets, Properties of Binary Relations, Relation Matrix, Operations on Relations, Transitive Closure, Equivalence Relation, Compatibility and Partial Ordering Relations, Hasse Diagrams, Lattices: LUB, GLB.
Functions: Bijective Functions, Composition of Functions, Inverse Functions.

UNIT – III
Graph Theory I & II
Graph Theory I : Basic Concepts of Graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Eulerian and Hamiltonian Graphs.
Graph Theory II: Planar Graphs, Euler's Formula, Graph Coloring, Chromatic Number, Graph Traversals: BFS, DFS. Trees**:** Spanning Trees: Properties, Algorithms for Minimum cost Spanning Trees

UNIT – IV
Algebraic Structures &Combinatorics
Algebraic Systems with one Binary Operation, Properties of Binary operations, Semi groups and Monoids: Homomorphism of Semi groups and Monoids, Group, Abelian group, Sub Groups, Lagrange's Theorem
Combinatorics: Basic of Counting, Permutations, Combinations, Combinations with repetition Pigeonhole Principle and its Applications, Principle of inclusion-exclusion.

UNIT – V
Recurrence Relation
Generating Function of Sequences, Calculating Coefficient of Generating Functions, Recurrence Relations, Solving linear or homogeneous recurrence Relations by substitution, generating functions and Characteristic Roots.

TEXT BOOKS
1. Tremblay, Manohar, Discrete Mathematical Structures with Applications to ComputerScience, TMH Publications [units- 1,2,3,4,5]

REFERENCES
1. Chandrasekaran,Umaparvathi,DiscreteMathematics,PHI, 2010[1,2,3,4,5]
2. Ralph. P.Grimaldi, Ramana, Discrete and Combinational Mathematics,Pearson,5th edition. [1,2,3,4,5]
3. https://nptel.ac.in/courses/106/106/106106183/[1,2,3,4,5] .

	L	T	P	Cr.
B.Tech. (II Sem.) 20MC01 - CONSTITUTION OF INDIA	2	0	0	0

Pre-requisites: Nil

Course Educational Objectives
• To enable the student to understand the importance of constitution.
• To understand the structure of Executive, Legislature and Judiciary.
• To understand Philosophy of fundamental rights and duties.
• To understand the autonomous nature of constitution bodies like SupremeCourt and High Court Controller and Auditor General of India and ElectionCommission of India.
• To understand the Central and State relation, financial and administrative.

Course Outcomes: At the end of the course, the student shall be able to

CO1: Understand history and philosophy of constitution with reference to Preamble, Fundamental Rights and Duties(**Understand – L2**).

CO2: Understand the concept of Unitary and Federal Government along with therole of President, Prime Minister and Judicial System(**Understand – L2**).

CO3: Understand the structure of the state government, Secretariat, Governor and Chief Ministerand their functions(**Understand – L2**).

CO4: Learn local administration viz. Panchayat, Block, Municipality and Corporation (**Understand – L2**).

CO5: Learn about Election Commission and the process and about SC, ST, OBCand women(**Understand – L2**).

UNIT – I:
Introduction to Indian Constitution: 'Constitution' meaning of the term, IndianConstitution – Sources and Constitutional History, Features – Citizenship,Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II:
Union Government and its Administration Structure of the Indian Union: FederalismCentre – State relationship, President: Role, Power and Position. Prime Minister(PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, RajyaSabha. The Supreme Court and High Court: Powers and Functions.

UNIT – III:
State Government and its Administration Governor – Role and Position – ChiefMinister (CM) and Council of Ministers. State Secretariat: Organization, Structureand Functions.

UNIT – IV:
A Local Administration -- Role and Importance,Municipalities – Mayor and Role of Elected Representative,Panchayati Raj: Functions of PanchayatiRaj Institution, Zilla Panchayat, Elected Officials and their roles, Villagelevel – Role of Elected and Appointed officials.

UNIT – V:
Election Commission: Election Commission – Role of Chief Election Commissionerand Election Commissionerate State Election Commission: Functions andCommissions for the welfare of SC/ST/OBC and Women.

REFERENCE BOOKS:
1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall ofIndiaPvt.Ltd., New Delhi.
2. SubashKashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government and Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (UniversalLaw Publication).
6. J.C. Johari, Indian Government and Politics Hans.
7. J.Raj, Indian Government and Politics.
8. M.V. Pylee, Indian Constitution, Durga Das Basu, Human Rights in
Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi.
9. Noorani, A.G. (South Asia Human Rights Documentation Centre), Challengesto Civil Right).
Challenges to Civil Rights Guarantees in India, OxfordUniversity Press 2012.

E-Resources:
1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.
4. www.hss.iitb.ac.in/en/lecture-details.
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indianconstitution.

		L	T	P	Cr.
B.Tech. (II Sem.)	**20FE51 - PROFESSIONAL COMMUNICATION SKILLS LAB**	0	0	2	1

Pre-requisites : Nil

Course Educational Objective: To improve the proficiency of students in English with an emphasis on better communication in formal and informal situations; Develop speaking skills required for expressing their knowledge and abilities and to face interviews with confidence.

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

- **CO1:** Introduce oneself and others using appropriate language and details (**Understand – L2**)
- **CO2:** Comprehend short talks and speak clearly on a specific topic using error free

  English(**Understand – L2**)
- **CO3:** Report effectively after participating in informal discussions ethically (**Remember –L1**)
- **CO4:** Interpret data aptly, ethically & make oral presentations (**Apply – L3**)

Syllabus: Professional Communication Skills Lab (PCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self- study by learners.
- **Interactive Communication Skills (ICS) Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo – audio & video system and camcorder etc.

Exercise – I
CALL Lab: Understand - Sentence structure

ICS Lab: Practice - Listening: Identifying the topic, the context and specific information
Speaking: Introducing oneself and others

Exercise – II
CALL Lab: Understand - Framing questions

ICS Lab: Practice - Listening: Answering a series of questions about main idea and supporting ideas after listening to audio text
Speaking: Discussing in pairs/small groups on specific topics; Delivering short structured talks using suitable cohesive devices (JAM)

Exercise – III
CALL Lab: Understand - Comprehension practice – Strategies for Effective Communication

ICS Lab: Practice - Listening: Listening for global comprehension and summarizing
Speaking: Discussing specific topics in pairs/small groups, reporting what is discussed
Exercise – IV
CALL Lab: Understand- Features of Good Conversation – Strategies for Effective Communication.

ICS Lab: Practice -Listening: Making predictions while listening to conversations/transactional dialogues with/without video
Speaking: Role – plays – formal & informal – asking for and giving information / directions / instructions / suggestions

Exercise – V
CALL Lab: Understand - Features of Good Presentation, Methodology of Group Discussion
ICS Lab: Practice - Introduction to Group Discussions
Listening: Answering questions, identifying key terms and understanding concepts
Speaking: Formal Oral & Poster presentations on topics from academic contexts without the use of PPT
Lab Manual:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient BlackSwan, Hyderabad, 2019.

Suggested Software:

1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley,USA,2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company,USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi,2008.

	L	T	P	Cr.
B.Tech. (II Sem.)　　　**20FE54 - APPLIED PHYSICS LAB**	0	0	3	1.5

Pre-requisites　　:　　Nil

Course Educational Objective: This course enables the students to acquire theoretical ideas, analytical techniques, and graphical analysis, by completing a host of experiments with the procedures and observational skills for appropriate use of simple and complex apparatus.

COURSE OUTCOMES: At the end of the course, the student will be able to:

CO1: Analyze the wave characteristics of light(**Understand – L2**).

CO2: Estimate the magnetic field using Stewart's and Gee's apparatus(**Understand – L2**).

CO3: Verify the characteristics of semiconductor diodes(**Apply – L3**).

CO4: Determine the acceptance angle and numerical aperture of optical fiber (**Apply – L3**).

CO5: Improve report writing skills and individual teamwork with ethical values (**Understand – L2**).

LIST OF EXPERIMENTS

　(Any of the 10 experiments are required to be conducted)

GENERAL EXPERIMENTS:
1. Determine the energy band gap of a semiconductor Diode.
2. Study the characteristics of Zener Diode.
3. Study the magnetic field along the axis of a current carrying circular coil using Stewart's & Gee's apparatus and to verify Biot - Savart's law.
4. Study the characteristics of Solar cell
5. Determination of dielectric constant by charging and discharging method.
6. Study the characteristics of Photo diode.
7. Determination of resistivity of semiconductor by four probe method.

OPTICS LAB EXPERIMENTS:
8. Determine the wavelength of a laser radiation.
9. Determine the width of a single slit by forming diffraction pattern.
10. Determine the Radius of Curvature of a Plano - Convex lens by forming Newton's Rings.
11. Determine the Wavelengths of various spectral lines by using diffraction grating.
12. Resolving power of grating.
13. Determine the acceptance angle and numerical aperture of a fiber.
14. Measure the bending losses in the optical fiber cable at different wavelengths.

	L	T	P	Cr.
B.Tech. (II Sem.) **20CS53 - DATA STRUCTURES LAB**	0	0	3	1.5

Pre-requisite: Programming Language

COURSE EDUCATIONAL OBJECTIVES: The objective of this course is to make students familiar with writing algorithms to implement different data structures like stacks, queues, trees and graphs, and various sorting techniques.

COURSE OUTCOMES (COs): At the end of this course, the student will be able to

CO 1: Implement Linear Data Structures using array and Linked list.(**Apply - L3**)

CO 2: Implement Various Sorting Techniques.(**Apply - L3**)

CO 3: Implement Non-Linear Data Structure such as Trees &Graphs.(**Apply - L3**)

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

LIST OF PROGRAMS:
I)Exercise Programs on List ADT
     a) Implementation of List using Arrays.
     b) Implementation of List using Linked List.
II) Exercise Programs on Stacks & Queue ADT
     a) Implementation of Stack Operations using Arrays.
     b) Implementation of Stack Operations using Linked List.
     c) Implementation of Queue Operations using Arrays.
     d) Implementation of Queue Operations using Linked List.
III) Exercise Programs on Stack Applications
     a) Conversion of Infix Expression to postfix Expression.
     b) Conversion of Infix Expression to prefix Expression.
     c) Evaluation of Postfix Expression
     d) Implementation of Balancing Symbols.
IV) Exercise Programs on Types of Queues
     a) Implementation of Circular Queues Linked List.
     b) Implementation of Double Ended Queue using Arrays.
     c) Implementation of Double Ended Queue using Linked List.
V) Exercise Programs on Sorting Techniques.
     a) Implementation of Insertion Sort and
     b) Implementation of Selection Sort.
     c) Implementation of Merge Sort.
     d) Implementation of Quick Sort.
     e) Implementation of Bubble Sort.
     f) Implementation of Heap Sort.
VI) Exercise Programs on Trees
     a) Implementation of Binary Tree Traversals.
     b) Implementation of Binary Search Tree Operations.
VII) Exercise Programs on Graph Traversal Techniques.
     a) Breadth First Search (BFS)   b) Depth First Search (DFS)

	L	T	P	Cr.
B.Tech. (II Sem.) **20ME53 - COMPUTER AIDED ENGINEERING DRAWING**	0	0	3	1.5

Pre-requisites: Nil

COURSE EDUCATIONAL OBJECTIVE:
The main objectives of this course are to familiarize various commands used in Auto-CAD and to visualize the isometric and orthographic views of any solid object.

COURSE OUTCOMES: After completion of the course students are the able to:

CO 1: Understand the Auto-CAD basics and apply to solve practical problems used inindustries where the speed and accuracy can be achieved. (**Understand-L2**)

CO 2: Understand the principle of Orthographic projections of points, lines, planes and solids. (**Understand-L2**)

CO 3: Draw the isometric views of lines, planes and simple solids.(**Understand-L2**)

CO 4: Convert orthographic to isometric vice versa.(**Understand-L2**)

At least 10 Exercises are to be conducted using Auto Cad software:

BASIC AUTO CAD COMMANDS:
1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide a line, offset).
4. Hatching & line commands (hatching with different angles& different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer& fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter& text).

PROJECTION OF POINTS AND LINES:
1. Projection of points (I, II, III, & IV quadrants).
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.

PROJECTION OF PLANES AND SOLIDS:
1. Projection of planes parallel to one reference plane & perpendicular to other reference plane.
2. Projection of planes inclined to one reference plane& perpendicular to other reference plane.
3. Projection of solids in simple position.
4. Projection of solids with axes inclined to one reference plane & parallel to other.

CONVERSION OF ORTHOGRAPHIC PROJECTIONS INTO ISOMETRIC PROJECTIONS & VICE VERSA:
1. Conversion of plane objects.
2. Conversion of circular objects.
3. Conversion of both combination of plane figures and circular objects.

Expt. No.	Type of Drawings	Name of the Experiment
1.	Basic drawing Commands	Exercise on Basic Drawing Commands-I
2.		Exercise on Basic Drawing Commands-II
3.	Modify commands	Exercise on Modify Commands
4.	Projection of Lines	Exercise on Projection of Lines-I
5.		Exercise on Projection of Lines-II
6.	Isometric Diagrams	Exercise on isometric views-I
7.		Exercise on isometric views-II
8.		Exercise on isometric views-III
9.		Exercise on isometric views-IV
10.	Conversion of Isometric to Orthographic views	Exercise on conversion of Isometric views into Orthographic views

REFERENCES

1. M. Kulkarni, A.P Rastogi, and A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
2. Bethune, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
3. N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar Publishers, 2012.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20FE09 - PROBABILITY AND STATISTICS**

Pre-requisite(s)   **:**   None

Course Educational Objective: The objective of this course is to provide students with the foundations and applications of probabilistic and statistical methods mainly used in varied applications in engineering and science.

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

CO1: Understand various probabilistic situations using the various laws of probability and random variables **(Understand - L2)**

CO2: Apply probability distributions like Binomial, Poisson, Normal and Exponential distributions in solving engineering problems (**Apply - L3**)

CO3: Calculate the standard error of sampling distribution and confidence intervals for parameters like mean and proportion based on the sample data. **(Apply - L3)**

CO4: Analyze the data scientifically with the appropriate statistical methodologies to apply the suitable test of hypothesis **(Analyze - L4)**

CO5: Construct the regression lines to predict the dependent variables and calculate the Correlation Coefficient for a bivariate statistical data.**(Apply – L3)**

UNIT-1:
Probability and Random variables
Probability, Sample space and events, Additive Rule, Conditional probability, Multiplicative rule, Baye's theorem.
Random variables – Discrete and continuous Random Variables, distribution function. Mathematical Expectation of one-dimensional Random Variable.

UNIT-2:
Probability Distributions
Binomial distribution, Poisson distribution, Poisson approximation to Binomial distribution, Exponential distribution, Normal distribution,Normal approximation to Binomial distribution.

UNIT-3:
Sampling distribution & Estimation
Population, sample, parameter, statistic, sampling distribution, Standard error, Types of sampling, Sampling distribution of means and sampling distribution of variance,
Parameter estimations –point estimation and interval estimation for mean and proportions.

UNIT-4:
Tests of Hypothesis
Hypothesis, Null and Alternate Hypothesis, Type I and Type II errors, level of significance.
Z-test for means and proportions, t-test for single mean, difference of means, paired t-test, F-test for equality of population variances, χ^2 - test for goodness of fit and independence of attributes.

UNIT-5:
Correlation & Regression
Karl Pearson's coefficient of correlation, linear Regression, Regression lines, Regression coefficients, Spearman's Rank correlation coefficient, Spearman's Rank correlation for repeated ranks.

TEXT BOOKS:
1. Jay L.Devore "Probability and Statistics for engineering and the sciences." , 8th edition, Cengage Learning india, 2012.
2. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 11thEdition, Sultan Chand and sons, New Delhi,2014.

REFERENCE BOOKS:
1. Miller & Freund's "Probability and Statistics for Engineers",8th edition. PHI, New Delhi,2011.
2. B.V. Ramana, "Higher Engineering Mathematics", 1st Edition, TMH, New Delhi, 2010

	L	T	P	Cr.
B.Tech. (III Sem.) **20MC02 – ENVIRONMENTAL SCIENCE**	2	0	0	0

Pre-requisite : Nil

Course Objectives:
In this course the student will learn about
- Environmental issues like over population, human health etc related to local, regional and global levels.
- The necessity of resources, their exploitation and sustainable management.
- The interactions of human and ecosystems and their role in the food web in the natural world.
- The global biodiversity, threats to biodiversity and its conservation.
- Environmental problems like pollution, disasters and possible solutions.

The importance of environmental decision making in organizations through audits

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

CO1: Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions**. (Remember-L1)**

CO2: Evaluate local, regional and global environmental issues related to resources and their sustainable management.**(Understand- L2)**

CO3: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.**(Understand- L2)**

CO4: Acknowledge and prevent the problems related to pollution of air, water and soil. **(Apply- L3)**

CO5: Identify the significance of implementing environmental laws and abatement devices for environmental management.**(Understand- L2)**

UNIT-I
Nature and scope of Environmental Problems
- Introduction to Environmental Science
- Population explosion, variations among nations
- Resettlement and Rehabilitation - Issues and possible solutions
- Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards.
- Role of Information Technology in environmental management and human health

UNIT-II
Natural Resources and Conservation
- Introduction and classification of Natural Resources
- Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, conflicts over water, interlinking of rivers, dams-benefits and problems, Rain water harvesting
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, soil salinity
- Energy resources: Growing energy needs renewable, non-renewable and alternate energy resources

UNIT-III
Ecology and Biodiversity
- Structure and functions of an Ecosystem, Food chains and Food webs, Ecological succession, Ecological pyramids, Biogeochemical cycles
- Biodiversity, Values of biodiversity, Bio geographical classification of India. Endangered and endemic species of India, Threats to biodiversity; Man and wild life conflicts, Conservation of biodiversity: In-situ and Ex-situ conservation methods

UNIT-IV
Environmental Pollution
Introduction to Environmental Pollution Causes, effects and control measures of:
Air pollution, Water pollution, Noise pollution, Solid Waste Management – Sources, Classification, effects and control measures of Municipal solid waste, Biomedical waste & Hazardous and e-waste, Disaster Management.

UNIT-V
Environmental Management
- Sustainable development and unsustainability
- Climate disruption, Greenhouse effect, Ozone layer depletion and Acid rain. Stockholm Conference
- Environmental Impact Assessment (EIA)
- Green building
- Environmental Law- Air, Water, Wild life, Forest, and Environmental protection act

TEXT BOOKS:
1. Anubha Kaushik, C.P.Kaushik, "*Perspectives in Environmental Studies*", 5nd edition, New age international publishers, Delhi, 2016.
2. G. Tyler Miller, Scott Spoolman, *"Introduction to Environmental Studies"*, 13th Edition, Cengage Learning, New Delhi, 2009.

REFERENCE BOOKS:
1. M. Anji Reddy, "*Textbook of Environmental Sciences and Technology*", 2nd Edition, BS Publications, Delhi 2011.
2. Deeshita Dave, P. UdayaBhaskar, "*Environmental Studies*", 2nd Edition, Cengage Learning, New Delhi, 2012.
3. S.Deswal, A. Deswal, "*A Basic course in Environmental Studies*", 2nd Edition, Educational & Technical Publishers, Delhi, 2014.
4. R. Rajagopalan, *"Environmental Studies (From Crisis to Cure)"*, 3rd Edition, Oxford University Press, New Delhi, 2012.
5. De, A.K, *"Environmental Chemistry"*, 5th Edition, New Age International (P) Limited, New Delhi, 2003.
6. Dr.K.V.S.G. Murali Krishna, *"Environmental Studies"*, 1st Edition, VGS Techno Series, Vijayawada, 2010.
7. MahuaBasu, S.Xavier, "*Fundamentals of Environmental Studies*", 1st edition, Cambridge University Press, Delhi, 2016.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20AD02-COMPUTER ARCHITECTURE**

Pre-requisite: Fundamentals of computerhardware

Course Educational Objective The objective of the course is to learn about the functional blocks and data representation of computer system, and understands the design principles of processor and organization and management of memory and peripheral devices.

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

- **CO1:** Identify the functional blocks of a computer and Instruction set architecture of CPU. **(Understand-L2)**
- **CO2:** Understand Data representation and perform computer arithmetic operations. **(Apply-L3)**
- **CO3:** Illustrate the design principles of control unit and pipelining. **(Understand-L2)**
- **CO4:** Analyze the memory hierarchy in a computer system. **(Analyze-L4)**
- **CO5:** Discuss the working principles of peripheral devices, their interfaces, and characteristics. **(Understand-L2)**

UNIT-I
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

UNIT-II
Data representation: signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, carry look- a head adder. Multiplication – shift-and add, Booth multiplier. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT-III
CPU control unit design: hardwired and micro-programmed design approaches. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

UNIT-IV
Memory system design: semiconductor memory technologies, memory organization. Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

UNIT-V
Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions

TEXT BOOKS:

1. M.MorrisMano, "Computer Systems Architecture", Pearson Educationpublishers. [units-1,2]

2. Carl Hamacher, ZvonksVranesic,SafeaZaky, "Computer Organization", TMH publications. [units-3,4,5]

REFERENCE BOOKS:

1. William Stallings, "Computer Organization and Architecture", Pearson/PHI publishers, Sixth Edition.
2. AndrewS.Tanenbaum, "StructuredComputerOrganization", Pearson/PHI publishers.
3. SivaraamaDandamudi, "Fundamentals or Computer Organization and Design", Springer publishers.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   20CS05-PYTHON PROGRAMMING

Pre-requisites   :Problem SolvingSkills

Course Educational Objective: The objective of the course is to provide basic knowledge of python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language for Problem solving and programming capability.

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

CO1: Identify basic building blocks of python to solve mathematical problems. **(Understand-L2)**

CO2: Apply the in-built data structures like list, tuple, set and dictionary for solving problems. **(Apply - L3)**

CO3: Use exception-handling mechanism to catch run-time errors**(Apply– L3)**

CO4: Demonstrate compelling concepts about string manipulation, regular expressions, and file handling. (**Understand - L2**)

CO5: Demonstrate object-oriented programming principles of python. (**Understand - L2**)

UNIT- I
Introduction to Python: History of Python, Usage of Python interpreter, Python Shell, Indentation, Python Built-in types, Variables, Assignment, Input-Output Statements, Simple Programs, Identifiers and keywords, Literals. **Operators:** Arithmetic operators, Relational operators, Logical operators, Assignment operators, Bit-wise operators, Python Membership Operators (in & not in), Python Identity Operators (is & is not), Operator precedence.
Control Structures: Conditional Statements - if, if-else, Nested if-else. Jumping Statements - continue, break, and pass. Python Loops - while, for, Nested loops with Programming Examples, Mathematical Functions and Constants (import math), Random Number Functions.

UNIT-II
Lists: Concept, Creating and Accessing Elements, Updating & Deleting Lists, basic List Operations, Reverse, Indexing, Slicing and Matrices, Built-in List Functions.
Tuples: Introduction, Creating & Deleting Tuples, Accessing values in a Tuple, Updating tuples, Delete Tuple Elements, basic Tuple Operations, Indexing, Slicing and Matrices, built- in tuple Functions.
Sets: Concept, Operations.
Dictionaries: Introduction, Accessing values in dictionaries, working with dictionaries, Properties, Functions.

UNIT- III
Functions: Defining a Function, Calling a Function, Types of Functions, Function Arguments, Anonymous functions, Global and Local Variables, Recursion
Modular Design: Creating modules, import statement, from, Date and Time Module.
Exception Handling: Exception, Exception Handling, except clause, Try, finally clause, User Defined Exceptions.

UNIT- IV
Python strings: Concept, Slicing, Escape characters, String Special Operations, String formatting Operator, Triple Quotes, Raw String, Unicode Strings, and Built-in String methods.
Regular Expression Operations: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.
Files: Introduction to files, file operations- Read, write, and search

UNIT- V
Object Oriented Programming OOP in Python: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, and Data hiding.

TEXT BOOKS:
1. ReemaThareja,"PythonProgrammingUsingProblemSolvingApproach", OxfordPublications

2. Python for Everybody: Exploring Data In Python 3by Dr. Charles Russell Severance, Sue Blumenberg

REFERENCE BOOKS:
1. Gowri Shankar SandVeena,"IntroductiontoPythonProgramming",CRCPress, Taylor, andFrancisGroup–ACHAPMAN&HALLBOOK.

2. R. NageswaraRao, "Core python programming", Dreamtech,2017.

3. Y. Daniel Liang, "RevelforIntroductionto Python Programmingand DataStructures", PearsonPublications

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20CS07 - DATABASE MANAGEMENT SYSTEMS**

Pre-requisite: Data Structures.

Course Educational Objective: The Objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing, Indexing and Interfacing with NOSQL using MonogoDB.

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

CO1: State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand-L2)**

CO2: Examine the relational model using Structured Query Language (SQL). **(Apply-L3)**

CO3: Employ principles of normalization for effective database design. **(Apply-L3)**

CO4: Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand-L2)**

CO5: Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand-L2)**

UNIT – I

Introduction: An overview of Database Management System, Database System Vs File System, Database System Concepts and Three Schema Architecture, Data Models, Database Schema and Instances, Data Independence, Database Languages, Database Structure.

Data Modelling using the Entity Relationship Model: ER model concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Relationships of Higher Degree.

UNIT – II

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints, and Relational Algebra.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data types and Literals, Insert, Update and Delete Operations, Tables, Views and Indexes, Nested Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Cursors in SQL, Triggers in SQL.

UNIT – III

Normalization: Functional Dependencies, Normal Forms - First, Second, Third Normal Forms, BCNF, Inclusion Dependences, Loss Less Join Decompositions, Multi Valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT – IV

Transaction Processing Concepts: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializability, Recoverability, Deadlock Handling.

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Recovery with Concurrent Transactions.

Crash Recovery: Log Based Recovery, Checkpoints, ARIES Algorithm

UNIT – V

Physical Database Design: Storage and file structure, indexed files, hashed files, B+ trees, files with dense index; files with variable length records.

Interfacing and interacting with NoSQL: Introduction to NoSQL, Storing and Accessing Data, Storing Data in and Accessing Data from MongoDB, Querying MongoDB.

TEXT BOOKS:

1. HenryF.Korth,AbrahamSilberschatz, S.Sudarshan, ―DatabaseSystemConcepts‖,McGraw Hill, 6th edition, 2009. [**1,2,3,4,5**]
2. ShashankTiwari, "ProfessionalNoSql", JohnWielysons",2011.

REFERENCE BOOKS:

1. RaghuRamaKrishnan,JohanneseGehrke, ―DatabaseManagementSystem‖,McGrawHill,3 rdedition,2000.
2. DateCJ,―AnIntroductiontoDatabaseSystem,PearsonEducation,8thedition,2003.
3. RamezElmasri, Sham kanthB.Navathe,―Fundamentals of Database Systems‖, Addison Wesley, 6th edition, 2010.

	L	T	P	Cr.
B.Tech. (III Sem.) 20CS09 -OBJECT ORIENTED PROGRAMMING	3	0	0	3

Pre-requisite   **:**   Programming for Problem Solving using C.

Course Educational Objective: The objective of the course is to learn the constructs of the Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. In the process of learning the language, they will be applying knowledge of object-oriented programming; they will get the fundamental knowledge reason collection framework.

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

CO 1   Demonstrate the fundamentals of object-oriented programming and basic building blocks of Java. **(Understand- L2)**

CO 2   Apply object-oriented programming principles for the development of reusable applications. **(Apply - L3)**

CO 3   Understand the importance of abstraction, user defined package creation and handling different exceptions. **(Understand- L2)**

CO 4   Develop multitasking applications using JAVA multithreaded programming and perform different operations upon various data structures by using collection framework. **(Apply – L3)**

CO 5   Develop GUI applications using AWT (Abstract Window Toolkit). **(Apply- L3)**

UNIT-I

Introduction to OOP: Programming paradigms, procedural programming language versus object-oriented language, principles of OOP.

Introduction to JAVA: Data types, variables, keywords, operators, and control statements.

Introduction to Classes and Object: Class definition, variables, and methods. Declaring Objects, Constructors, and this keyword.

UNIT-2

Classes and objects: overloading methods and constructors, parameter passing, returning objects, recursion. Access control, nested and inner classes, final and static keyword, variable and command-line arguments.

Inheritance and polymorphism: Inheritance, types of inheritance, super keyword, polymorphism (overloading & overriding), dynamic method dispatch, abstract class, using final with inheritance.

String handling classes: String, StringBuffer, StringTokenizer.

UNIT-3

Interfaces and packages: Interface methods, inheritance in interfaces. API : The built-in JAVA packages and creating and managing user defined packages, importance of CLASSPATH.

Exception Handling: Exception hierarchy, importance of try, catch, throw, throws and finally. Block creation of user-defined exceptions, Assertions.

UNIT-4

Multithreading: Introduction, thread life cycle, creation of threads, naming a thread, joining a thread, thread priorities, daemon thread, thread pool, thread group, thread synchronization, Inter-thread communication.

Collection Framework: Introduction, generics, collection framework hierarchy, list, set, queue, and map.

UNIT-5

AWT: AWT hierarchy, components and containers, Button, Label, Text Field, Checkbox, Choice, List, Canvas, Scrollbar, Menu Item & Menu, Container class, Layout managers (Border Layout, Flow Layout, Grid Layout, Card Layout).

Event handling: Event delegation model, event classes (Action Event, Mouse Event, Key Event, Window Event), listener interfaces (Action Listener, Mouse Listener and MouseMotionListener, Key Listener, Window Listener), adapter classes, close AWT window.

TEXTBOOKS:

1. Herbert Schildt, "Java: The complete reference", TMH Publications, 7th edition, 2006.
2. Cay S. Horstmann, "Core Java Volume I – Fundamentals", Pearson, Eleventh edition, 2018.

REFERENCE BOOKS:

1. Dr.R.NageswaraRao, "Core JAVA: An Integrated Approach", Dreamtech Press, 1st Edition2008.

2. E. Balaguruswamy, "Programming with JAVA", TMH Publications, 2ndEdition, 2000.

3. Patrick Niemeyer & Jonathan Knudsen, "Learning Java", O'REILLY Publications, 3rd Edition, 2005.

4. Benjamin J Evans & David Flanagan, "Java–in a Nutshell – A desktop quick reference", O'REILLY Publications, 6th Edition, 2014.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem.)   **20CS54 - PYTHON PROGRAMMING LAB**

Pre-requisite**:**   Basic Knowledge of Programming.

Course Educational Objective:

The Objective of Python course is to lead the students from the basics of writing and running Python scripts in problem solving and to design and implement the modules and understands the working of classes and objects in python.

Course Outcomes: *At the end of the course, the student shall be able to*

CO 1:   Apply building blocks of Python in solving computational problems. (**Apply - L3**)

CO 2:   Implement in-built data structures available in Python to solve computational problems. (**Apply - L3**)

CO 3:   Implement modular programming, string manipulations and Object-oriented programming in python. (**Apply - L3**)

CO 4:   Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example problems (Two weeks)

a) Implement Python Script for checking the given year is leap year or not.

b) Implement Python Script for finding biggest number among 3 numbers.

c) Implement Python Script for displaying reversal of a number.

d) Implement Python Script to check given number is Armstrong or not.

e) Implement Python Script to print sum of N natural numbers.

f) Implement Python Script to check given number is palindrome or not.

g) Implement Python script to print factorial of a number.

h) Implement Python Script to print all prime numbers within the given range.

i) Implement Python Script to calculate the series: S=1+x+x2+x3+.......xn

j) Implement Python Script to print the following pattern:

$$*$$
$$*\quad*$$
$$*\quad*\quad*$$

Module 1:   Exercise Programs on Lists.

    a) Write a Python script to display elements of list in reverse order.

    b) Write a Python script to find the minimum and maximum elements without using built-in operations in the lists.

    c) Write a Python script to remove duplicates from a list.

    d) Write a Python script to append a list to the second list.

    e) Write a Python script to count the number of strings in a list where the string length is 2 or more.

Module 2:   Exercise Programs on Tuples.

    a) Write a Python script to create a tuple with different data types.

    b) Write a Python script to find the repeated items of a tuple.

    c) Write a Python script to replace last value of tuples in a list.

Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]

    Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]

    d) Write a Python script to sort a tuple by its float element.

Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')]

    Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]

Module 3:   Exercise Programs on Sets and Dictionaries.

    a) Write a Python script to add member(s) in a set.

    b) Write a Python script to perform Union, Intersection, difference and symmetric difference of given two sets.

    c) Write Python script to test whether every element in S is in T and every element in T is in S.

    d) Write a Python script to sort (ascending and descending) a dictionary by value.

    e) Write a Python script to check whether a given key already exists or not in a dictionary.

    f) Write a Python script to concatenate following dictionaries to create a new one.

    g) Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}

        Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}

    h) Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys.

    i) Write a Python program to map two lists into a dictionary.

Module 4: Exercise Programs on functions and recursion.

a) Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.

b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.

c) Define functions to find mean, median, mode for the given numbers in a list.

d) Define a function which generates Fibonacci series up to n numbers.

e) Implement a python script for factorial of number by using recursion.

f) Implement a python script to find GCD of given two numbers using recursion.

Module 5: Exercise programs on Date and Time Modules.

a) Write a Python script to get the current time in Python.

b) Write a Python script to get current time in milliseconds in Python

c) Write a Python script to print next 5 days starting from today.

Module 6: Exercise programs on Exception Handling.

a) Write a Python script to handle simple errors by using exception handling mechanism.

b) Write a Python script to handle multiple errors with one except statement.

Module 7: Exercise programs on Strings

a) Implement Python Script to perform various operations on string using string libraries.

b) Implement Python Script to check given string is palindrome or not.

c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.

d) Implement python script that takes a list of words and returns the length of the longest one.

Module 8: Exercise programs on Regular Expressions

a) Write a Python script to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).

b) Write a Python script to check whether password is valid or not.

      Conditions for a valid password are:

      Should have at least one number.

      Should have at least one uppercase and one lowercase character.

      Should have at least one special symbol.

      Should be between 6 to 20 characters long.

Module 9: Exercise programs on Object Oriented Programming

   a) Write a Python script to create and access class variables and methods.

   b) Write a Python script to implement method overloading.

   c) Write a Python script to implement single inheritance.

   d) Write a Python script to implement method overriding.

Module 10: Exercise programs on Python Libraries – Numpy , Pandas , Matplotlib

   a) Write a NumPy program to generate a matrix product of two arrays.

   b) Write a NumPy program to create a random array with 1000 elements and compute the average, variance, standard deviation of the array elements.

   c) Demonstrate how to download dataset and how to create DataFrame

      i.   Write a Pandas program to get the first 3 rows of a DataFrame

      ii. Write a Pandas program to select the specified columns and rows from a given data frame.

      iii. Write a Pandas program to select the rows where the score is missing, i.e. is NaN.

      iv. Write a Pandas program to insert a new column in existing DataFrame.

   d) Write a Python programming to display a bar chart using different color for each

      bar.

   e) Write a Python programming to create a pie chart with a title.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem.)   20CS56-DATABASE MANAGEMENT SYSTEMS LAB

Pre-requisite: Programming language, Set theory, and Data structures.

Course Educational Objective: The objective of this lab is to provide a strong formal foundation in database concepts, technology, and practice to the participants to groom them into well-informed database application developers.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Create & manipulate the relational database using SQL. **(Apply-L3)**

CO2: Implement Views, procedures, triggers, and cursors on relational database. **(Apply-L3)**

CO3: Create Unstructured Databases using MongoDB. **(Apply-L3)**

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example queries (**one or two weeks**)

1) Create a table STUDENT with appropriate data types and perform the following queries. Attributes are Roll number, student name, date of birth, branch and year of study.

  a) Insert 5 to 10 rows in atable?
  b) List all the students of allbranches
  c) Liststudentnameswhose namestartswith's '
  d) Liststudentnameswhosenamecontains 'sasthirdliteral
  e) Liststudentnameswhosecontainstwo 's 'anywhereinthename
  f) List students whose branch isNULL
  g) Liststudentsof AIDS&ECEwhobornafter1980
  h) Listallstudentsin reverseordeoftheirnames
  i) Deletestudentsof anybranchwhosenamestartswith's'
  j) Updatethebranchof AIDSstudentstoECE
  k) Displaystudentnamepaddedwith * afterthenameofallthestudents.

2) Create the following tables based on the above Schema Diagram with appropriate data types and constraints and perform the following queries.
   SAILORS (Sail id, Sailname, Rating, Age)
   RESERVES (Sailid, boatid, Day)
   BOATS (Boatid, Boat-name, Color)
  a) Insert 5 to 10 rows in alltables?
  b) Findthenameofsailorswhoreservedboatnumber3.
  c) Findthenameof sailorswhoreservedgreenboat.
  d) Findthecolorsof boatsreservedbyRamesh.
  e) Findthenamesof sailorswhohavereservedatleastoneboat.
  f) Findtheall sailed ofsailorswhohavearatingof10orhavereservedboated104.

g) Find the Sailid's of sailors with age over 20 who have not registered a red boat.
h) Find the names of sailors who have reserved a red or green boat.
i) Find sailors whose rating is better than some sailor called Salvador.
j) Find the names of sailors who are older than the oldest sailor with a rating of 10.

3) Schema Diagram for the rest of the SQL and PL SQL Programs.
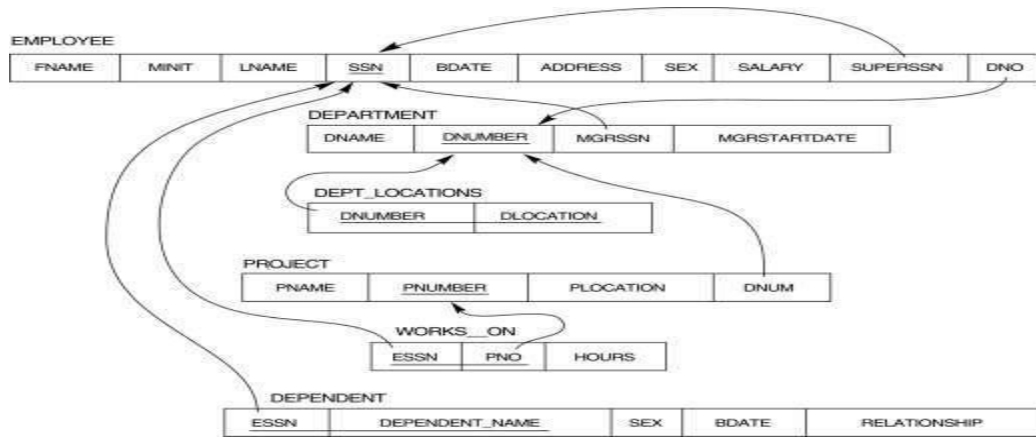
Create the following tables based on the above Schema Diagram with appropriate data types and constraints.

EMPLOYEE (Fname, Mname, Lname, SSN, Bdate, Address, Gender, Salary, SuperSSN,Dno)
DEPARTMENT (Dnumber, Dname, MgrSSN, Mgrstartdate)
DEPENDENT (ESSN, Dependent_Name, Gender, Bdate, Relationship)

a) Insert 5 to 10 rows into all the tables.
b) Display all employees' names along with their department names.
c) Display all employees' names along with their dependent details.
d) Display name and address of all employees who work for Research department.
e) List the names of all employees with two or more dependents.
f) List the names of employee who have no dependents.
g) List the names of employees who have at least one dependent.
h) List the names of the employees along with names of their supervisors using aliases.
i) Display name of the department and name of manager for all the departments.

j) Display the name of each employee who has a dependent with the same first name and gender as the employee. a) Insert 5 to 10 rows into all the tables.

4) Create the following tables based on the above Schema Diagram with appropriate data types and constraints in addition to the tables in Experiment 2.

DEPT_LOCATIONS (Dnumber, Dloaction) PROJECT (Pname, Pnumber, Plocation, Dnum)
WORKS_ON (ESSN, Pno, Hours)

a) Insert 5 to 10 rows into all the tables.

b) Find the names of the employees who work on all the projects controlled by the department Research.

c) List the project number, name and no. Of employees who work on that project for all the projects.

d) List the names of all the projects controlled by the departments department wise.

e) Retrieve the names of employees who work on all projects that John works on.

f) List the project numbers for projects that involve an employee either as worker or as a manager of the department that controls the project.

g) List the names of all employees in one department who work more than 10 hours on one specific project.

h) For each project, list the project name and total hours (by all employees) spent on that project.

i) Retrieve the names of all employees who work on every project.

j) Retrieve the names of all employees who do not work on any project. a) List the projects that are controlled by one department from this view.

b) List the managers of the controlling departments for all the projects.

c) Demonstrate one update operation on this view.

d) List the Location of the controlling departments for all the projects.

e) Retrieve the data from the view.

5) Create a view that has project name, controlling department name, number of employees Andtotal hours worked on the project for each project with more than one employee working on it.

6) Create a view emp from employee such that it contains only emp_noemp_name and department.

7) Create a view dept from department with only dept_no and location.

8) Create a view that contains the details of employees who are managers only.

9) Write a procedure to check whether the given number is Armstrong or not.

10) Write a procedure which accept the account number of a customer and retrieve the balance.

11) Write a procedure which accepts the student number and displays the department in which he belongs to.

12) Create a cursor to modify the salary of all employees belonging to 'Research' department by 150%.

13) Consider the college database. Retrieve all students who have registered for a specific course and store their details into another table using Cursors.

14) Write an update trigger on Account table. The system should keep track of the records that are being updated.

15) Create NoSQL database for a sample application and perform CURD operations

Design Database for any one of the following Case Studies

Case Study1 :Hospital Management System

Aim: XYZ hospital is a multi-specialty hospital that includes a number of departments,rooms, doctors, nurses, compounders, and other staff working in the hospital. Patients having different kinds of ailments come to the hospital and get checkup done from the concerneddoctors. If required they are admitted in the hospital and discharged after treatment.The aim of this case study is to design and develop a database for the hospital to maintain therecords of various departments, rooms, and doctors in the hospital. It also maintains recordsof the regular patients, patients admitted in the hospital, the checkup of patients done by thedoctors, the patients that have been operated, and patients discharged from the hospital.

Description: In hospital, there are many departments like Orthopedic, Pathology,Emergency, Dental, Gynecology, Anesthetics, I.C.U., Blood Bank, Operation Theater ,Laboratory, M.R.I., Neurology, Cardiology, Cancer Department, Corpse, etc. There is an OPD where patients come and get a card (that is, entry card of the patient) for check up from the concerned doctor. After making entry in the card, they go to the concerned doctor's room and the doctor checks up their ailments. According to the ailments, the doctor either prescribes medicine or admits the patient in the concerned department. The patient may choose either private or general room according to his/her need. But before getting admission in the hospital, the patient has to fulfill certain formalities of the hospital like room

charges,etc. After the treatment is completed, the doctor discharges the patient. Before discharging from the hospital, the patient again has to complete certain formalities of the hospital like balance charges, test charges, operation charges (if any), blood charges, doctors' charges, etc. Next we talk about the doctors of the hospital. There are two types of the doctors in the hospital, namely, regular doctors and call on doctors. Regular doctors are those doctors who come to the hospital daily. Calls on doctors are those doctors who are called by the hospital if the concerned doctor is not available.

Table Description:

Following are the tables along with constraints used in Hospital Management database

1. DEPARTMENT: This table consists of details about the various departments in the hospital. The information stored in this table includes department name, department location, and facilities available in that department.

Constraint: Department name will be unique for each department.

2. ALL_DOCTORS: This table stores information about all the doctors working for the hospital and the departments they are associated with. Each doctor is given an identity number starting with DR or DC prefixes only.

Constraint: Identity number is unique for each doctor and the corresponding department should exist in DEPARTMENT table.

3. DOC_REG: This table stores details of regular doctors working in the hospital. Doctors are referred to by their doctor number. This table also stores personal details of doctors like name, qualification, address, phone number, salary, date of joining, etc. Constraint: Doctor's number entered should contain DR only as a prefix and must exist in ALL_DOCTORS table.

4. DOC_ON_CALL: This table stores details of doctors called by hospital when additional doctors are required. Doctors are referred to by their doctor number. Other personal details like name, qualification, fees per call, payment due, address, phone number, etc., are also stored.

Constraint: Doctor's number entered should contain DC only as a prefix and must existin ALL_DOCTORS table.

5. PAT_ENTRY: The record in this table is created when any patient arrives in thehospital for a checkup. When patient arrives, a patient number is generated which actsas a primary key. Other details like name, age, sex, address, city, phone number, entrydate, name of the doctor referred to, diagnosis, and department name are also stored.After storing the necessary details patient is sent to the doctor for checkup.

Constraint: Patient number should begin with prefix PT. Sex should be M or F only.Doctor's name and department referred must exist.

6. PAT_CHKUP: This table stores the details about the patients who get treatmentfrom the doctor referred to. Details like patient number from patient entry table, doctornumber, date of checkup, diagnosis, and treatment are stored. One more field status isused to indicate whether patient is admitted, referred for operation or is a regularpatient to the hospital. If patient is admitted, further details are stored inPAT_ADMITtable. If patient is referred for operation, the further details are stored in PAT_OPR table and if patient is a regular patient to the hospital, the further details are stored inPAT_REG table.

Constraint: Patient number should exist in PAT_ENTRY table and it should be unique.

7. PAT_ADMIT: When patient is admitted, his/her related details are stored in this table. Information stored includes patient number, advance payment, mode of payment, room number, department, date of admission, initial condition, diagnosis, treatment, number of the doctor under whom treatment is done, attendant name, etc.

Constraint: Patient number should exist in PAT_ENTRY table. Department, doctornumber, room number must be valid.

8. PAT_DIS: An entry is made in this table whenever a patient gets discharged from the hospital. Each entry includes details like patient number, treatment given, treatment advice, payment made, mode of payment, date of discharge, etc.
Constraint: Patient number should exist in PAT_ENTRY table.

9. PAT_REG: Details of regular patients are stored in this table. Information stored includes date of visit, diagnosis, treatment, medicine recommended, status of treatment, etc.
Constraint: Patient number should exist in patient entry table. There can be multiple entries of one patient as patient might be visiting hospital repeatedly for checkup and there will be entry for patient's each visit.

10. PAT_OPR: If patient is operated in the hospital, his/her details are stored in this table. Information stored includes patient number, date of admission, date of operation, number of the doctor who conducted the operation, number of the operation theater in which operation was carried out, type of operation, patient's condition before and after operation, treatment advice, etc.
Constraint: Patient number should exist in PAT_ENTRY table. Department, doctor number should exist or should be valid.

11. ROOM_DETAILS: It contains details of all rooms in the hospital. The details stored in this table include room number, room type (general or private), status (whether occupied or not), if occupied, then patient number, patient name, charges per day, etc.
Constraint: Room number should be unique. Room type can only be G or P and status can only be Y or N.

Case Study2 :Railway Reservation
Aim: The railway reservation system facilitates the passengers to enquire about the trains available on the basis of source and destination, booking and cancellation of tickets, enquire about the status of the booked ticket, etc. The aim of case study is to design and develop a database maintaining the records of different trains, train status, and passengers. The record of train includes its number, name, source, destination, and days on which it is available, whereas record of train status includes dates for which tickets can be booked, total number of seats available, and number of seats already booked. The database has been developed and tested on the Oracle.
Description:
Passengers can book their tickets for the train in which seats are available. For this, passenger must provide the desired train number and the date for which ticket is to be booked. Before booking a ticket for a passenger, the validity of train number and booking date is checked. Once the train number and booking date are validated, it is checked whether the seat is available. If yes, the ticket is booked with confirm status and corresponding ticket IDis generated which is stored along with other details of the passenger. After all the available tickets are booked, certain numbers of tickets are booked with waiting status. If waiting lot is also finished, then tickets are not booked and a message of non-availability of seats is displayed.The ticket once booked can be cancelled at any time. For this, the passenger must provide the ticket ID (the unique key). The ticket ID is searched, and the corresponding record is deleted. With this, the first ticket with waiting status also gets confirmed.
List of Assumption
Since the reservation system is very large in reality, it is not feasible to develop the case study to that extent and prepare documentation at that level. Therefore, a small sample case study has been created to demonstrate the working of the reservation system. To implement this sample case study, some assumptions have been made, which are as follows:
1. The number of trains has been restricted to 5.
2. The booking is open only for next seven days from the current date.
3. Only two categories of tickets can be booked, namely, AC and General.
4. The total number of tickets that can be booked in each category (AC and General) is 10.
5. The total number of tickets that can be given the status of waiting is 2.
6. The in-between stoppage stations and their bookings are not considered.

Description of Tables and Procedures
Tables and procedures that will be created are as follows:

1.TrainList: This table consists of details about all the available trains. The information stored in this table includes train number, train name, source, destination, fair for AC ticket, fair for general ticket, and weekdays on which train is available.
Constraint: The train number is unique.

2. Train_Status: This table consists of details about the dates on which ticket can be booked for a train and the status of the availability of tickets. The information stored in this table includes train number, train date, total number of AC seats, total number of general seats, number of AC seats booked, and number of general seats booked.
Constraint: Train number should exist in TrainList table.

3. Passenger: This table consists of details about the booked tickets. The information stored in this table includes ticket ID, train number, date for which ticket is booked, name, age, sex and address of the passenger, status of reservation (either confirmed or waiting), and category for which ticket is booked.
Constraint: Ticket ID is unique and the train number should exist in TrainList table.

4.Booking: In this procedure, the train number, train date, and category is read from the passenger. On the basis of the values provided by the passenger, corresponding record is retrieved from the Train_Status table. If the desired category is AC, then total number of AC seats and number of booked AC seats are compared in order to find whether ticket can be booked or not. Similarly, it can be checked for the general category. If ticket can be booked, then passenger details are read and stored in the Passenger table.

5.Cancel: In this procedure, ticket ID is read from the passenger and corresponding record is searched in the Passenger table. If the record exists, it is deleted from the table. After deleting the record (if it is confirmed), first record with waiting status for the same train and same category are searched from the Passenger table and its status is changed to confirm.

Case Study3 :Painting Hire Business
System Description:
A local businesswoman has decided to start her own Internet business,calledMasterpiecesLtd, hiring paintings to private individuals and commercial companies.Because of your reputation as a database designer, she has called upon your services todesign and implement a database to support her new business. At the initial planning meeting,to discuss the design, the following user requirements were requested.The system must be able to manage the details of customers, paintings and those paintingscurrently on hire to customers. Customers are categorized as B (bronze), S (silver), G (gold) orP (platinum). These categories entitle a customer to a discount of 0%, 5%, 10% or 15%respectively.

Customers often request paintings by a particular artist or theme (e.g. animal, landscape,seascape, naval, still-life, etc). Over time a customer may hire the same painting morethan once.

Each painting is allocated a customer monthly rental price defined by the owner. The owner of the painting is then paid 10% of that customer rental price. Any paintings that are not hired within six months are returned to the owner. However, after three months, an owner may resubmit a returned painting.Each painting can only have one artist associated with it.Several reports are required from the system. Three main ones are:
1. For each customer, a report showing an overview of all the paintings they have hired or are currently hiring
2. For each artist, a report of all paintings submitted for hire
3. For each artist, a returns report for those paintings not hired over the past six months remember to identify key attributes and any foreign key attributes.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem)   20CS57-OBJECT ORIENTED PROGRAMMING LAB

Pre-requisite : Programming for Problem Solving using C and Data structures

Course Educational Objective: The objective of the course is to apply the constructs of Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. They will be applying knowledge of object-oriented programming, collection framework to perform all operations on data.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Solve basic mathematical problems using fundamentals of Java and its object-oriented principles. **(Apply – L3)**

CO2: Implement multithreading and exception handling mechanisms. **(Apply – L3)**

CO3: Develop GUI applications and basic data structures using collection framework. **(Apply – L3)**

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example problems (**one or two Modules**)

1. Write a C++ program to display default value of all primitive data type of Java.
2. Write a C++ program that display the roots of a quadratic equation $ax2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.
3. Write a C++ Program to find the factorial of list of numbers reading input as command line argument.
4. Write a C++ Program to display all prime numbers between two limits.
5. Five bikers compete in a race such that they drive at a constant speed, which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all five racers. Take as input the speed of each racer and print back the speed of qualifying racers.
6. Write a C++ program to implement Rhombus pattern reading the limit from the user.
7. Write a C++ program to calculate gross salary & net salary taking the following data.
   Input:empno, empname, basic salary
   Process: DA=50% of basic, HRA=25% of basic, CCA=Rs240/-, PF=10% of basic, PT=Rs100/-.
8. Write a C++ program to search for an element in a given list of elements using binary search mechanism.

Module 1:
   a. Develop a java program to create class, which contains data & methods, create an object to access those members.
   b. Develop a java program, which implements all types of java variables (local, class level: static, instance).
   c. Develop a java program to calculate the sum of diagonal elements of given n x n matrix.
Module 2:
   a. Develop a java program, which contains both static and non-static methods.
   b. Develop a java program to find area of geometrical figures using method.

c. Develop a java program to initialize instance variables by using constructors.

d. Develop a java program, which implements constructor overloading by passing different number of parameters of different types.

Module 3:

a. Develop a java program to count the words, characters in the given line of text.

b. Develop a java program for sorting a given list of names in ascending order.

c. Develop a java program that reads a line of integers separated by commas and then displays each integer, find the sum of the integers (using StringTokenizer).

d. Develop a java program to implement multi-level inheritance.

Module 4:

a. Develop a java program to create and access user-defined package.

b. Develop a java program to identify the accessibility of a variable by means of different access specifies within and outside the package.

c. Develop a java program to implement the concept of method overloading.

d. Develop a java program to implement the concept of method overriding.

Module 5:

a. Develop a java program for abstract class to find areas of different shapes.

b. Develop a java program to achieve multiple inheritance using interfaces.

c. Develop a java program to create an interface named Vehicle which contains two abstract methods (Specifications (), Display ()). Provide two classes named Two-wheeler, Four-wheeler that is implemented by that interface.

Module 6:

a. Develop a java program that implements a multi-threaded program, which has three threads. First thread generates a random integer for every 1 second, if the generated integer is even the second thread computes the square of the number and print it. If the generated integer is odd the third thread will print the value of cube of the number.

b. Develop a java program to identify the use of synchronized blocks, synchronized methods and static synchronized methods in threads concept.

c. Develop a java program to illustrate the concept of inter thread communication.

Module 7:

a. Develop a java program that creates a user interface to perform integer divisions with possible validations (Divide by Zero, NumberFormatException).

b. Develop a java program to implement mouse events like mouse pressed, mouse released, and mouse moved by means of adapter classes.

Module 8:

a. Develop a java program that works as a simple calculator. Use a Grid Layout to arrange Buttons for digits and for the + - * % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

b. Develop a java program to simulate a traffic light, user can select any one of the three buttons with: red, yellow, and green color. On selecting a button, an appropriate message with **"Stop" or "Ready" or "Go"** should appear with the selected button color.

Module 9:

a. Develop a java program to print the collection data by using the following ways
i) for loop   ii) for-each loop   iii) Iterator   iv) ListIterator

b. Develop a java program to perform all the operations in Collection interface.

Module 10:

a. Develop a java program to implement and perform all the operations in List, Set Interface.

b. Develop a java program to implement and perform all the operations in Map interface.

20CSS1 – WEB APPLICATION DEVELOPMENT	**L**	**T**	**P**	**Cr.**

B.Tech. (III Sem.)	**USING FULL STACK – MODULE - I** **(FRONT END DEVELOPMENT)**	1	0	2	2

Pre-requisite : Knowledge of basic Computer hardware & software.
Course Educational Objective: The objective of the course is to understand the design of HTML web pages, Styling of HTML pages using CSS, web forms validation using JavaScript and developing responsive web page using JQuery.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Understand the basic design and styling of web pages. **(Understand- L2)**

CO2: Understand the DOM of web design, markup language and client-side scripting. **(Understand- L2)**

CO3: Understand the responsive web design using DHTML. **(Understand- L2)**

CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Modules

1. Design of web pages (Basic Structure, text formatting tags, heading tags, image tag, marquee tag, hyperlink, paragraph, font, line breaking, types of lists).
2. Creating Web applications using HTML5 (Table tags, Form elements, Frames concept)
3. Styling the web pages using CSS (Types of CSS, CSS Selectors, Properties: Text, backgrounds, font, Links, Borders, Margins, Cell padding,   Layouts).
4. Validating the web forms using JavaScript (JavaScript Introduction, JavaScript DOM, Form validation).
5. Handling and validating semi-structured data
   a. XML document validation using DTD & Schema
   b. JSON
6. jQuery
   a. selectors
   b. validation
   c. hide
   d. slide
   e. fades
   f. animation

REFERENCE BOOKS:
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2. Beginning HTML, XHTML, CSS, and JavaScript by Jon Duckett, Wiley India, 2010.
3. jQuery Cookbook by Cody Lindley, O'Reilly Media, 2009
4. HTML, XHTML, and CSS Bible, 5th Edition by Steven M. Schafer, Wiley India, 2011.
5. Web Development with jQuery by Richard York, Wiley India, 2015.
6. Head first HTML & CSS 2nd Edition by Elisabeth Robson, Eric Freeman, O'Reilly.

L	T	P	Cr.

B.Tech. (IV Sem.)   20CS06-DESIGN AND ANALYSIS OF ALGORITHMS | 3 | 0 | 0 | 3 |

Pre-requisite: Discrete Mathematics and Data Structures.

Course Educational Objective: The Objective of the course is to learn various algorithm design techniques and analyze the computing resources of the algorithms, and motivate the students to design new algorithms for various problems

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

CO1: Identify the characteristics of an algorithm and analyze its time and space complexity. **(Understand- L2)**

CO2: Apply the divide-and-conquer method for solving problems like searching and sorting. **(Apply- L3)**

CO3: Design Greedy algorithms for the optimization problems like knapsack problem, minimum cost spanning tree, single source shortest path problem. **(Apply - L3)**

CO4: Apply dynamic programming paradigm to solve optimization problems like travelling sales person problem,0/1 knapsack problem, Optimal binary search tree. **(Apply - L3)**

CO5: Analyze the backtracking and branch-and-bound search methods on optimization problems like N-queens, sum of subsets,0/1 knapsack, Hamiltonian circuit and so on. **(Apply - L3)**

UNIT – I
Introduction: Algorithm definition, Specifications, Performance Analysis- Time Complexity, Space Complexity. Asymptotic Notations-Big-Oh, Omega, Theta.
Divide and Conquer: General Method, Binary Search, Finding Maximum and Minimum, Merge Sort, Quick sort.

UNIT – II
The Greedy Method– General Method, Knapsack Problem, Job sequencing with deadlines, Minimum-cost spanning trees, Optimal storage on tapes, Single source shortest paths, Huffman coding.

UNIT – III
Dynamic Programming- General method, Multistage graph, All pairs shortest path, Single Source Shortest path, Optimal Binary search trees, 0/1 Knapsack, Reliability design, the travelling salesman problem.

UNIT - IV
Back tracking- The General Method, The 8-Queens Problem, Sum of subsets, Graph Coloring, Hamiltonian cycles.

UNIT-V
Branch and Bound– General method, Job sequencing with deadlines –LC Branch and Bound, FIFO Branch and Bound and LIFO Branch and Bound, 0/1 Knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution, travelling salesperson Problem – LC Branch and Bound solution

TEXT BOOKS:
1. Ellis Horowitz, SartajSahni, ―Fundamentals of Computer Algorithms, Galgotia Publications [**units – 1,2,3,4,5**]

REFERENCE BOOKS:
1. MarkAllenWeiss, ―DataStructuresandAlgorithmAnalysisinC++‖, Pearson,3/e,2007.
2. Aho,Hopcroft Ullman, ―TheDesignandAnalysisofComputerAlgorithms, Addison Wesleypublications.
3. ThomasH.Cormanetal, ―IntroductiontoAlgorithms,PHI.
4. AnanyLevitin, ―IntroductiontotheDesignandAnalysisofAlgorithms,PEA
5. P.H. Dave, H.B. Dave, ―DesignandAnalysisofAlgorithms‖, PearsonEducation,2008.

		20HS01 – UNIVERSAL HUMAN VALUES 2:	**L**	**T**	**P**	**Cr.**
B.Tech. (IV Sem.)		UNDERSTANDING HARMONY	3	0	0	3

Pre-requisite : Nil

Course Educational Objective: To become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

COURSE OUTCOMES: At the end of the course, the student will be able to-
  CO1: Apply the value inputs in life and profession **(Apply – L3)**
  CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body **(Understand – L2)**
  CO3: Understand the role of a human being in ensuring harmony in society **(Understand – L2)**
  CO4: Understand the role of a human being in ensuring harmony in the nature and existence. **(Understand – L2)**
  CO5: Distinguish between ethical and unethical practices (**Apply – L3**)

UNIT-I: Need, Basic Guidelines, Content and Process for Value Education
'Natural Acceptance' and Experiential Validation- as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer);
Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship;
Understanding the harmony in the society: Resolution, Prosperity, fearlessness and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family, Gratitude as a universal value in relationships.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics
Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Strategy for transition from the present state to Universal Human Order

TEXT BOOKS:
1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS:
1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

	20AD03 -INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	**L**	**T**	**P**	**Cr.**
B.Tech. (IV Sem.)		3	0	0	3

Pre-requisite : Knowledge of Computer fundamentals & Data structures& Algorithms

Course Educational Objective: The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and also provide fundamentals of Data Science.

Course Outcomes: At the end of this course, the student will be able to
> **CO1:** Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
> **CO2:** Apply the basic principles of AI in problem solving. **(Apply-L3)**.
> **CO3:** Choose the appropriate representation of Knowledge. **(Understand-L2)**.
> **CO4:** Enumerate the fundamentals of data science and NumPy. **(Understand-L2)**.
> **CO5:** Summarize and compute descriptive statistics using pandas. **(Understand-L2)**.

UNIT I
Introduction: What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II
Problem Solving: Problem-Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT III
Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

UNIT IV
What is Data science? Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.
NumPy Basics: The NumPyndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

UNIT V
Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

Text Books:

1) Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall

2) Wes McKinney, "Python for Data Analysis",O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.

3) Rachel Schutt&O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

Reference Books:

1) Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

2) Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

3) David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

4) Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.

5) Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015

6) Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

Web Resources:

1) https://nptel.ac.in/courses/106105077

2) https://nptel.ac.in/courses/106106126

3) https://aima.cs.berkeley.edu

4) https://ai.berkeley,edu/project_overview.html

		L	**T**	**P**	**Cr.**
B.Tech. (IV Sem.)	**20CS10 – DATA WAREHOUSING AND DATA MINING**	3	0	0	3

Pre-requisite:DBMS and Probability and Statistics

Course Educational Objective: The Objective of the course is to introduce the concepts of data warehouse and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

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

CO1: Summarize the architecture of data warehouse. **(Understand- L2)**
CO2: Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data. **(Apply – L3)**
CO3: Construct a decision tree and resolve the problem of model overfitting. **(Analyze – L4)**
CO4: Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation. **(Apply - L3)**
CO5: Apply suitable clustering algorithm for the given data set. **(Apply - L3)**

UNIT-I
Data Warehouse and OLAP Technology: An Overview: Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber)

UNIT-2
Data Mining: Introduction, Data Mining, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.
Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin)

UNIT-3
Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.
Model Overfitting: Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)

UNIT-4

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Apriori Principle, Apriori Algorithm, Rule Generation, Compact Representation of Frequent Itemsets, FPGrowth Algorithm. (Tan &Vipin)

UNIT-5
Cluster Analysis: Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin)

TEXTBOOKS:
1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015.

2. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

REFERENCE BOOKS:
1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010.
2. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008.
4. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

	L	T	P	Cr.
B.Tech. (IV Sem.) **20CS11 - OPERATING SYSTEMS**	3	0	0	3

Pre-requisite **:** Knowledge of Computer fundamentals & Data structures& Algorithms

Course Educational Objective: The objective of the course is to provide basic knowledge of computer operating system structure and functioning, understand how Operating Systems evolved with advent of computer architecture, and comprehend the different CPU scheduling algorithms, page replacement algorithms, disk scheduling and identify best one.

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

CO1: Demonstrate the underlying principles and techniques of operating system**(Understand-L2)**

CO2: Interpret scheduling and communication methods of processes handled by operating systems**(Understand-L2)**.

CO3: Distinguish the process synchronization methods and deadlock handling approaches employed in operating systems**(Understand-L2)**.

CO4: Classify memory management techniques and virtual memory mechanisms**(Understand-L2)**.

CO5: Interpret the strategies of disk scheduling algorithms and file system architecture **(Understand-L2)**.

Unit-1: Introduction to Operating System
Operating System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation, System Boot.

Unit-2: Process Management
Processes: Processconcept, Inter-process Communication, Communication in Client-Server Systems.
Threads: Overview, Multithreading Models
Process Scheduling: Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, PRIORITY, ROUNDROBIN)

Unit-3: Synchronization and Deadlocks
Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance, Deadlock Detection, Recovery from deadlock.

Unit-4: Memory Management
Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.
Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

Unit-5: File System Management
Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management.
Implementing File System: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery.

TEXTBOOKS:

1. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007.

REFERENCE BOOKS:

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, ―Unix and shell Programming‖, Thomson, First Edition, New Delhi, 2003.
3. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html
4. https://swayam.gov.in/nd1_noc19_cs50/preview

	20AD52 – INTRODUCTION TO ARTIFICIAL	**L**	**T**	**P**	**Cr.**
B.Tech. (IV Sem.)	**INTELLIGENCE AND DATA SCIENCE LAB**	0	0	3	1.5

Pre-requisite :Knowledge of Computer fundamentals & Data structures& Algorithms

Course Educational Objective: The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and also provide fundamentals of Data Science.

Course Outcomes: At the end of this course,

> **CO1 :** Apply the basic principles of AI in problem solving using LISP/PROLOG(**Apply – L3**)
> **CO2 :** Implement different algorithms using LISP/PROLOG(**Apply – L3**)
> **CO3 :** Perform various operations using numpy and pandas(**Understand - L2**)
> **CO4 :** Improve individual / teamwork skills, communication & report writing skills with ethical values.

List of Experiments (Artificial Intelligence)

1. Implementation of DFS for water jug problem using LISP/PROLOG

2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java

3. Implementation of TSP using heuristic approach using Java/LISP/Prolog

4. Implementation of Simulated Annealing Algorithm using LISP/PROLOG

5. Implementation of Hill-climbing to solve 8- Puzzle Problem

6. Implementation of Monkey Banana Problem using LISP/PROLOG

List of Experiments (Data Science)

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays
4. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column

5. Read the following file formats using pandas
    a. Text files
    b. CSV files
    c. Excel files
    d. JSON files
    6. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot

Web References:
1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-explorationpython/

L	T	P	Cr.
0	0	3	1.5

B.Tech. (IV Sem.)　　　　　**20IT53 – R PROGRAMMING LAB**

Pre-requisite 　　　　　　　　**:**　　　Nil

Course Educational Objective: In this course student will learn about the fundamentals of R programming, standard R libraries, solid understanding of R functions, write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R.

Course Outcomes: At the end of this course,

CO1: Implement basic concepts of R programming, and its different module that includes conditional, looping, lists, Strings, Functions, Frames, Arrays, and File programming. **(Understand - L2)**

CO2: Implement the concepts of R Script to extract the data from data frames and file operations. **(Apply – L3)**

CO3: Implement the various statistical techniques with visualization using R add-on packages. **(Apply – L3)**

CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values

Week 1:
a) Installing R and RStudio
b) Basic functionality of R, variable, data types in R

Week 2:
a) Implement R script to show the usage of various operators available in R language.
b) Implement R script to read person's age from keyboard and display whether he is eligible for voting or not.
c) Implement R script to find biggest number between two numbers.
d) Implement R script to check the given year is leap year or not.

Week 3:
a) Implement R Script to create a list.
b) Implement R Script to access elements in the list.
c) Implement R Script to merge two or more lists.
d) Implement R Script to perform matrix operation

Week 4:
Implement R script to perform following operations:
a) various operations on vectors
b) Finding the sum and average of given numbers using arrays.
c) To display elements of list in reverse order.
d) Finding the minimum and maximum elements in the array.

Week 5:
a) Implement R Script to perform various operations on matrices
b) Implement R Script to extract the data from dataframes.
c) Write R script to display file contents.
d) Write R script to copy file contents from one file to another

Week 6:
a) Write an R script to find basic descriptive statistics using summary(), str(), quartile() function on mtcars datasets.
b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset

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Week 7:
   a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disk location.
   b) Reading Excel data sheet in R.
   c) Reading XML dataset in R

Week 8:
   a) Implement R Script to create a Pie chart, Bar Chart, Scatter Plot and Histogram (Introduction to ggplot2 graphics)
   b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.

Week 9:
   a) Implement R Script to perform Normal, and Binomial distributions.
   b) Implement R Script to perform correlation, Linear and multiple regression.

Week 10:
   a) Introduction to Non-Tabular Data Types: Time series, spatial data, Network data.
   b) Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding.

Week 11:
   Introduction to Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates, outliers, spelling.

Week 12:
   Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Google Spreadsheets, API and web scraping examples

REFERENCE BOOKS:

1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications.
3. R Programming for Dummies by Joris Meys Andrie de Vries, Wiley Publications
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. – 2017 edition
6. R Fundamentals and Programming Techniques, Thomas Lumely.
7. R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison Wesley Series.
8. The Art of R Programming, Norman Matloff, Cengage Learning.
9. Maria Dolores Ugarte, Ana F.Militino, AlanT.Arnholt―Probability and Statistics with R, 2nd Edition, CRC Press,2016.
10. R-programming for Data science, Roger D.Peng.
11. An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani.

WEB LINKS:
1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf (Online Resources)
2. http://nptel.ac.in/courses/106104135/48
3. http://nptel.ac.in/courses/110106064/

SOFTWARE REQUIREMENTS:
1. The R statistical software program. Available from: https://www.r-project.org/
2. RStudio an Integrated Development Environment (IDE) for R. Available from:https://www.rstudio.com/

L	T	P	Cr.

B.Tech. (IV Sem.)	20CS58 – DATA MINING USING PYTHON LAB	0	0	3	1.5

Pre-requisite : Python Programming.

Course Educational Objective: The objective of this lab is to Practical exposure on implementation of well-known data mining algorithms and Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

- **CO1:** Apply preprocessing techniques on real world datasets.**(Apply-L3)**
- **CO2:** Apply apriori algorithm to generate frequent itemsets. **(Apply L3)**
- **CO3:** Apply Classification and clustering algorithms on different datasets. **(Apply L3)**
- **CO 4:** Improve individual / teamwork skills, communication & report writing skills with ethical values.

Use python library scikit-learn wherever necessary

1. Demonstrate the following data preprocessing tasks using python libraries.
   - a) Loading the dataset
   - b) Identifying the dependent and independent variables.
   - c) Dealing with missing data
2. Demonstrate the following data preprocessing tasks using python libraries.
   - a) Dealing with categorical data.
   - b) Scaling the features.
   - c) Splitting dataset into Training and Testing Sets
3. Demonstrate the following Similarity and Dissimilarity Measures using python
   - a) Pearson's Correlation
   - b) Cosine Similarity
   - c) Jaccard Similarity
   - d) Euclidean Distance
   - e) Manhattan Distance
4. Build a model using linear regression algorithm on any dataset.
5. Build a classification model using Decision Tree algorithm on iris dataset
6. Apply Naïve Bayes Classification algorithm on any dataset
7. Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data.
8. Apply K- Means clustering algorithm on any dataset.
9. Apply Hierarchical Clustering algorithm on any dataset.
10. Apply DBSCAN clustering algorithm on any dataset.

Web Resources:

1. https://analyticsindiamag.com/data-pre-processing-in-python/
2. https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3. https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4. https://www.springboard.com/blog/data-mining-python-tutorial/
5. https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6. https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
7. https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
8. https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learnd690cbae4c5d

		L	**T**	**P**	**Cr**
B.Tech. (IV Sem.)	**20CSS2 – WEB APPLICATION DEVELOPMENT USING FULL STACK – MODULE - II (BACKEND DEVELOPMENT)**	1	0	2	2

Pre-requisite : Object Oriented Programming and Data Base Management Systems.

Course Educational Objective: The objective of this course is to learn the importance of client-server architecture in the web application development and able to develop dynamic data driven web applications by using advanced java technologies (Servlets, JSP, Struts2 and Hibernate framework).

Course Outcomes (CO): *At the end of this course, the student will be able to:*

 CO1: Apply JDBC concepts to establish the communication between Java Applications and database. **(Apply-L3)**

 CO2: Develop Static and Dynamic Web Applications by using Servlets and Java Server Pages (JSP). **(Apply L3)**

 CO3: Develop Dynamic Data Driven Web Applications by using Struts2 and Hibernate frameworks. **(Apply L3)**

 CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

List of Experiments

Module 1:
 a) Develop a java program to connect oracle database by using JDBC Connection string.
 b) Develop a java program to prepare the Statement to execute the query to insert the number of records into oracle database.
 c) Develop a java program to fetch the records from the oracle database table by using ResultSet Interface.

Module 2:
 a) Develop a java program to prevent the SQL Injection attacks by using Prepared Statement.
 b) Develop a java program to execute stored procedures and sub functions by using Callable Statement.
 c) Develop a java program to Scroll the ResultSet data in both forward and backword directions by using Scrollable ResultSet.
 d) Develop a java program to print the database table meta data by using ResultSetMetaData.

Module 3:
 a) Develop a Servlet program to demonstrate the role of Servlet Life Cycle methods in the web application.
 b) Develop a Servlet program to access Init parameter values form web.xml to Servlet program by using ServletConfig interface.
 c) Develop a Servlet program to navigate from one Servlet page to another Servlet page by using RequestDispatcher interface.

Module 4:
 a) Develop a Servlet program to AUTHENTICATE User details from oracle database by using JDBC connectivity. (Dynamic Login Checking for the registered users in the oracle database)
 b) Develop a Servlet program to implement Session Management concept by using HttpSession.

Module 5:
 a) Develop a JSP program to demonstrate the importance of Scripting elements in JSP.
 b) Develop a JSP program to illustrate the importance of implicit objects in JSP.
 c) Develop a JSP program to access JavaBean class by using jsp:useBean, jsp:setProperty and jsp:getProperty.

Module 6:

a) Develop a JSP program to insert and retrieve the records from the oracle database.
b) Develop a JSP program to demonstrate the session management in between login and logout period of the end user.
c) Develop a JSP program to illustrate the process of handling errors and exceptions in JSP pages.

Module 7:
   a) Develop a Struts2 web application to perform Insert, Update and Delete operations in the oracle database table through JDBC.
   b) Develop a Struts2 web application to fetch all the records of the table created in the above from oracle database.

Module 8:
   a) Develop a Program how to code a basic Java Hibernate program by using eclipse IDE.
   b) Develop a web application to insert the record of the user in the oracle database by using Hibernate.

REFERENCE BOOK(S):

1   Herbert Schildt, "Java: The complete reference", TMH Publications, 7th edition, 2006.

2   Kathy Sierra & Bert Bates, "Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam", O'Reilly Publications Second Edition.

3   Budi Kurniawan, "Struts 2 Design and Programming: A Tutorial", BrainySoftware, 2nd Edition, 2008.

4   Christian Bauer, Gavin King, Gary Gregory "Java Persistence with Hibernate: Revised Edition of Hibernate in Action Paperback", Manning Publication, 2nd Edition, 2006**.**

5   Santosh Kumar K, "JDBC 4.2, Servlet 3.1, and JSP 2.3 Includes JSF 2.2 and Design Patterns, Black Book", Dreamtech publication, 2ndEdition**.**

6   Mahmoud Parsian, "JDBC Recipes: A Problem-Solution Approach", Apresss.

7   Madhusudhan Konda**, "**Just Hibernate, A Lightweight Introduction to the Hibernate Framework"**,** O'Reilly Media**.**

8   Chuck Cavaness, "Programming Jakarta Struts",O'Reilly Media, 2nd Edition.

		L	T	P	Cr.
B. Tech.(V Sem.)	**20CS12-COMPUTER NETWORKS**	3	0	0	3

Pre-requisite   : Data Structures and Operating Systems

Course Educational Objective: The Objective of the course is to provide a foundation to understand computer networks using layered architectures. It also helps students to understand the various network models, addressing concept, routing protocols and design aspects of computer networks.

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

CO1: Demonstrate the modern network architectures from a design perspective
 (Understand-L2)

CO2: Apply various Data Link layer design issues and error detection &correction techniques to solve collisions problems.**(Apply-L3)**

CO3: Demonstrate the network Layer functionalities**(Understand-L2)**

CO4: Outline the functions of transport layer protocols**(Understand-L2)**

CO5: Examine different application layer protocols.**(Understand-L2)**

UNIT I
 Data Communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN :Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN.

UNIT II
 Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA

UNIT III
 Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping –ARP,RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT IV
 Transport Layer: Process to Process Communication ,User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT V

    Application layer: Domain Name Space(DNS),DDNS,TELNET,EMAIL, File Transfer Protocol (FTP),WWW ,HTTP ,SNMP ,Bluetooth, Firewalls.

TEXTBOOKS:

1. BehrouzA. Forouzan, , "Data Communication andNetworking",McGraw-Hill,4thEdition,2011.
2. Andrew S. Tanenbaum, "Computer Networks", Pearson New InternationalEdition,8thEdition,2013.

REFERENCEBOOKS:

1. WilliamStallings,"DataandComputerCommunication",PearsonPrent iceHallIndia,8th Edition.
2. Douglas Comer, Internetworking with TCP/IP, Prentice Hall of India, Volume 1,6[th]Edition,2009. Richard Stevens, "TCP/IP Illustrated", Addison-Wesley

	L	T	P	Cr.
B.Tech.(VSem.) **20AD04-MACHINE LEARNING**	3	0	0	3

Pre-requisite: Probability and Statistics

Course Educational Objective: The objective of the course is to provide the basic concepts and techniques of Machine Learning and help to use recent machine learning approaches for solving practical problems. It enables students to gain experience to do independent study and research.

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

CO1: Identify the characteristics of machine learning.**(Understand- L2)**

CO2: Understand the Model building and evaluation approaches.**(Understand- L2)**

CO3: Apply regression algorithms for real-world Problems.**(Apply- L3)**

CO4: Handle classification problems via supervised learning algorithms.**(Apply- L3)**

CO5: Learn advanced learning techniques to deal with complex data.**(Apply- L3)**

UNIT I

Introduction to Machine Learning - Introduction, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning. Preparing to Model- Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT II

Modeling & Evaluation- Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model.
Basics of Feature Engineering- Introduction, Feature Transformation – Feature Construction, Feature Extraction, Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Linear Discriminate Analysis (LDA), Feature Subset Selection

UNIT III

Regression: Introduction to regression analysis, Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the linear regression model, Polynomial Regression Model, Logistic Regression, Regularization, Regularized Linear Regression, Regularized Logistic Regression.

UNIT IV:

Supervised Learning: Classification- Introduction, Example of Supervised Learning, Classification Model, and Classification Learning Steps. Common Classification Algorithms - k-Nearest Neighbor (kNN), Support vector Machines (SVM), Random Forest model.

UNIT-V:

Other Types of Learning : Ensemble Learning- Bagging, Boosting, Stacking and its impact on bias and variance, AdaBoost, Gradient Boosting Machines, XGBoost.

Reinforcement Learning - Introduction, Q Learning

TEXTBOOKS

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson
   Education India ,1st edition,2015.
2. Tom M. Mitchell, "Machine Learning', MGH, 1997.

REFERENCE BOOKS

1. Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge.
2. Peter Harington, "Machine Learning in Action" , Cengage, 1st edition, 2012.
3. Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge university press,2012.
4. Jason Brownlee, "Machine Learning Mastery with Python Understand Your Data, Create Accurate Models and Work Projects End-To-End", Edition: v1.4, 2011.

	L	T	P	Cr.
B. Tech.(V Sem.) **20AD05-AUTOMATA AND COMPILER DESIGN**	3	0	0	3

Prerequisite: Knowledge in Discrete mathematics (set theory and graph theory) and programming language.

Course Educational Objective (CEO): To introduce students to the mathematical foundations of computation like automata theory, the theory of formal languages and grammars, the notion of algorithm, decidability, complexity, and computability. Understand the theory and practice of compiler implementation.

Course Outcomes(COs): After the completion of this course, student will be able to:

CO1: Design Finite Automata and Regular expression for regular languages. **(Apply-L3)**

CO2: Design Context-free grammar and push-down automata for CFL. **(Apply-L3)**

CO3: Design and implement lexical analyzer and syntax analyzer. **(Apply-L3)**

CO4: Create frame work for syntax directed translation schemes and understand the run-time organization of the program**. (Understand-l2)**

CO5: Analyze various code optimization techniques and code generation. **(Apply-L3)**

UNIT I

Introduction to Automata and formal language theory: Basic Mathematical notations and techniques, classification of Automata, definitions and its applications. Finite state Machine Deterministic Finite State Automaton (DFA), Nondeterministic Finite State Automaton(NFA), Equivalence of NFA and DFA, Minimization of DFA, examples.
Regular expressions- Equivalence of Regular expressions and Finite Automata, pumping lemma and closure properties.

UNIT II

Introduction to Grammar–Context-free Grammar(CFG), derivation, parse tree, ambiguity, Simplification of CFG, Chomsky Normal Form (CNF) and Greenback Normal Form(GNF).
Push down Automata-Definition, Equivalence of Context-free Languages and pushdown Automata, Deterministic Pushdown Automaton, pumping lemma and properties of context-free Languages.

UNIT III

Introduction to compiler: Basic Language processing system, phases of a compiler, Boot strapping.
Lexical Analysis: The role of a Lexical analyzer, input buffering, Specification and Recognition of tokens, LEX tool.
Syntax Analysis: The role of a Parser, top-down parsing-recursive descent and predictive parsing, Bottom -up Parsing-Handle pruning, shift-reduce parsing, LR parsers-SLR, CLR and LALR.

UNIT IV

Syntax-Directed translation (SDT): Attribute grammar, Syntax-Directed Definitions (SDD), and Translation schemes, Applications of SDT 's. Intermediate Code Representations-syntax tree, three-address code and static Single-Assignment. Translation of expressions and statements.

UNIT V

Basics of Code optimization: Basic blocks and flow graphs, the principal sources of optimization, optimization of Basic blocks, loops in flow graph. Code generation: Issues in the design of a code generator, generic code generation algorithm, Register allocation and assignment, DAG representation of basic blocks, peephole optimization.

TEXTBOOKS

1. John E. Hop craft and J. D. Ull man, ―Introduction to AutomataTheory Languages and Computation‖, Narosa Publications,1999(for1,2units)
2. AlfredV.Aho,JeffreyUllman,Ravisethi,―CompilersPrinciples,Techniquesa ndTools‖,PearsonEducation,2nd Edition,2008.(for3,4,5units)

REFERENCES

1. Sipser,―Introduction to Theory of Computation‖, Thomson,2nd Edition Mishra and Chandra shekaran, ‖Theory of Computer Science–
2. Automata languages and computation––―2nd edition,PHI
3. Parag H.Dave, Himanshu B.Dave― Compilers Principles and Practice‖, Person Education,First Edition,2012.

	L	**T**	**P**	**Cr.**
B.Tech.(VSem.)	3	0	0	3
20CS14-COMPUTER GRAPHICS				

Prerequisite: Basic of Mathematics (Knowledge of coordinate geometry), basics of Computers and C Programming Language.

Course Educational Objective :The objective of the course is to have an appreciation of the history and evolution of computer graphics, both hardware and software. Students will understand 2Dgraphics and algorithms which include line drawing, polygon filling, clipping, and transformations. Students will understand the concepts & techniques used in 3D computer graphics, including viewing transformations, hierarchical modeling ,color, lighting and texture mapping.

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

CO1: Summarize the working principle of display devices, interactive input devices and

graphic applications**(L1-Remember)**

CO2: Analyze line, circle, ellipse and character generation algorithms.**(L2- Understand)**

CO3: Demonstrate2-Dimensionalgeometricaltransformations.**(L3-Apply)**

CO4: Apply the clipping algorithms on points, lines , and polygons. **(L3- Apply)**

CO5: Applytransformationtechniqueson3-Dimensionalobjects.**(L3-Apply)**

UNIT I

Introduction to Computer Graphics and their Applications
A Survey of Computer Graphics: Presentation Graphics, Computer Aided Design, Computer Art, Entertainment, Education and Training, Visualization, Image Processing, Graphical User Interfaces.
Overview of Graphics systems: Video Display Devices, Raster Scan systems, random scan systems, Graphics monitors and work stations, Input devices.

UNIT II

Output primitives: Points and Lines, Line Drawing Algorithms, Loading the Frame buffer, Line function, Circle, Generating Algorithms, Ellipse Generating Algorithms, Other Curves, Parallel Curve Algorithms, Curve Functions, Pixel Addressing, Filled Area Primitives, Filled Area Functions.

UNIT III

Two Dimensional Geometric Transformations: Basic Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations, Transformation Functions, Raster methods for Transformation.

UNIT IV

Two-Dimensional Viewing: The viewing Pipeline, Viewing Coordinate Reference Frame, Window – to – Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Clipping Operations: Point Clipping, Line Clipping, Polygon Clipping.

UNIT V

Three Dimensional Concepts, Object Representations, Geometric and modeling Transformations: Three Dimensional Concepts and Object representations: 3D display methods, 3DGraphics- Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces Three Dimensional Geometric and Modeling Transformations: Translation,Rotation,Scaling,OtherTransformations,CompositeTransformations, 3D transformation Functions, Modeling and Coordinate Transformations.

TEXTBOOK

1. Donald Hearn & M. Pauline Baker, "Computer Graphics C Version", Pearson Education, New Delhi, 2009(Chapters1to12except10-9to10-22oftheTextbook)

REFERENCEBOOKS:

1. DavidF .Rogers" Procedural Elements for Computer Graphics" TMH Publications. J. D. Foley, S.K Feiner, A Van DamF. H John;
2. "Computer Graphics: Principles & Practice in C" Pearson.
3. Franscis S HillJr "Computer Graphics using open GL"; Pearson Education,2004.

	L	**T**	**P**	**Cr.**
B.Tech.(VSem.)	3	0	0	3
20AD06-ARTIFICIAL NEURAL NETWORKS				

Pre -requisite: Basic of Mathematics (Knowledge of coordinate geometry).

Course Objective : The main objective of this course is to provide the student with the basic understanding of neural networks fundamentals, Program the related algorithms and Design the required and related systems.

CO1: Demonstrate ANN structure and activation functions**.(Understand-L2)**

CO2: Define foundations and learning mechanisms and state-space

  Concepts. **(Understand-L2)**

CO3: Identify structure and learning of perceptions. **(Understand-L2)**

CO4: Explain Feed forward, multi-layer feed forward networks and

  Back propagation Algorithms. **(Understand-L2)**

CO5: Analyze Radial Basis Function Networks, The Regularization and

  RBFnetworks**. (Apply-L3)**

 UNIT I

Characteristics of neural networks, Structure and working of biological neural networks, artificial neural networks: Terminology, Models of neurons: McCulloch Pitts model, perception model, Adeline model, topology, basic learning laws, Functional unit for ANN for pattern recognition task.

UNIT II

Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memory based learning, Hebbian learning. Competitive learning.

UNIT III

Single layer perceptions: Structure and learning of perceptions, Pattern classifier, Introduction and Bayes' classifiers, Precept orasa pattern classifier, Perception convergence. Limitations of a perceptions.

 UNIT IV

Introduction: Feed forward ANN, Structures of Multi-layer feed forward networks .Back propagation algorithm, Back Propagation- training and convergence, Functional approximation with back propagation. Practical and design issues of back propagation learning.

 UNIT V

Radial Basis Function Networks: Pattern separability and interpolation, Regularization The Regularization and RBF networks. RBF network design and training. Approximation properties of RBF.

TEXTBOOKS:

1. B.Yagnanarayana,"ArtificialNeuralNetwork",PHIPublication2012
2. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition,Pearson Education Asia.
3. SatishKumar,"NeuralNetworks:Aclassroomapproach",TataMcGrawHill,2004.

REFERENCE BOOKS:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-HillInternationalEditions,1997.

		L	T	P	Cr.
B.Tech.(V Sem.)	**20CS24-CLOUD COMPUTING**	3	0	0	3

Pre-requisite: Computer networks, and Operating Systems.

Course Objectives:
- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to
- Illustrate the key dimensions of the challenge of Cloud Computing **(Understand – L2)**
- Classify the Levels of Virtualization and mechanism of tools. **(Understand – L2)**
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud. **(Analyze – L4)**
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud. **(Apply – L3)**
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application **(Analyze – L4)**

UNIT I:
Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, Performance, Security and Energy Efficiency

UNIT II:
Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:
Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS, and Microsoft Azure

UNIT IV:
Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V:
Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

Text Books:
1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

Reference Books:
1. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
3. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

				L	T	P	Cr.

B.Tech.(VSem.)

20CS60-COMPUTER NETWORKS LAB

L	T	P	Cr.
0	0	3	1.5

Pre-requisite: Data Structures, and Operating Systems

Course Educational Objective: The Objective of the course is to prepare students to write programs to illustrate communication in networks, configure different networks (LAN,WAN) and prepare students to differentiate various protocols and their performance.

Course Outcomes(CO): At the end of this course, the student will be able to:

CO1: Implement Network layer functionalities using NS3 simulator.**(Apply-L3)**

CO2: Demonstrate Transport Layer functionalities.**(Understand-L2)**

CO3: Analyze Application layer protocols using Wire shark.**(Analyze–L4)**

CO4: Improve individual / team work skills, communication & report writing skills with ethical values.

Experiments:

1. To gain familiarity with the basic network commands & utilities available in the Linux OS.

2. To learn about network layer tools and analyze captures for congestion.

3. To learn about queue management techniques, and global routing inns3.

4. To learn about broadcasting, multicasting, and bridging in a Local Area Network usingns3.

5. To learn about Wifi and Mobile Adhoc topologies with ns3.

6. To introduce Socket Programming in TCP and UDP.

7. Observations of Transmission Control Protocol(TCP) Connection states, Flags andFlow control.

8. To learn Transmission Control Protocol(TCP) Flow Control, ErrorControl, and Congestion.

9. To introduce Wire shark & tcp dump, and observation of packets in a LAN network.

10. To analyze HTTP packets using Wire shark tool, and understand the records returned by a DNS server.

				L	**T**	**P**	**Cr.**
B.Tech.(V Sem.)		**20AD54-MACHINE LEARNING LAB**		0	0	3	1.5

Pre-requisite   : Probability and Statistics, Python Programming

Course Educational Objective: The objective of this lab is to Make use of Data sets in implementing the machine learning algorithms in any suitable language of choice.

Course Outcomes (CO): At the end of this course, the student will be able to:

CO1: Apply the appropriate pre-processing techniques on data set. (**Apply – L3**)

CO2: Implement supervised Machine Learning algorithms. (**Apply – L3**)

CO3: Implement advanced Machine Learning algorithms (**Apply – L3**)

CO4: Improve individual / teamwork skills, communication & report
           writingskills with ethical values.

Experiments:

1. Basic statistical functions for data exploration

2. Data Visualization: Box plot, scatter plot, histogram

3. Data Pre-processing: Handling missing values, outliers, normalization, Scaling

4. Principal Component Analysis (PCA)

5. Singular Value Decomposition (SVD)

6. Linear Discriminant Analysis (LDA)

7. Regression Analysis: Linear regression, Logistic regression, Polynomial regression

8. Regularized Regression

9. K-Nearest Neighbour (kNN) Classifier

10. Support Vector Machines (SVMs)

11. Random Forest model

12. AdaBoost Classifier and XGBoost

		L	**T**	**P**	**Cr.**
B.Tech.(V Sem.)	**20CSS3- MEAN STACK TECHNOLOGIES**	1	0	2	2

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Develop professional web pages of an application using HTML elements like

　　lists, navigations, tables, various form elements, embedded media which

　　includes images, audio, video and CSS Styles.

CO2: Utilize JavaScript for developing interactive HTML web pages and validate form

　　data.

CO3: Build a basic web server using Node.js and also working with Node Package

　　Manager (NPM).

CO4: Build a web server using Express.js

　　　Make use of Typescript to optimize JavaScript code by using the concept of
　strict type checking.

List of Exercises

1.a	**Course Name:** HTML5 - The Language
	Module Name: Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element
	Include the Metadata element in Homepage.html for providing description as "IEKart's is an online shopping website that sells goods in retail. This company deals with various categories like Electronics, Clothing, Accessories etc.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28320667711144660000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.b	**Course Name:** HTML5 - The Language
	Module Name: Sectioning Elements
	Enhance the Homepage.html of IEKart's Shopping Application by adding appropriate sectioning elements.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6372291347110857000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.c	**Course Name:** HTML5 - The Language
	Module Name: Paragraph Element, Division and Span Elements, List Element
	Make use of appropriate grouping elements such as list items to "About Us" page of IEKart's Shopping Application
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32785192040894940000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.d	**Course Name:** HTML5 - The Language
	Module Name: Link Element
	Link "Login", "SignUp" and "Track order" to "Login.html", "SignUp.html" and "Track.html" page respectively. Bookmark each category to its details of IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15515105953273338000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.e	**Course Name:** HTML5 - The Language
	Module Name: Character Entities
	Add the © symbol in the Home page footer of IEKart's Shopping application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-

		module/lex_547667376938096260_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course
1.f	**Course Name:** HTML5 - The Language	
	Module Name: HTML5 Global Attributes	
	Add the global attributes such as contenteditable, spellcheck, id etc. to enhance the Signup Page functionality of IEKart's Shopping application.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28723566050321920000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course	
2.a	**Course Name:** HTML5 - The Language	
	Module Name: Creating Table Elements, Table Elements : Colspan/Rowspan Attributes, border, cellspacing, cellpadding attributes	
	Enhance the details page of IEKart's Shopping application by adding a table element to display the available mobile/any inventories.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013168035284033536113_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course	
2.b	**Course Name:** HTML5 - The Language	
	Module Name: Creating Form Elements, Color and Date Pickers, Select and Datalist Elements	
	Using the form elements create Signup page for IEKart's Shopping application.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13975270903118459000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course	
2.c	**Course Name:** HTML5 - The Language	
	Module Name: Input Elements - Attributes	
	Enhance Signup page functionality of IEKart's Shopping application by adding attributes to input elements.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_14048414537062347000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course	
2.d	**Course Name:** HTML5 - The Language	
	Module Name: Media, Iframe	
	Add media content in a frame using audio, video, iframe elements to the Home page of IEKart's Shopping application.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_30738402225794945000_shared?collectionId=lex_17739732834840810000_shared&collectionType=Course	
3.a	**Course Name:** Javascript	
	Module Name: Type of Identifiers	
	Write a JavaScript program to find the area of a circle using radius (var and let - reassign and observe the difference with var and let) and PI (const)	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013053264414818304732_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course	
3.b	**Course Name:** Javascript	
	Module Name: Primitive and Non Primitive Data Types	
	Write JavaScript code to display the movie details such as movie name, starring, language, and ratings. Initialize the variables with values of appropriate types. Use template literals wherever necessary.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_21528322245232402000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course	
3.c	**Course Name:** Javascript	
	Module Name: Operators and Types of Operators	
	Write JavaScript code to book movie tickets online and calculate the total price, considering the number of tickets and price per ticket as Rs. 150. Also, apply a festive season discount of 10%	

	and calculate the discounted amount.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13808338384481720000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.d	**Course Name:** Javascript
	Module Name: Types of Statements, Non - Conditional Statements, Types of Conditional Statements, if Statements, switch Statements
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If se
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_16257498471333610000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
3.e	**Course Name:** Javascript
	Module Name: Types of Loops
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6238536888292970000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.a	**Course Name:** Javascript
	Module Name: Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15455199570613326000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.b	**Course Name:** Javascript
	Module Name: Working With Classes, Creating and Inheriting Classes
	Create an Employee class extending from a base class Person. Hints: (i) Create a class Person with name and age as attributes. (ii) Add a constructor to initialize the values (iii) Create a class Employee extending Person with additional attributes role
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012599811117760512458_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.c	**Course Name:** Javascript
	Module Name: In-built Events and Handlers
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 3 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed. (c) If se
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_4192188372573027000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
4.d	**Course Name:** Javascript
	Module Name: Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser Object Model, Document Object Model
	If a user clicks on the given link, they should see an empty cone, a different heading, and a different message and a different background color. If user clicks again, they should see a re-filled cone, a different heading, a different message, and a diffe
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13197025862804100000_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course

5.a	**Course Name:** Javascript
	Module Name: Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods
	Create an array of objects having movie details. The object should include the movie name, starring, language, and ratings. Render the details of movies on the page using the array.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013053270191734784711_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
5.b	**Course Name:** Javascript
	Module Name: Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API
	Simulate a periodic stock price change and display on the console. Hints: (i) Create a method which returns a random number - use Math.random, floor and other methods to return a rounded value. (ii) Invoke the method for every three seconds and stop when
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012599811633905664460_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
5.c	**Course Name:** Javascript
	Module Name: Creating Modules, Consuming Modules
	Validate the user by creating a login module. Hints: (i) Create a file login.js with a User class. (ii) Create a validate method with username and password as arguments. (iii) If the username and password are equal it will return "Login Successful" else w
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013052857053585408667_shared?collectionId=lex_18109698366332810000_shared&collectionType=Course
6.a	**Course Name:** Node.js
	Module Name: How to use Node.js
	Verify how to execute different functions successfully in the Node.js platform.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19002830632103186000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
6.b	**Course Name:** Node.js
	Module Name: Create a web server in Node.js
	Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28177338996267815000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
6.c	**Course Name:** Node.js
	Module Name: Modular programming in Node.js
	Write a Node.js module to show the workflow of Modularization of Node application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28865394191004004000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
6.d	**Course Name:** Node.js
	Module Name: Restarting Node Application
	Write a program to show the workflow of restarting a Node application.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_91740738560000159000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
6.e	**Course Name:** Node.js
	Module Name: File Operations
	Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33376440180246100000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
7.a	**Course Name:** Express.js

		Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters
		Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_29394215542149950000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
7.b		**Course Name:** Express.js
		Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares
		In myNotes application: (i) we want to handle POST submissions. (ii) display customized error messages. (iii) perform logging.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13930661312009580000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
7.c		**Course Name:** Express.js
		Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults
		Write a Mongoose schema to connect with MongoDB.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035588775485440691_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
7.d		**Course Name:** Express.js
		Module Name: Models
		Write a program to wrap the Schema into a Model object.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035593896869888662_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.a		**Course Name:** Express.js
		Module Name: CRUD Operations
		Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035684270129152696_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.b		**Course Name:** Express.js
		Module Name: API Development
		In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details bas
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035745250975744755_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.c		**Course Name:** Express.js
		Module Name: Why Session management, Cookies
		Write a program to explain session management using cookies.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24299316914857090000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.d		**Course Name:** Express.js
		Module Name: Sessions
		Write a program to explain session management using sessions.
		https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_90541303472449100_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
8.e		**Course Name:** Express.js
		Module Name: Why and What Security, Helmet Middleware
		Implement security features in myNotes application
		https://infyspringboard.onwingspan.com/web/en/viewer/web-

		module/lex_31677453061177940000_shared?collectionId=lex_32407835671946760000_shared &collectionType=Course
9.a	**Course Name:** Typescript	
	Module Name: Basics of TypeScript	
	On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28910354929502245000_shared?collectionId=lex_9436233116512678000_shared& collectionType=Course	
9.b	**Course Name:** Typescript	
	Module Name: Function	
	Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass the selected product object to the next screen.	
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10783156469383723000_shared?collectionId=lex_9436233116512678000_shared& collectionType=Course	
9.c	**Course Name:** Typescript	
	Module Name: Parameter Types and Return Types	
	Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.	
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712912427057152901_shared?collectionId=lex_9436233116512678000_shared &collectionType=Course	
9.d	**Course Name:** Typescript	
	Module Name: Arrow Function	
	Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equ	
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712910875500544904_shared?collectionId=lex_9436233116512678000_shared &collectionType=Course	
9.e	**Course Name:** Typescript	
	Module Name: Optional and Default Parameters	
	Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function shoul	
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712914940641280906_shared?collectionId=lex_9436233116512678000_shared &collectionType=Course	
10.a	**Course Name:** Typescript	
	Module Name: Rest Parameter	
	Implement business logic for adding multiple Product values into a cart variable which is type of string array.	
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712921860915200909_shared?collectionId=lex_9436233116512678000_shared &collectionType=Course	
10.b	**Course Name:** Typescript	
	Module Name: Creating an Interface	
	Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.	
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712925244276736910_shared?collectionId=lex_9436233116512678000_shared &collectionType=Course	
10.c	**Course Name:** Typescript	

	Module Name: Duck Typing
	Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logic to populate the Product details.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712925595458560912_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
10.d	**Course Name:** Typescript
	Module Name: Function Types
	Declare an interface with function type and access its value.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712948945346560918_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.a	**Course Name:** Typescript
	Module Name: Extending Interfaces
	Declare a productList interface which extends properties from two other declared interfaces like Category,Product as well as implementation to create a variable of this interface type.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712951652139008920_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.b	**Course Name:** Typescript
	Module Name: Classes
	Consider the Mobile Cart application, Create objects of the Product class and place them into the productlist array.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_3705824317381604400_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.c	**Course Name:** Typescript
	Module Name: Constructor
	Declare a class named - Product with the below-mentioned declarations: (i) productId as number property (ii) Constructor to initialize this value (iii) getProductId method to return the message "Product id is <<id value>>".
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712954616782848927_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
11.d	**Course Name:** Typescript
	Module Name: Access Modifiers
	Create a Product class with 4 properties namely productId, productName, productPrice, productCategory with private, public, static, and protected access modifiers and accessing them through Gadget class and its methods.
	https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712953517170688931_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.a	**Course Name:** Typescript
	Module Name: Properties and Methods
	Create a Product class with 4 properties namely productId and methods to setProductId() and getProductId().
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9356738095572543000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
12.b	**Course Name:** Typescript
	Module Name: Creating and using Namespaces
	Create a namespace called ProductUtility and place the Product class definition in it. Import the Product class inside productlist file and use it.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_20787271128051925000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript	
Module Name: Creating and using Modules	
Consider the Mobile Cart application which is designed as part of the functions in a module to calculate the total price of the product using the quantity and price values and assign it to a totalPrice variable.	
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24788158187785620000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course	
Course Name: Typescript	
Module Name: What is Generics, What are Type Parameters, Generic Functions, Generic Constraints	
Create a generic array and function to sort numbers as well as string values.	
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_446287045482942800_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course	

Software configuration and installation
1. HTML & Javascript

- Simple editors such as Notepad or go for IDEs like Visual Studio Code(recommended),Eclipse etc. which makes coding easier.
- And, to execute application, you can use any commonly used browser such as Google Chrome(recommended), Mozilla Firefox etc
- Setup details: Environmental Setup for HTML5 - Viewer Page | Infosys Springboard (onwingspan.com)
- Environment Setup: Internal - Viewer Page | Infosys Springboard (onwingspan.com)

2. Node JS
Download **Node.js** from the official site
Setup details : How to use Node.js - Viewer Page | Infosys Springboard (onwingspan.com

3. Typescript
Installing TypeScript - Internal - Viewer Page | Infosys Springboard   (onwingspan.com)

TEXT BOOKS:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.

REFERENCE BOOKS:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.

WEB LINKS:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview(HTML5)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview(Javascript)
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview(Node.js & Express.js)
4. https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview(Typescript)

		L	**T**	**P**	**Cr.**
B.Tech.(VI Sem.)	**20CS20- PATTERN RECOGNITION**	3	0	0	3

Pre-requisite :Basic knowledge of probability & statistics, data mining.

Course Educational Objective: The main objective of the course is that the concept of a pattern and the fundamentals of pattern recognition and its relevance to classical and modern problems and to be able to identify where, when and how pattern recognition can be applied.

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

CO1 : Understand the primitives of Pattern Recognition**.(Understand-L2)**

CO2 : Understand the fundamental concepts of Bayesian approach. **(Apply–L3)**

CO3 : Understand Bayesian classifier with respect to its parameter estimation.

　　　(Understand-L2)

CO4: Gain knowledge of Mixture densities and clustering techniques**. (Understand- L2)**

CO5: Develop a statistical frame work for Speech Recognition**.(Apply-L3)**

UNIT I

Introduction: Machine perception, pattern recognition example, pattern recognition systems, the Design cycle, learning and adaptation

Bayesian Decision Theory: Introduction, continuous features–two categories classifications, minimum error –rate classification- zero–one loss function, classifiers, discriminate functions, and decision surface

UNIT II

Normal density: Univariate and multivariate density, discriminate functions for the normal Density different cases, Bayes decision theory–discrete features, compound Bayesian decision theory and context.

UNIT III

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood Estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT IV

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering–similarity measures criteria function for clustering.

UNIT-V

Pattern recognition using discrete hidden Markov models: Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, Types of HMMs

TEXTBOOKS

1. Pattern classifications, Richard O.Duda, Peter E. Hart, David G.Stroke.Wiley's student edition, Second Edition,2004.
2. Pattern Recognition, an Introduction ,V Sub shell Devi, M Narsimha Murthy, Universiy Press,2010.
3. Fundamentals of speech Recognition, Lawrence Rabiner, Biing – Hwang JuangPearson education.

REFERENCEBOOKS

1. R.C Gonzalez and R.E.Woods,―Digital Image Processing ‖,Addison Wesley,1992.
2. Pattern Recognition and Image Analysis–Earl Gose, Richard John baugh, Steve Jost PHI 2004.
3. Pattern Recognition, Sergios The odoridis, Konstantinos Koutroumbas, Academic Press, Elsevier, 4ed.

	L	T	P	Cr.
B.Tech.(VI Sem.) **20CS19- BIG DATA ANALYTICS**	3	0	0	3

Pre-requisite: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Educational Objective: Understanding the process of distributed data (Structured, Semi-Structured and Unstructured) that process the Terabytes of data using Hadoop Eco System Tools.

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

CO1: Identify Big Data and its Business Implications.(**Understand-L2**)

CO2: Process of distributed file system using Hadoop (**Apply-L3**)

CO3: Illustrate the Map Reduce mechanism(**Apply-L3**)

CO4: Develop Structured data processing tools(**Apply-L3**)

CO5: Develop semi/ unstructured data processing tools(**Apply– L3**)

UNIT I

Introduction to Big data: Types of Digital Data, Classification of Digital Data, Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?, Other Characteristics of Data Which are not Definitional Traits of Big Data, Why Big Data?, analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System.

UNIT II

Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Dataflow, Data Ingestion with Sqoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avroand File-Based Data structures.

UNIT III

Map Reduce Technique: How Map Reduce works?, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

UNIT IV

Structured Data Processing Tools
Hive: Installation, Running Hive, Hive QL, Tables, Querying Data, User Defined functions Sqoop: Introduction, generate code, Database import, working with imported data, Importing large objects , performing an exports

UNIT V

Semi-structured and unstructured Data Processing Tools Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. HBase: Basics, Concepts, Clients , Example ,HBase Versus RDBMS..

TEXT BOOKS:
1. Tom White" Hadoop: The Definitive Guide" Third Edit,O'reilyMedia,2012.
2. Big Data and Analytics, 2ed Seema Acharya, Subhashini Chellappan,Wiley2015.

REFERENCE BOOKS:
1. Michael Berthold,DavidJ.Hand,"IntelligentDataAnalysis",Springer,2007.
2. Jay Liebowitz ,"Big Data and Business Analytics" Auerbach Publications ,CRCpress (2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop",McGraw-Hill/Osborne Media(2013),Oracle press.
4. AnandRajaramanandJefreyDavidUlman,"MiningofMassiveDatasets",Cambri dgeUniversityPress,2012.

		L	T	P	Cr.
B.Tech- (VI SEM)	**20AD07 - DEEP LEARNING**	3	0	0	3

Pre-requisite **:** Probability and Statistics, LATT, Machine Learning

Course Educational Objective: The objective of the course is to make students learn the frameworks of deep learning and their application

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

CO1: Apply the fundamentals of linear algebra to machine learning algorithms. **(Apply- L3)**

CO2: Understand the fundamental building blocks of deep learning**(Understand- L2)**

CO3: Apply the concepts of Convolutional Neural Networks to computer vision applications. **(Apply- L3)**

CO4: Apply the concepts of Recurrent Neural Networks to Natural Language Processing. **(Apply- L3)**

CO5: Apply the regularization techniques to improve the model performance. **(Apply- L3)**

UNIT-I: Mathematical foundations of Deep Learning
Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear dependence and span, Norms, Special kinds of matrices and vectors, Trace operations, Eigen value decomposition

UNIT-II: Fundamentals of Deep Learning
Anatomy of Neural Networks: Layers, Models, Loss functions and optimizers
Training Deep Networks: Cost Functions, Optimizers
Types of Deep Neural Networks

UNIT-III: Convolutional Neural Networks
Motivation, Convolution Operation, Types of layers, Pooling, LENET5 Architecture

UNIT-IV: Recurrent Neural Networks
Architecture of traditional RNN, Types and applications of RNN, Variants of RNNs, Word Embedding using Word2vec

UNIT-V: Regularization and Autoencoders
Regularization for Deep Learning: L1 and L2, Dropout, Data Augmentation, Early Stopping, Case study on MNIST data
Autoencoders: Architecture, Implementation, Denoising Autoencoders, Sparse Autoencoders, Use cases

TEXTBOOKS:
1. Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn, Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference Books:
1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

Web Link:
Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs22/previewB.Tech.(Artificial Intelligence and Data Science) Deep Learning:

L	**T**	**P**	**Cr.**
3	0	0	3

B.Tech.(VI Sem.)

20AD08 SPEECH PROCESSING

Pre-requisite : Linear Algebra, Algorithms

Course Educational Objective: The Objective of the course is to provide a foundation to understand speech processing. It also helps students to understand a statistical framework to develop speech processing applications.

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

CO1: Understand the process of speech production and nature of different sounds. **(Understand-L2)**

CO2: Represent the speech signal and model the speech sounds using LPC Method**.(Apply-L3)**

CO3: Understand the vector quantization technique and use the quantization to reduce the size of data representation. **(Apply-L2)**

CO4: Apply template training methods for speech signal understanding**. (Apply-L2)**

CO5: Design a Speech recognition system using HMM**.(Apply-L2)**

UNIT-I
Introduction: Process of speech production and perception in Human beings, the speech production process, Representing speech in the time and frequency domains, Speech sounds and features.

UNIT-II
Linear Predictive Coding model for Speech Recognition: LPC Model, LPC Analysis Equations, Autocorrelation Method, Covariance method, LPC Processor for Speech Processing

UNIT-III
Vector Quantization: Elements of Vector quantization implementation, VQ Training Set, Similarity of Distance measures, Clustering the training vectors, Vector classification procedure, Comparison of vector and scalar quantizers, Extensions of Vector Quantizers.

UNIT-IV
K-Means Clustering algorithm, Dynamic Time-warping Solution, Template Training Method

UNIT-V
Hidden Markov Modeling: Discrete-Time Markov Processes, Extensions to HMMs, The three basic problems for HMMs, Types of HMM.

TEXTBOOK

1. Lawrence Rabiner, Bling- Hwang Juang, B. Yagnarayana, Fundamentals of Speech Recognition, Pearson,2013.

REFERENCE BOOKS

1. Lawrence R. Rabiner, Ronald W.Schafer, Digital Processing of Speech Signals,Pearson,2016.
2. Daniel Juraf sky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" ,Pearson Education.

	L	T	P	Cr.
B.Tech.(VI Sem.) **20CS28-COMPUTER VISION**	3	0	0	3

Pre-requisite: Linear Algebra, Probability and Statistics, Computer Graphics.

Course Educational Objective: To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems and to provide the student with programming.

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

CO1: Understand image processing techniques required for computer vision.

(Understand L2)

CO2: Describe image formation models. **(Understand–L2)**

CO3: Understand feature extraction and motion estimation techniques.**(Understand - L2)**

CO4: Apply segmentation algorithms for shape analysis. **(Apply–L3)**

CO5: Implement image classification Applications using object recognition methods.

(Apply –L3)

UNIT-I

Introduction: Image Processing, Computer Vision and Computer Graphics , What is Computer Vision -Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

UNIT II

Image Formation Models: Monocular imaging system ,Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus, Construction of 3D model from images.

UNIT III

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete), Edge detection.
Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure formation.

UNIT IV

Shape Representation and Segmentation: Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, and Multire solution analysis.

UNIT V

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

TEXTBOOKS

1. Computer Vision –A modern approach, by D. Forsyth and J .Ponce, Prentice Hall Robot Vision, by B. K .P .Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri,Publisher : Prentice Hall.

REFERENCE BOOKS

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc.,1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Engle wood Cliffs, 1982.
3. Richard S zeliski, Computer Vision: Algorithms and Applications(CVAA), Springer,2010.
4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
5. E.R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press,2012.

		L	T	P	Cr.
B.Tech.(VI Sem.)	**20IT01-SOFTWARE ENGINEERING**	3	0	0	3

Pre-requisite : Object Oriented Programming

Course Educational Objective: The objective of the course is to provide understanding of different s/w process models and how to choose one among them by gathering the requirements from a client and specifying them. Using those requirements in the design of the software architecture based on the choices with the help of modules and interfaces. To enable s/w development, by using different testing techniques like unit, integration and functional testing, the quality assurance can be achieved.

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

CO1 Understand the fundamentals of software engineering concepts and software Process models.**(Understand-L2)**

CO2 Apply the requirement elicitation techniques for preparing SRS and design engineering. **(Apply-L3)**

CO3 Understanding the basic building blocks of UML, Class and object diagrams. **(Understand-L2)**

CO4 Apply the behavioral models for real world applications.**(Apply-L3)**

CO5 Demonstrate different software testing approaches for testing the real time applications. **(Understand-L2)**

UNIT I

Software and software Engineering: The evolving role of Software, Characteristics of Software, Importance of software Engineering, Changing nature of software, Legacy Software, Software Myths. Software Process and Process Models: Layered technology, Process frame work, The process and Product, software process models, the water fall model, incremental model, the spiral and V Model, Component based s /w development, Unified process model.

UNIT II

Requirements Analysis and Software design: Requirements gathering and analysis, software requirements specifications (SRS).

Design Engineering: overview of design process, Design Concepts, Architectural Concepts

UNIT III

Design Using UML: Building Blocks of UML, Defining things, relationships and diagrams, Common Mechanism in UML, Class and Object Diagrams

UNIT IV

Behavioral Modeling: Interactions, Interaction diagrams, use cases, Use case Diagrams, Activity Diagrams, Events and signals, state machines, processes and Threads, time and space, state chart diagrams Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT V

Testing Techniques: Software testing fundamentals, Unit testing, Integration testing, Black box testing, white box testing, Debugging, System testing.

TEXTBOOKS

1. Roger S. Pressman, "Software engineering- A practitioner 's Approach", TMH InternationalEdition, 6th edition, 2005.
2. Grady Booch, James Rum baugh, Ivar Jacobson, "The Unified Modeling Language User Guide", PEARSON,4thImpression,2012.

REFERENCEBOOKS:

1. Software Engineering- Concepts and practices: Ugrasen Suman, Cengage learning
2. Object- oriented analysis and design using UML", Mahesh P. Matha, PHI
3. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI
4. https://onlinecourses.nptel.ac.in/noc20_cs68[1,2,3,4,5]

		L	T	P	Cr.
B.Tech.(VI Sem.)		0	0	3	1.5
	20AD55-CASE TOOLS LAB				

Pre-requisite   :   Object Oriented Programming

Course Educational Objective: The main objective of this course is that a student will be familiar with principles behind the Object-Oriented Design and able to apply those principles in a project setting. Students will analyze applications and know how to take a pragmatic approach to software design and development.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1:   Analyze Software Requirements for the given Real-World Application using Use Cases. **(Analyze-L4)**

CO2:   Develop the UML Diagrams to view Software System in static aspects. **(Analyze-L4)**

CO3:   Develop the UML Diagrams to view Software System in dynamic aspects. **(Analyze-L4)**

CO4:   Improve individual /team work skills, communication & report writingskills with Ethical values**.**

Cycle-1: Analyze the Requirements for the following Case Studies.
1) Automated Teller Machine(ATM)
2) Library Management System
3) Railway Ticket Reservation System

Cycle-2: Analyze the Requirements for the following Case Studies.
1) Point-of-Sale Terminal
2) Customer Support Service Operations
3) Cab Booking Service

Cycle-3: Basics of UML

1) Introduction to UML

2) Familiarization with any one of the Software such as Rational Rose or Umbrelloor Gliffy Diagram etc.

Cycle-4: For each case study given earlier, Construct Use Case Diagram for following:
1) Identify and Analyze the Actors.
2) Identify the Actions.
3) Analyze the Relationships between Actors and Actions.
4) Sketch the Use Case Diagram.

Cycle-5 and Cycle-6: For each case study given earlier, Construct Class Diagram inthe following manner:
1) Identify and Analyze the Classes related to your problem.
2) Analyze the Attributes and Operations
3) Analyze the Relation ships between Classes
4) Sketch the Class Diagram

Cycle7: For each case study given earlier, Construct Interaction Diagrams in thefollowing manner:

1) Identify the Objects participating in Communication.
2) Identify the Messages between the objects.
3) Give numbering to messages.
4) Use Flat Sequencing or Procedural Sequencing for numbering.

Cycle-8: For each case study given earlier, Construct Activity Diagram in thefollowing manner:

1) Identify activities in your case study.
2) Identify relationships among activities.
3) Use Fork or Join ,if necessary.
4) Sketch the diagram.

Cycle9: For each case study given earlier, Construct State Chart Diagram in the following manner:

1) Identify the different states in your case study.
2) List out the different sub-states present in th estate.
3) Identify relationships among the state to state.
4) Sketch the diagram.

Cycle10: For each case study given earlier, Construct Component Diagram in thefollowing manner:

1) Identify the different components in your case study.
2) Create a visual for each of the component.
3) Describe the organization and relationships between componentsusing interfaces, ports etc.
4) Sketch the diagram.

Cycle11: For each case study given earlier, Construct Deployment Diagram inthe following manner:

1) Identify the nodes.
2) Identify the relationships among the nodes.
3) Sketch the Diagram.

REFERENCE BOOKS

1. Roger S. Pressman, "Software engineering- A practitioner's Approach", TMH International Edition,6th edition,2005.

2. Grady Booch, James Rum baugh, Ivar Jacobson,"The Unified Modeling Language User Guide", Pearson Education,2ndEdition,ISBN:0-201-57168-4,1998.

3. Meilir Page- Jones,"Fundamentals of Object-Oriented Design inUML",PearsonEducation,1stEdition,ISBN:9788177586770,8177586777,and2007.

				L	T	P	Cr.
B.Tech.(VI Sem.)				0	0	3	1.5
	20CS62 DATA ANALYTICS AND VISUALIZATION LAB						

Pre-requisite: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Educational Objective: The Objective of the course is to provide practical, foundation level training that enables immediate and effective participation in Big Data and other Analytics projects using Hadoop and Data Visualization using Tableau.

Course Outcomes(CO): At the end of this course, the student will be able to:

CO1: Demonstrate the installation of Big data analytic tools**.(Understand–L2)**

CO2: Apply data modeling techniques to large datasets. **(Apply–L3)**

CO3: Conduct exploratory data analysis using visualization**.(Understand–L2)**

CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

List of Experiments

1. Refreshing Linux Commands and Installation of Hadoop
2. Implementation of Run a basic Word Count Map Reduce program
3. Implementation of Matrix Multiplication with Hadoop Map Reduce.
4. Implementation of Weather mining by taking weather dataset using Map Reduce.
5. Installation of Hive along with practice examples.
6. Installation of Sqoop along with Practice examples.
7. Downloading and installing Tableau Understanding about importing data, saving,opening, and sharing work books.
8. Data Preparation with Tableau
9. Charts: Bar Charts, Legends, Filters ,and Hierarchies ,Step Charts, Line Charts.
10. Maps: Symbol Maps, Filled Maps, Density Maps, Maps with Pie Charts
11. Interactive Dash boards

TEXTBOOKS
1. Seema Acharya, Subhasini Chellappan,"**BigDataAnalytics"**Wiley2015
2. Alexander Loth,"**Visual Analytics withTableau**",ISBN:978-1-119-56020-3, Wiley2019

REFERENCES

1. Tom White, "**Hadoop: The Definitive Guide**",ThirdEditon,O'reilyMedia,2012
2. Michael Berthold, David J. Hand, "**Intelligent Data Analysis**"Springer,2007.
3. JayLiebowitz,"**BigDataandBusinessAnalytics**"AuerbachPublications,CRC press(2013).
4. Anand Rajaraman and Jefrey David Ulman, "**Mining of Massive Datasets**",

		L	T	P	Cr.
B.Tech.(VI Sem.)	**20AD56- DEEP LEARNING WITH TENSOR FLOW**	0	0	3	1.5

Pre-requisite   : Python

Course Educational Objective: The Objective of the course is to provide practical, foundation level training that enables to handle various high dimensional data sets using various deep learning techniques

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1:   Implement deep neural networks to solve real world problems (**Apply-L3)**

CO2:   Choose an appropriate pre-trained model to solve real-time problems. **(Analyze – L4)**

CO3:   Interpret the results of two different deep learning models. (**Analyze – L4)**

CO 4:   Improve individual / teamwork skills, communication & report writing skills with ethical values.

Experiments:

1.   Numerical Methods to solve matrix problems in Python

2.   Eigen Value decomposition techniques

3.   Dimensionality Reduction-PCA

4.   Fundamentals of Tensor flow

5.   Build a Convolution Neural Network for MNIST Handwritten Digit Classification

6.   Build a Convolution Neural Network for simple image Classification

7.   Implement one hot encoding of words or characters.

8.   Word2vec Framework

9.   Implement word embeddings for IMDB dataset.

10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Book:
Reza Zadeh and Bharath Ramsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

References:
https://github.com/fchollet/deep-learning-with-python-notebooks

B.Tech.(VI Sem.)

20HSS1- SOFT SKILLS COURSE (SOC)

L	T	P	Cr.
1	0	2	2

Course Educational Objectives:
The Soft Skills Laboratory course equips students with required behavioral, interpersonal & Intrapersonal skills, communication skills, leadership skills etc. It aims at training undergraduate students on soft skills leading to enhanced self-confidence, esteem, and acceptability in professional circles.

Course Outcomes (COs): At the end of the course, student will be able

CO1: To Develop self-awareness and personality traits for professional growth
(Understand – L2)
CO2: Work effectively in multi-disciplinary and heterogeneous teams through knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality.
(Apply – L3)
CO3: Communicate through verbal/oral communication with good listening skills and empathy (Apply – L3)
CO4: Apply skills required to qualify in recruitment tests, Interviews & other professional assignments (Apply – L3)

Personality Development Skills
Role of language in Personality – How language reflects, impacts Personality – Using gender-neutral language in MNCs – being culturally-sensitive-Personality Traits - Grooming & Dress code
Activities: Group Discussion/Role play/Presentations (authentic materials: News papers, pamphlets and news clippings)

Impactful Communication
Activities : Extempore / Story Telling/ Group Discussion (Case studies/Current affairs etc.)/ Elocution on Interpretation of given quotes/ Critical Appreciation and Textual Analysis/ Writing reviews on short story/videos/book/Social Media profiling/ Pronunciation Practice

Professional Skills:
Career Planning- job vs. career- goal setting- SWOT analysis-Time management – self-management – stress-management.
Activities: SWOT analysis of the self/Goal setting-Presentation/Writing Report/Listening exercises/Effective Resume-Writing and presentation/ Interview Skills: Mock interviews/Video samples.

REFERENCES :
1. Edward Holffman, "Ace the Corporate Personality", McGraw Hill,2001
2. Adrian Furnham, Personality and Intelligence at Work, Psyc 2. hology Press, 2008.
3. M.Ashraf Rizvi, "Effective Technical Communication", 1 st edition, Tata McGraw Hill, 2005
4. Ace of Soft skills Gopalaswamy Ramesh, Pearson Education India, 2018
5. Soft Skills for the Workplace, Goodheart-Willcox Publisher · 2020.
6. How to Win Friends and Influence People, Dale Carnegie · 2020

		L	T	P	Cr.
B.Tech.(VII Sem.)	**20AD09 NATURAL LANGUAGE PROCESSING**	3	0	0	3

Pre-requisite : Nil

Course Educational Objective: The Objective of the course is to make learn the basic elements of C programming, control structures, derived data types, Modular programming, user defined structures, basics of files and its I/O operations.

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

CO1: Familiar with the basic components of NLP. **(Understand - L2)**

CO2: Applying N-gram models to predict a sequence of text**. (Apply - L3)**

CO3: Build a basic language understanding system using preliminary concepts of NLTK library**. (Apply - L3)**

CO4: Exposure on advanced techniques for understanding patterns in text **(Apply- L3)**

CO5: Understand the semantics of linguistic components in a natural dialogue **(Understand - L2)**

UNIT I
Introduction Knowledge in Speech and Language Processing: Ambiguity; Models and Algorithms; Language, Thought and Understanding; History Regular Expressions Regular Expression; Words; Corpora; Text Normalization; Minimum Edit Distance

UNIT II
N-gram Language Models N-Grams: Evaluating Language Models. Generalization and Zeros. Smoothing: Laplace Smoothing; Add-k Smoothing; Back off and Interpolation; Kneser - Ney Smoothing

UNIT – III
Natural language processing tools in Python (NLTK Package) Part-I: Introduction to NLTK; Tokenizing; Filtering Stop words; Stemming; Tagging parts of speech; Lemmatizing; Chunking; Chinking
Part-II: Using Named Entity Recognition (NER); Getting Text to Analyze; Using a Concordance; Making a Dispersion Plot;

UNIT – IV
Information Extraction: Relation Extraction Algorithms; Using Patterns to extract relations; Relation extraction via supervised learning; Semi supervised relation extraction via bootstrapping; Distant Supervision for Relation Extraction; Evaluation of Relation Extraction; Extracting Times; Extracting Events and their Times; Template Filling

UNIT – V
Word Senses and Word Net Defining Word Senses: How many senses do words have?Relations between senses Word Net: Sense relations in Word Net; Word Sense Disambiguation; Alternate WSD algorithms and Tasks

TEXTBOOKS

1. Daniel Jurafsky, James H. Martin ,"Speech and Language Processing" , Third Edition, PHI, 2020.
2. https://realpython.com/nltk-nlp-python/#getting-text-to-analyze

REFERENCE BOOKS

1. Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, 2011
2. Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning, Benjamin Bengfort, Rebecca Bilbro, 2018
3. Speech and Language Processing, 2nd Edition, Daniel Jurafsky, James H. Martin, 2009.

	L	T	P	Cr.
B.Tech.(VII Sem.) **20AD10 RECOMMENDER SYSTEMS**	3	0	0	3

Pre-requisite : Machine Learning and Data Mining

Course Educational Objective: To understand the foundations of recommender system, significance of machine learning and data mining algorithms, performance evaluation. Students can design and implement recommender system using collaborative filtering.

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

CO1: Understand the basic concepts of recommender systems **(Understand-L2)**

CO2: Carry out performance evaluation of recommender systems based on various metrics**(Apply - L3)**

CO3: Implement machine-learning and data-mining algorithms in recommender systems data sets**(Apply – L3)**

CO4: Design and implement a simple recommender system with the help of collaborative filtering **(Apply – L3)**

CO5: Recognize the importance of recommender systems in various applications. **(Understand-L2)**

UNIT 1

Introduction and basic taxonomy of recommender systems (RSs),traditional and non-personalized RSs, overview of data mining methods for recommender systems- similarity measures, classification, clustering, SVMs, dimensionality reduction, overview of convex and linear optimization principles.

UNIT II

Content-based recommendation

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms

UNIT III

Collaborative Filtering (CF)-based RSs:

A systematic approach Nearest-neighbor collaborative filtering (CF), user- based and item-based CF, and comparison, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection), and attacks on collaborative recommender systems.

UNIT IV

Advanced topics:Network aspects of content RSs Recommender systems for video content distribution. Implications of recommender systems in 5G wireless networks. RSs for optimizing wireless network performance. Case studies (i) Joint content recommendations and content caching in small cells wireless networks (ii) The interplay of RSs and User access point association.

UNIT V

Applications of RSs

RSs for content media, social media and communities, Music and video RSs. Group recommender systems. Social recommendations. Recommending friends: link prediction models. Similarities and differences of RSs with task assignment in mobile crowd sensing, social network diffusion awareness in RSs.

TEXT BOOK

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1sted.

REFERENCE BOOKS

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook,Springer(2011), 1sted.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems ForLearning, Springer (2013), 1st ed.
3. C.C. Aggarwal, Recommender Systems: The Textbook, Springer,2016.
4. F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.

B.Tech.(VII Sem.)	**20CS22 DISTRIBUTED OPERATING SYSTEMS**	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Knowledge of Operating systems, Computer Networks

Course Educational Objectives:
This course enables the students to know about a comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems. In particular, the course will consider inherent functionality and processing of program execution. The emphasis of the course will be placed on understanding.

Course Outcomes (COs): At the end of this course, the student will be able to

CO1: Identify the hardware and software components to design the communication model in Distributed System**. (L2-Understand)**

CO2: Illustrate the processor allocation and process scheduling algorithms in Distributed Systems. **(L2-Understand)**

CO3: Apply the Clock Synchronization protocols and Deadlock handling mechanisms in Distributed system**. (L3-Apply)**

CO4: Analyze the implementation of Distributed Shared memory for real world problems**. (L2-Understand)**

CO5: Demonstrate the Implementation of Distributed file system and CHROUS, MACH distributed operating systems**. (L3-Apply)**

UNIT I

Introduction to Distributed Systems
Definition, Goals, Hardware Concepts, Software Concepts, Design issues. Communication in Distributed Systems: Layered Protocols, ATM networks, Client-Server model, Remote Procedure Call, Group Communication.

UNIT II

Processes and Processors in Distributed Systems
Threads, System Models, Processor Allocation, Scheduling in Distributed Systems, Fault tolerance, Real time Distributed Systems.

UNIT III

Synchronization in Distributed Systems
Clock Synchronization, Mutual Exclusion, Election Algorithms, Atomic Transactions, Deadlocks in Distributed Systems.

UNIT IV

Distributed Shared Memory
Introduction, Consistency Models, Page-based Distributed shared memory, Shared-variable Distributed shared memory, Object-based Distributed shared memory.

UNIT V

Distributed File Systems
Distributed File System design, Distributed File System implementation, Trends in Distributed File Systems. Case Studies: MACH, CHORUS

TEXT BOOKS

1. T Andrew S Tanenbaum, "Distributed Operating Systems" , 3rd edition, Pearson publication, 2007
2. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems-Concepts and Design" , 5th Edition, Pearson Publications, 2009

REFERENCE BOOKS

1. Ajay D. Kshem kalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008.
2. Sunita Mahajan, Seema Shan, Distributed Computing, Oxford University Press, 2015
3. Web link: https://dinus.ac.id/repository/docs/ajar/George-Coulouris-
4. Distributed-Systems-Concepts-and-Design-5th-Edition.pdf

	L	**T**	**P**	**Cr.**
B.Tech.(VII Sem.)				
20CS21 INFORMATION RETRIEVAL SYSTEM	3	0	0	3

Pre-requisite   :   DBMS, Data Structures, and DW&DM

Course Educational Objective: The main objective of this course is to present the basic concepts in information retrieval and the significance of various indexing and searching techniques for information retrieval.

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

CO 1 Identify the basic concepts of Information retrieval system.. **(Remember – L1)**

CO 2 Describe the taxonomy of different information retrieval models**.(Understand-L2)**

CO 3 Demonstrate and evaluate automatic indexing, document & term clustering techniques. **(Understand-L2)**

CO 4 Demonstrate and evaluate various searching techniques. **(Understand- L2)**

CO 5 Evaluate text processing techniques and operations in information retrieval system. (**Apply- L3**)

UNIT I
   Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses. Information Retrieval System Capabilities: Search, Browse and Miscellaneous Capabilities.

UNIT II
   Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.
   Cataloguing and Indexing: Objectives, Indexing Process, Automatic Indexing, and Information Extraction.

UNIT III
   Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages. **Document and Term Clustering**: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT IV
   User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext.
   Information Visualization: Introduction, Cognition and perception, Information visualization technologies.

UNIT V
   Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

TEXT BOOK

1. Kowalski, Gerald, Mark T Maybury ― Information Storage & Retrieval Systems: Theory and Implementation‖, Kluwer Academic Press, 2nd edition, 2002.

REFERENCE BOOKS

1. C. D. Manning, P. Raghavan, and H. Schutze , An Introduction to Information Retrieval, Cambridge University Press, 2009.
2. William B Frakes , Ric do BaezaYates , "Information Retrieval Data Structures and Algorithms", Pearson Education, 1992.
3. https://epdf.tips/queue/information-storage-and-retrieval-systems-theory-and-implementation- the-informat.html
4. Robert Korthagen, "Information Storage & Retrieval", John Wiley & Sons,3rd Edition,2011.

	L	T	P	Cr.
B.Tech.(VII Sem.) **20CS25 SOFTWARE PROJECT MANAGEMENT**	3	0	0	3

Pre-requisite   : Software Engineering, Software Testing Methodologies, Objectoriented Analysis and Design.

Course Educational Objective: This course is centered on unique aspects of software project management at three levels: Organizational management, Infrastructure management and project management and measurement of the Project, and how these are applied to actual software projects.

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

CO 1: Identify the process of Conventional Software Management the Evolution and Improvement of Software Economics. **(Remember-L1)**

CO 2: Describe the basic s/w processes, Cost estimation and improvement in s/w Economics. **(Remember-L1)**

CO 3: Summarize Life cycle phases and Artifacts of the process in Software project Management. **(Understand-L2)**

CO 4: Apply Workflows and checkpoints in Iterative Process planning.**(Apply-L3)**

CO 5: Illustrate Project Organizations, process automation building blocks and metrics in assessing Software Quality. **(Understand-L2)**

UNIT I
Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation. **Improving Software Economics**: Reducing Software product size, improving software processes, The principles of conventional software Engineering, principles of modern software management, transitioning to aniterative process.

UNIT II
Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts, A Management perspective and technical perspective.

UNIT III
Workflows of the process: Software process workflows, Iteration workflows. Checkpoints of the process: Major milestones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT IV
Project Organizations and Responsibilities : Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building blocks, The Project Environment. Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics.

UNIT V

Tailoring the Process: Process discriminants Future Software Project Management: Modem Project Profiles, Next generation Software economics, modern process transitions.Case Study: The command Center Processing and Display system-Replacement (CCPDS)

TEXTBOOK

1. Walker Royce ,"Software Project Management", Pearson Education, 2015.

REFERENCE BOOKS:

1. Robert K. Wysocki, "Effective Software Project Management", Wiley Publication,2011.

2. Walker Royce, "Software Project Management", Addison-Wesley, 1998.

3. Bob Hughes and Mike Cotterell, "Software Project Management ",Tata McGraw-HillEdition,2000.

	L	T	P	Cr.
B.Tech.(VII Sem.) **20CS29 BLOCK CHAIN TECHNOLOGY**	3	0	0	3

Pre-requisite **:** Information Security

Course Educational Objective:

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

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

CO1: Demonstrate the foundation of the Block chain technology and understand the

processes in payment and funding. **(Understand - L2)**

CO2: Identify the risks involved in building Block chain applications.

(Understand - L2)

CO3: Review of legal implications using smart contracts. **(Understand - L2)**

CO4: Choose the present landscape of Block chain implementations and Understand

Crypto currency markets. **(Apply- L3)**

CO5: Examine how to profit from trading crypto currencies. **(Understand - L2)**

UNIT I

Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics,Opportunities Using Block chain, History of Block chain.
Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.

UNIT II

Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle -Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction**.**

UNIT III

Architecting Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.

UNIT IV

Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Meta mask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts

UNIT V

Hyper ledger Block chain Implementation: Introduction, Use Case – Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, Fab Car Use Case Implementation, Invoking Chain code Functions Using Client Application. Advanced Concepts in Block chain: Introduction, Interplanetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Block chain with IoT and AI/ML Quantum Computing and Block chain, Initial Coin Offering, Block chain Cloud Offerings, Block chain and its Future Potential.

TEXT BOOKS:

1. Ambadas, Arshad Sarfarz Ariff, Sham "Block chain for Enterprise Application Developers",Wiley
2. Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Block chain" , O'Reilly

REFERENCE BOOKS:

1. Block chain: A Practical Guide to Developing Business, Law, and TechnologySolutions, Joseph Bambara, Paul R. Allen, Mc GrawHill.
2. Block chain: Blueprint for a New Economy, Melanie Swan,O'Reilly https://github.com/blockchainedindia/resources

		L	T	P	Cr.
B.Tech.(VII Sem.)	**20CS27 SOCIAL NETWORK ANALYSIS**	3	0	0	3

Pre-requisite : Graph Theory, Computer Networks.

Course Educational Objective: The learning objective of the course «Social Network Analysis is to provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

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

CO1: Develop semantic web applications**. (Apply-L3)**

CO2: Represent social network data using the principles of Ontology.**(Apply-L3)**

CO3: Implement community mining algorithms to extract knowledge from Social Network Applications**. (Apply-L3)**

CO4: Predict human behavior in social web and related communities**(Apply-L3)**

CO5: Use visualization tools to represent the knowledge of social network data. **(Apply-L3)**

UNIT - I

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web -Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II

Modelling, Aggregating And Knowledge Representation: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations**.**

UNIT - III

Extraction and Mining Communities In Web Social Networks:
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi- Relational characterization of dynamic social network communities.

UNIT IV

Predicting Human Behaviour And Privacy Issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V

Visualization And Applications Of Social Networks: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", 1stEdition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications",3rdEdition, Springer, 2015.

REFERENCE BOOKS:

1. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: EmergingTechnologies and Applications for Searching the Web Effectively", IGI GlobalSnippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling ", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

	L	T	P	Cr.

B.Tech.(VII Sem.)

20AD11 REINFORCEMENT LEARNING

L	T	P	Cr.
3	0	0	3

Pre-requisite : Basic Machine Learning and Linear Algebra

Course Educational Objective: To understand the foundation of Reinforcement learning is an area of machine learning, where an agent or a system of agents learn to archive a goal by interacting with their environment. RL is often seen as the third area of machine learning, in addition to supervised and unsupervised areas, in which learning of an agent occurs as a result of its own actions and interaction with the environment.

CO1: Understand the Basic concepts of Reinforcement learning **(Understanding L-2)**

CO2: Implement tabular methods to solve classical control problems **(Apply L-3)**

CO3: Understand the policy gradient methods from vanilla to more complex cases

      (Understanding L-2)

CO4: Understand the importance of model based RL approaches **(Understanding L-2)**

CO5: Recognize current advanced techniques and applications in RL**(Understanding L-2)**

UNIT-1

Introduction and Basics of RL , Defining RL Framework and Markov Decision Process, Polices, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras /Tensor flow)

UNIT-2

Tabular methods and Q-networks ,Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning) ,Deep Q-networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay)

UNIT-3

Introduction to policy-based methods: Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C) , Advanced policy gradient (PPO, TRPO, DDPG)

UNIT-4

Model-based RL approach: Analytic gradient computation, Sampling-based planning, Model-based data generation, Value-equivalence prediction, Model-based policy optimization. Model-based RL approach Recent Advances and Applications.

UNIT-5

Meta-learning: Multi-Agent Reinforcement Learning. Partially Observable Markov Decision Process. Ethics in RL . Applying RL for real-world problems

TEXT BOOKS

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012): 3

REFERENCE BOOKS

1. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach."Pearson Education Limited, 2016.
2. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016. • David Silver's course on Reinforcement Learning (link)

		L	T	P	Cr.
B.Tech.(VII Sem.)	**20CS17 INFORMATION SECURITY**	3	0	0	3

Pre-requisite : Computer Networks, Number theory and programming Language

Course Educational Objective: The Objective of the course is to course elevates the security aspects and provides the knowledge to understand the basic concept of Cryptography and Network Security principles. It antilight 's different types of cipher mechanisms and various symmetric and asymmetric algorithms. Also provides the knowledge on digital signatures, different threats, viruses, intruders, and firewalls.

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

CO1: Summarize encryption algorithms to achieve data confidentiality. (**Understand-L2)**

CO2: Apply Secure hash functions for attaining data integrity**. (Apply-L3)**

CO3: Illustrate the email security mechanisms to achieve authentication. **(Understand- L2)**

CO4: Demonstrate the techniques of web security. **(Understand-L2)**

CO5: Examine the threats and remedial measures for system security. (**Apply-L3)**

UNIT I

Introduction: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, Access Control and Availability) and Mechanisms. A Model for Internetwork security, Conventional Encryption Principles, Conventional Encryption Algorithms (DES, Triple DES and AES), Cipher Block Modes of Operations (CBC, CFB only), Stream Ciphers and RC4, Location of Encryption Devices, Key Distribution.

UNIT II

Public -Key Cryptography: Approaches of Message Authentication, MD5, Secure Hash Functions (SHA-512) and HMAC Algorithm, Public Key Cryptography principles, Public Key Cryptography Algorithms, Digital Signatures, Public Key Infrastructure, Digital Certificates, Certificate Authority, Key Management, X.509 certificate.

UNIT III

Email Privacy: Pretty Good Privacy (PGP), PGP and S/MIME, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, cryptographic Suites.

UNIT IV

Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET) and HTTPs.

UNIT V

Intruders: Intruder Behavior Patterns, Intrusion Techniques, Statistical Anomaly Detection, Rule-Based Intrusion Detection, Honeypot, Malicious Software: Backdoor, Logic Bomb, Trojan Horses, Mobile Code, Viruses: The Nature of Viruses, Viruses Classification, Antivirus Approaches, Distributed Denial of Service Attacks, DDoS Countermeasures Firewall Design principles, Trust Management System, Introduction to digital forensics.

TEXTBOOKS:

1. William Stallings, "Network Security Essentials (Applications and Standards)", PearsonEducation, 1999.
2. William Stallings, "Cryptography and Network Security", PHI/Pearson, fourth edition, 2000.

REFERENCE BOOKS:

1. Whitman, "Principles of Information Security", Thomson,PHI, 2000

2. Robert Bragg, Mark Rhodes, Network Security: The complete reference, TMH

3. Buchmann, Introduction to Cryptography,Springer,2010.

4. Jeetendra pande, Ajay, "Digital Foresnsics', ISBN: 978-93-84813-94-9

5. https://www.mat.unical.it/ianni/storage/Intro-2013.ppt

6. http://www.inf.ufsc.br/~bosco.sobral/ensino/ine5680/material-cripto-seg/2014

7. http://www.williamstallings.com/netsec/netsec4e.html

8. https://www.cs.kau.se/cs/dvgc19/ch14.pdf

9. https://www.ntut.edu.tw/~jhwang/IS

		L	T	P	Cr.
B.Tech.(VII Sem.)	**20CSS4 CONTINUOUS INTEGRATION AND DELIVERY USING DEVOPS**	3	0	0	3

Pre-requisite : Basic knowledge of certain basic programming languages such as Java, and Python

Course Educational Objective: This course is designed to provide the core education necessary to build your DevOps vocabulary and to understand its principles and practices. With the help of key DevOps concepts and terminology, real-life case studies, examples and interactive group discussions and exercises, you will acquire a fundamental understanding of DevOps.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Understand the why, what, and how of DevOps adoption**(Understand – L2)**

CO2: Attain literacy on DevOps**(Apply L3)**

CO3: Align capabilities required in the team and create an automated CICD pipeline using a stack of tools**(Apply L3)**

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Module 1:

Reference Course Name:Software Engineering and Agile Software Development
Get an understanding of the stages in software development lifecycle, the process models, values and principles of agility and the need for agile software development. This will enable you to work in projects following an agile approach to software development.
Solve the questions given in the reference course name to gauge your understanding of the topic

Module 2:

Reference course name: Development & Testing with Agile: Extreme Programming
Get a working knowledge of using extreme automation through XP programming practices of test first development, refactoring and automating test case writing.
Solve the questions in the "Take test" module given in the reference course name to gauge your understanding of the topic

Module 3:

Module name: DevOps adoption in projects
It is important to comprehend the need to automate the software development lifecycle stages through DevOps. Gain an understanding of the capabilities required to implement DevOps, continuous integration, and continuous delivery practices.
Solve the questions given in Quiz1, Quiz2, Quiz 3

Module 4:

Module name: Implementation of CICD with Java and open-source stack
Configure the web application and Version control using Git using Git commands and version control operations.

Module 5:

Module Name: Implementation of CICD with Java and open-source stack
Configure a static code analyzer which will perform static analysis of the web application code and identify the coding practices that are not appropriate. Configure the profiles and dashboard of the static code analysis tool.

Module 6:

Module Name: Implementation of CICD with Java and open-source stack
Write a build script to build the application using a build automation tool like Maven. Create a folder structure that will run the build script and invoke the various software development build stages. This script should invoke the static analysis tool and unit test cases and deploy the application to a web application server like Tomcat.

Module 7:

Module Name: Implementation of CICD with Java and open-source stack
Configure the Jenkins tool with the required paths, path variables, users, and pipeline views.

Module 8:

Module name: Implementation of CICD with Java and open-source stack
Configure the Jenkins pipeline to call the build script jobs and configure to run it whenever there is a change made to an application in the version control system. Make a change to the background color of the landing page of the web application and check if the configured pipeline runs.

Module 9:

Module name: Implementation of CICD with Java and open-source stack
Create a pipeline view of the Jenkins pipeline used in Exercise 8. Configure it with user defined messages.

Module 10:

Module name: Implementation of CICD with Java and open-source stack
In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static analysis of code.

Module 11:

Module name: Implementation of CICD with Java and open-source stack
In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static unit testing.

Module 12:

Module name: Course end assessment
In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for code coverage.

Reference Books:

1. Learning Continuous Integration with Jenkins: A beginner's guide to implementing Continuous Integration and Continuous Delivery using Jenkins - Nikhil Pathania ,Packt publication[https://www.amazon.in/Learning-Continuous-Integration-Jenkins-Pathania/dp/1785284835]
2. Jenkins 2 – Up and Running: Evolve Your Deployment Pipeline for Next Generation Automation - Brent Laster, O'Reilly publication [https://www.amazon.in/Jenkins-2-Running-Brent-Laster/dp/1491979593]

Hardware and Software Configuration:
1. Git [GitHub or Gitlab]
2. Sonarqube
3. Jenkins
4. JUnit
5. Eclipse
6. Tomcat server
7. Maven
8. Cobertura or JaCoCo
9. Java SDK
10. All necessary drivers and jar files for connecting the software
11. Windows machine with 16GB RAM

Web Links: (Courses mapped to Infosys Springboard platform)

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013382690411003904735_shared/overview [Software Engineering and Agile software development]

2. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_01350157819497676810467 [Development & Testing with Agile: Extreme Programming]

3. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_01353898917192499226_shared [DevOps CICD]

	L	T	P	Cr.
B.Tech.(VII Sem.)	3	0	0	3
20HS02- MANAGEMENT SCIENCE FOR ENGINEERS				

Course Description:

In this course, students will learn fundamental concepts and contributions of management. This course also teaches human resources practices which play a vital role in the organisation it gives knowledge about use of improve quality of work and project management.

Course Objectives:

1. To make students understand management, its principles, contribution to management, organization, and its basic issues and types
2. To make students understand the concept of plant location and its factors and plant layout and types, method of production and work study importance
3. To understand the purpose and function of statistical quality control.And understand the material management techniques
4. To make students understand the concept of HRM and its functions
5. To make students understand PERT & CPM methods in effective project management and need of project crashing and its consequence on cost of project

Course Outcomes:

CO1: Understand management principles to practical situations based on the organization structures**. (L2)**
CO2: Design Effective plant Layouts by using work study methods. **(L2)**
CO3: Apply quality control techniques for improvement of quality and materials management. **(L3)**
CO4: Develop best practices of HRM in corporate Business to raise employee productivity. **(L2)**
CO5: Identify critical path and project completion time by using CPM and PERT techniques. **(L3)**

UNIT I
Introduction: Management - Definition, Nature, Importance of management Functions of Management - Taylor's scientific management theory, Fayal's principles of management, Contribution of Elton mayo,Maslow, Herzberg, Douglas MC Gregor, Basic Concepts Of Organisation- Authority, Responsibility Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures(Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization)

UNIT II
Operations Management: Plant location, Factors influencing location,Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement

UNIT III
Statistical quality control –Concept of Quality & Quality Control-functions ,Meaningof SQC -Variables and attributes - X chart, R Chart, C Chart, P Chart,(simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality.
Materials management –Meaning and objectives,inventory control-Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels

UNIT IV
Human Resource management (HRM): Concepts of HRM, Basic functions of HR manager:Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

UNIT V
Project management: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)

Text Books:
Dr. A.R.Aryasri, Management Science, TMH, 10th edition, 2012

References:
1. Koontz & weihrich – Essentials of management, TMH, 10th edition, 2015
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and Management L.S.Srinath, PERT & CPM