R-20

COURSESTRUCTUREANDSYLLABUS

for

B.Tech

COMPUTER SCIENCE AND ENGINEERING

(DATASCIENCE)

(*Applicableforbatchesadmittedfrom2021-22*)

PRAGATIENGINEERINGCOLLEGE

(AUTONOMOUS)

Approved by **AICTE**, Permanently Affiliated to **JNTUK, Kakinada**,Accredited by**NBA**, **NAAC**with –**A**‖Grade

Recognizedby**UGC2(f)**and**12(b)** under UGCact,1956

#1-378, ADBRoad,Surampalem,Near Peddapuram, E.G.Dist,A.P.–533437

PRAGATIENGINEERINGCOLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

IYearISemester							
S.No	**Category**	**Course Code**	**CourseTitle**	**Hours perWeek**			**Credits**
				L	**T**	**P**	**C**
1	HSC	20HE1T01	Professional Communicative English	3	0	0	3
2	BSC	20BM1T01	Differential Equations andNumericalMethods	3	0	0	3
3	BSC	20BC1T02	AppliedChemistry	3	0	0	3
4	ESC	20CS1T01	Programming for ProblemSolvingusingC	3	0	0	3
5	ESC	20IT1L01	ComputerEngineeringWorkshop	1	0	4	3
6	HSC	20HE1L01	Professional Communicative EnglishLaboratory	0	0	3	1.5
7	BSC	20BC1L02	AppliedChemistryLaboratory	0	0	3	1.5
8	ESC	20CS1L01	Programming for ProblemSolvingusingCLaboratory	0	0	3	1.5
9	MC	20BE1T01	EnvironmentalScience	2	0	0	0
TotalCredits							**19.5**

IYearIISemester							
S.No	**Category**	**Course Code**	**CourseTitle**	**Hours perWeek**			**Credits**
				L	**T**	**P**	**C**
1	BSC	20BM2T02	Linear Algebra and PartialDifferentialEquations	3	0	0	3
2	BSC	20BP2T02	AppliedPhysics	3	0	0	3
3	ESC	20EC2T03	DigitalLogicDesign	3	0	0	3
4	ESC	20CS2T03	PythonProgramming	3	0	0	3
5	ESC	20IT2T01	DataStructures	3	0	0	3
6	BSC	20BP2L02	AppliedPhysicsLaboratory	0	0	3	1.5
7	ESC	20CS2L03	PythonProgrammingLaboratory	0	0	3	1.5

8	ESC	20IT2L02	DataStructuresLaboratory	0	0	3	1.5
9	MC	20HM2T05	ConstitutionofIndia	2	0	0	0
TotalCredits							**19.5**

IIYearISemester							
S.No	**Category**	**Course Code**	**CourseTitle**	**Hours perWeek**			**Credits**
				L	**T**	**P**	**C**
1	BSC	20BM3T03	Transformsand VectorCalculus	3	0	0	3
2	PCC	20CS3T04	Advanced DataStructuresthroughC	3	0	0	3
3	PCC	20CS3T06	DataSciencethroughPython	3	0	0	3
4	PCC	20IT3T02	DatabaseManagementSystems	3	0	0	3
5	PCC	20IT3T03	Mathematical Foundations of ComputerScience	3	0	0	3
6	PCC	20CS3L04	AdvancedDataStructuresthroughC Laboratory	0	0	3	1.5
7	PCC	20CS3L06	Data Science through Python Laboratory	0	0	3	1.5
8	PCC	20IT3L04	Database Management Systems Laboratory	0	0	3	1.5
9	SOC	20CS3S03	Mobile App Development through Android	0	0	4	2
10	MC	20HM3T06	Essence of Indian Traditional Knowledge	2	0	0	0
11	Project	20DS3P01	Community Service Project	0	0	0	4
TotalCredits							**25.5**

IIYearIISemester							
S.No	**Category**	**Course Code**	**CourseTitle**	**Hours perWeek**			**Credits**
				L	**T**	**P**	**C**
1	BSC	20BM4T05	Probabilityand Statistics	3	0	0	3
2	ESC	20EC4T12	ComputerOrganization	3	0	0	3
3	PCC	20CS4T07	DataMining	3	0	0	3
4	ESC	20CS4T10	JavaProgramming	3	0	0	3
5	HSC	20HM4T01	ManagerialEconomicsandFinancial Analysis	3	0	0	3
6	PCC	20CS4L10	RProgrammingLaboratory	0	0	3	1.5

7	PCC	20CS4L11	Data Mining using Python Laboratory	0	0	3	1.5
8	ESC	20CS4L12	JavaProgrammingLaboratory	0	0	3	1.5
9	SOC	20CS4S06	ApplicationsofMongoDB	0	0	4	2
TotalCredits							**21.5**
Internship2Months(Mandatory)duringsummervacation							

III Year– I Semester							
S.No.	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	PC	20IT5T05	Automata Theory &Compiler Design	3	-	-	3
2	PC	20IT5T04	Operating Systems	3	-	-	3
3	PC	20AM5T02	Machine Learning	3	-	-	3
4	Open Elective		**Open Elective-I**	3	-	-	3
		20CE5T01	Surveying				
		20EE5T13	Renewable Energy Engineering				
		20HM5T03	Entrepreneurship				
		20ME5T29	Optimization Techniques				
5	PE		**Professional Elective-I**	3	-	-	3
		20CS5T05	Software Engineering				
		20CS5T16	Object Oriented Analysis and Design				
		20IT5T07	DevOps				
		20AM5T05	Game Theory				
6	PC	20AI5L02	Operating Systems & Compiler Design Lab	-	-	3	1.5
7	PC	20AM5L02	Machine Learning using Python Lab	-	-	3	1.5
8	SO		**Skill Oriented Course - III**	1	-	2	0
		20IT5S05	Continuous Integration and Continuous Delivery using DevOps				
		20DS5S02	Helical Insight				
9	HSC	20HE5T02	Employability Skills-I	2	-	-	0
10	#PR	20DS5I01	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)	-	-	-	1.5
			Total Credits				**21.5**

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III Year – II Semester							
S.No.	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	PC	20CS6T08	Computer Networks	3	-	-	3
2	PC	20DS6T02	Big Data Analytics	3	-	-	3
3	PC	20CS6T09	Design and Analysis of Algorithms	3	-	-	3
4	PE		**Professional Elective-II**	3	-	-	3
		20AM6T04	Deep Learning				
		20CS6T12	Software Project Management				
		20DS6T03	Data Wrangling in Data Science				
		20DS6T04	ETL Principles				
5	Open Elective		**Open Elective-II**	3	-	-	3
		20CE6T35	Disaster Management				
		20ME6T25	Introduction to Automobile Engineering				
		20EC6T26	Sensors and transducers				
		20EE6T19	Fundamentals of Electric Vehicles				
6	PC	20CS6L09	Computer Networks Lab	-	-	3	1.5
7	PC	20DS6L02	Big Data Analytics Lab	-	-	3	1.5
8	PC	20AM6L04	Deep Learning with Tensorflow	-	-	3	1.5
9	SO		**Skill Oriented Course - IV**	1	-	2	2
		20HE6S01	Soft Skills and Inter Personal Communication				
10	MC	20HE6T03	Employability Skills-II	2	-	-	0
			Total Credits				**21.5**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation							

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IV Year – I Semester							
S.No.	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	PE		**Professional Elective-III**	3	-	-	3
		20AM7T06	Reinforcement Learning				
		20AI7T08	Nature Inspired Computing Techniques				
		20DS7T05	Social Media Analytics				
		20IT7T16	Block Chain Technologies				
2	PE		**Professional Elective-IV**	3	-	-	3
		20DS7T06	Snow Flake Cloud Analytics				
		20DS7T07	Mining Massive Datasets				
		20DS7T08	Information Retrieval Systems				
		20DS7T09	NOSQL Databases				
3	PE		**Professional Elective-V**	3	-	-	3
		20IT7T14	Social Network Analysis				
		20AM7T08	Recommender Systems				
		20AI7T07	AI Chatbots				
		20DS7T10	Data Visualization Techniques				
	Open Elective		**Open Elective-III**	2	-	2	3
		20CE7T11	Highway engineering				
		20EE7T29	Battery Management Systems and Charging Stations				
		20EC7T40	Industrial Electronics				
		20HM7T09	Organizational Behavior				
4	Open Elective		**Open Elective-IV**	2	-	2	3
		20CE7T13	Water resource engineering				
		20ME7T38	Sustainable Energy Technologies				
		20EC7T41	Biomedical Instrumentation				
		20HM7T04	Marketing Management				
6	HS	20HM7T	Universal Human Values 2: Understanding Harmony	3	-	-	3
7	SO		**Skill Oriented Course – V**	-	-	4	2
		20AM7S05	Machine Learning with Go (Infosys Spring Board)				
		20CS6S06	MEAN Stack Technologies- MongoDB, Express.js, Angular JS Node.js and AJAX				
8	#PR	20DS7I02	Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluated during VII semester	-	-	-	3
			Total Credits				**23**

IV Year– II Semester							
S.No.	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	#PR	20DS8P02	Major Project Work, Seminar Internship	-	-	-	8
			Total Credits				8

L= Lecture T=Tutorial P=Practical C=Credits

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Professional Communicative English
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Humanities and Social Sciences	**Course Code**	20HE1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Emphasizes that the ultimate aim of Education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment.	K2
CO2	Enables the learners to promote peaceful co-existence and universal harmony in society and empowers them to initiate innovation.	K2
CO3	Imparts the students to manage different cultural shock due to globalization and develop multiculturalism to appreciate diverse cultures and motivate them to contribute to their nation.	K3
CO4	Arouses the thought of life to lead in the right path by recognizing the importance of work besides enhancing their LSRW skills.	K2
CO5	Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-

CO 3	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-

COURSE CONTENT	
UNIT I	1. _The Greatest Resource- Education' from Professional Communicative English. Objective: Schumacher describes the education system by saying that it was mere training, something more than knowledge of facts. Outcome: Underscores that the ultimate aim of Education is to enhance wisdom. 2. 'War' from _Panorama: A Course on Reading' Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT II	1. ' A Dilemma' from Professional Communicative English Objective: The lesson centres on the pros and cons of the development of science and technology. Outcome: Enables the students to promote peaceful co-existence and universal harmony among people in society. 2. 'The Verger' from _Panorama: A Course on Reading' Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT III	1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English. Objective: Depicts of the symptoms of Cultural Shock and the aftermath consequences Outcome: Enables the students to manage different cultural shocks due to globalization. 2. 'The Scarecrow' from Panorama: A Course on Reading Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills

UNIT IV	1. _The Secret of Work‘ from Professional Communicative English. Objective: Portrays the ways of living life in its real sense. Outcome: Arouses the thoughtto lead life in a right path by recognizing the importance of work. 2. 'A Village Lost to the Nation' from Panorama: A Course on Reading Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT V	1. *' The Chief Software Architect' from Professional Communicative English.* Objective: Supports the developments of technology for the betterment of human life. Outcome: Pupil gets inspired by eminent personalities who toiled for the present-day advancement of software development. 2. *'Martin Luther King and Africa' from Panorama: A Course on Reading* Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills

TEXT BOOKS	
1.	**DETAILED TEXTBOOK:** • **PROFESSIONAL COMMUNICATIVE ENGLISH** *Published by Maruthi Publishers.*
2.	**NON-DETAILED TEXTBOOK:** • ***PANORAMA: A COURSE ON READING****, Published by Oxford University Press India* The course content, along with the study material, is divided into six units.

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Computer Science and Engineering
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Differential Equations and Numerical Methods
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BM1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Solve first order differential equations and its applications	K3
CO2	Solve the linear differential equations with constant coefficients by appropriate method	K3
CO3	Apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data.	K3
CO4	Find the approximate roots of transcendental equations by using different numerical methods	K2
CO5	Solve initial value problems by using different numerical schemes	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Differential equations of first order and first degree** Linear – Bernoulli – Exact – Reducible to exact. **Applications:** Newton‘s Law of cooling – Law of natural growth and decay – Orthogonal trajectories.
UNIT II	**Linear differential equations of higher order** Non-homogeneous equations of higher order with constant coefficients with non-homogeneous form e^{ax}, $\sin ax$, $\cos ax$ polynomials in $x^n, e^{ax}V(x), x^mV(x)$ - Method of Variation of parameters.
UNIT III	**Interpolation** Introduction– Errors in polynomial interpolation – Finite differences – Forward differences– Backward differences –Central differences –properties – Differences of a polynomial- Newton‘s formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals: Lagrange‘s interpolation formula.
UNIT IV	**Solution of Algebraic and Transcendental Equations** Introduction- Bisection method – Method of false position – Iteration method – Newton-Raphson method (One variable).
UNIT V	**Solution of Ordinary Differential equations** Solution of ordinary differential equations by Taylor‘s series-Picard‘s method of successive approximations-Euler‘s method – Modified Euler‘s method - Runge-Kutta method (second and fourth order).

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
WEB RESOURCES	
1.	**UNIT I: Differential equations of first order and first degree** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://www.khanacademy.org/math/differential-equations/first-order-differential-equations
2.	**UNIT II: Linear differential equations of higher order** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://nptel.ac.in/courses/122107037/20
3.	**UNIT III: Interpolation** https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation
4.	**UNIT IV: Solution of Algebraic and Transcendental Equations** https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations
5.	**UNIT V: Solution of Ordinary Differential Equations** https://nptel.ac.in/courses/111107063/ https://www.facweb.iitkgp.ac.in/~rajas/cgen/page/nptlcrs

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Computer Science and Engineering
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Applied Chemistry
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BC1T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Intermediate Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about Electrochemical cells, Batteries and Fuel cells
2	To learn about non conventional energy sources
3	To study about Nano materials, Super conductors and their preparation, applications and also about principles of green chemistry and green engineering applications
4	To know about Polymers, Plastics and Elastomers
5	To Understand the principles of different analytical instruments and their applications

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	To compare different types of batteries and explain the merits of fuel cell.	K2
CO2	List out different renewable sources of energy.	K3
CO3	To explain the Green methods of Synthesis and applications of Green technologies and also Band theory applications.	K3
CO4	Analyze the importance of Polymers in engineering applications.	K2
CO5	To Distinguish between Rotaxane and Catenane molecular machines	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	3	1	2	2	2	-	2	-	-	-	2	-	1	-	**1**
CO 2	2	2	1	-	-	1	1	-	-	-	1	-	-	-	-
CO 3	1	1	-	1	2	-	-	-	-	-	-	1	-	**1**	-
CO 4	2	2	-	1	-	-	1	-	-	-	-	1	-	-	-
CO 5	**1**	1	1	-	-	-	1	-	-	-	2	1	1	-	-

COURSE CONTENT	
UNIT I	**ELECTROCHEMICAL ENERGY SYSTEMS** Electrode Potential, Nernst Equation, EMF of the cell, Types of Electrodes - Hydrogen and Calomel Electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, ***Concentration Cells***, Types of Ion Selective Electrodes- Glass Membrane Electro **Batteries**- Characteristics, Classification and Important Applications. Classical batteries- Dry/Lechlanche cell, Modern batteries- Zinc air, Lithium cells : Li -MnO_2 cell. **Fuel cells**- Introduction, H_2-O_2 fuel cell, Advantages of fuel cells.
UNIT II	**ENERGY SOURCES AND APPLICATIONS** Introduction- Sources of renewable energy **Solar energy** – Introduction- Photo voltaic cell/ Solar cell – Construction and Working, Applications of Solar energy. Photo Galvanic Cells, Electrochemical Sensors. **Non Conventional Energy Sources:** Hydropower, Geo Thermal Power, Tidal Power, Ocean Thermal Energy Conversion (OTEC).
UNIT III	**MATERIAL SCIENCE AND ENGINEERING** **III-A: Nanomaterials:** Introduction , Preparation of Carbon Nano Tubes(CNTs) by Arc discharge and Chemical Vapor Deposition Methods. Fullerenes : Preparation, Properties and Applications; Chemical Synthesis of Nanomaterials : Sol-gel method, Applications of Nano Materials in Wastewater treatment and Medicine. **III-B: Green Chemistry:** Introduction, Principles of Green Chemistry and Engineering Applications with a ***case study*** **Band Theory of Solids:** Introduction –Explanation of Conductors, Semiconductors and

	Insulators by Band Theory. Super conductors: Types-Preparation, Properties and Applications**.**
UNIT IV	**POLYMER CHEMISTRY** **Polymers**: Introduction, Functionality of monomers, Chain (Addition) Polymerization, Step(Condensation) Polymerization, Co-Ordination Polymerization, Co - Polymerization with examples and Mechanism. Conducting polymers : Mechanism of Conduction in Poly acetylene, Poly aniline and their Applications. **Plastics**: Thermoplastics and Thermo Setting resins; Preparation, Properties and Applications of Bakelite, Urea- formaldehyde Resin, Nylon – 6,6. **Elastomers**: ***Vulcanization of rubber***, Preparation, Properties and Applications of Buna-S and Buna – N.
UNIT V	**Instrumental Methods & Molecular Machines and Switches** A) Spectroscopic Techniques: Electromagnetic Spectrum- Introduction, Absorption of radiation: Beer-Lambert's law. Principles of UV-Visible and IR Spectroscopic techniques and their Applications. B) Molecular Machines: Rotaxanes and Catenanes as artificial Molecular Machines. Molecular Switches: Introduction, Cyclodextrin based Switches.

TEXT BOOKS	
1.	P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2.	Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition .
REFERENCE BOOKS	
1.	Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2.	S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010)
3.	N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014)
WEB RESOURCES	
1.	**Electrochemical Energy systems** https://en.wikipedia.org/wiki/Electrochemical_cell
2.	**Energy Sources and Applications** *https://en.wikipedia.org/wiki/Hydropower*
3.	**Material Science and Engineering** https://en.wikipedia.org/wiki/Nanomaterials

4.	**Polymer Chemistry** https://en.wikipedia.org/wiki/Polymer_chemistry
5.	**Instrumental Methods & Molecular Machines and Switches** https://en.wikipedia.org/wiki/Spectroscopy

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Computer Science and Engineering
(Data Science)

Programming for Problem solving using C

(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT)

Course Category	Engineering Sciences	**Course Code**	20CS1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2	To gain knowledge of the operators, selection, control statements and repetition in C
3	To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage.
4	To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5	To assimilate about File I/O and significance of functions

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply the fundamentals of C Programming for Problem solving.	K3
CO2	Identify the appropriate Decision statement and Loops for a given Problem.	K2
CO3	Make use of Arrays and Strings to solve the problems in C.	K3
CO4	design and implement programs to analyze the different pointer applications	K3
CO5	Develop solutions for problems using Files and Functions.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	3	3	3	3	1	-	-	-	-	-	-	-	1	1	-
CO 2	3	3	3	3	1	-	-	-	-	-	-	-	1	1	-
CO 3	3	3	3	2	1	-	-	-	-	-	-	-	2	1	-
CO 4	2	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO 5	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-

COURSE CONTENT	
UNIT I	**Introduction to Computers**: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers **Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers. **Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.
UNIT II	**Bitwise Operators**: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators. **Selection & Making Decisions**: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions. **Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.
UNIT III	**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.
UNIT IV	**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application. Processor Commands: Processor Commands.
UNIT V	**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

	Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS	
1.	Programming for Problem Solving, Beerhouse A. Forouzan, Richard F.Gilberg, CENGAGE.
2.	The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.
REFERENCE BOOKS	
1.	Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2.	Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3.	Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD.
WEB RESOURCES	
1.	http://nptel.ac.in/courses/106104128/
2.	http://students.iitk.ac.in/programmingclub/course/#notes
3.	http://c-faq.com/~scs/cclass/cclass.html
4.	http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Computer Engineering Workshop
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	**Course Code**	20IT1L01
Course Type	Laboratory	**L-T-P-C**	1-0-4-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	PC Hardware: Identification of basic peripherals, Assembling a PC, Installation of system software like MS Windows, device drivers, etc. Troubleshooting of PC Hardware and Software issues.
2	Internet & World Wide Web: Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums. Awareness of cyber hygiene (protecting the personal computer from getting infected with the viruses), worms and other cyber attacks.
3	Productivity Tools: Understanding and practical approach of professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite office tools.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**BTL**
CO1	Identify, assemble and update the components of a computer	K2
CO2	Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems	K3
CO3	Make use of tools for converting pdf to word and vice versa	K2
CO4	Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTex	K3

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO3	2	2	2	1	2	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	-	1	2	2

COURSE CONTENT	
Task 1	Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.
Task 2	Practicing disassembling and assembling components of a PC
Task 3	Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual boating with Windows and Linux
Task 4	Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders.
Task 5	Demonstration of Hardware and Software Troubleshooting
Task 6	Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC, Bluetooth Technology, Wireless Technology, Modem, DSL, and Dialup Connection.
Task 7	Surfing the Web using Web Browsers, Awareness of various threats on the Internet and its solutions, Search engines and usage of various search engines, Need of anti-virus, Installation of anti-virus, configuring personal firewall and windows update. (Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers)
Productivity Tools	
Task 8	Basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3 and its properties. Preparation of a simple website/ homepage, Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list. Features to be covered:- Layouts, Inserting text objects, Editing text objects, Inserting Tables, Working with menu objects, Inserting pages, Hyper linking, Renaming, deleting, modifying pages,

	etc.,
Task 9	Demonstration and Practice of various features of Microsoft Word Assignment: 1. Create a project certificate. 2. Creating a news letter Features to be covered:-Formatting Fonts, Paragraphs, Text effects, Spacing, Borders and Colors, Header and Footer, Date and Time option, tables, Images, Bullets and Numbering, Table of Content, Newspaper columns, Drawing toolbar and Word Art and Mail Merge in word etc.,
Task 10	Demonstration and Practice of various features Microsoft Excel Assignment: 1. Creating a scheduler 2. Calculating GPA 3. Calculating Total, average of marks in various subjects and ranks of students based on marks Features to be covered:- Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel, Charts, Renaming and Inserting worksheets, etc.,
Task 11	Demonstration and Practice of various features Microsoft Power Point Features to be covered:- Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks Tables and Charts, Master Layouts, Types of views, Inserting – Background, textures, Design Templates, etc.,
Task 12	Demonstration and Practice of various features LaTeX – document preparation, presentation (Features covered in Task 9 and Task 11 need to be explored in LaTex)
Task 13	Tools for converting word to pdf and pdf to word
Task 14	Internet of Things (IoT): IoT fundamentals, applications, protocols, communication models, architecture, IoT devices

Note: Faculty to consolidate the workshop manuals using the textbook and references

REFERENCE BOOKS	
1	Computer Fundamentals, Anita Goel, Pearson India Education, 2017
2	PC Hardware Trouble Shooting Made Easy, TMH
3	Introduction to Information Technology, ITL Education Solutions Limited, 2nd Edition, Perason, 2020
4	Upgrading and Repairing PCs, 18th Edition, Scott Mueller, QUE, Pearson, 2008
5	LaTeX Companion – Leslie Lamport, PHI/Pearson
6	Introducing HTML5, Bruce Lawson, Remy Sharp, 2nd Edition, Pearson, 2012
7	Teach yourself HTML in 24 hours, By Techmedia
8	HTML 5 and CSS 3.0 to the Real World by Alexis Goldstein, Sitepoint publication

9	Internet of Things, Technologies, Applications, Challenges and Solutions, B K Tripathy, J Anuradha, CRC Press
10	Comdex Information Technology Course Tool Kit, Vikas Gupta, Wiley Dreamtech
11	IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme, CISCO Press, Pearson Education
12	Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu, S. Chand Publishers

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Professional Communicative English Laboratory
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Humanities and Social Sciences	**Course Code**	20HE1L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Understand different speech sounds and maintain proper pronunciation and rhythm in day to day conversations.	K2
CO2	Interpret and respond appropriately in various day to day contexts and improves technics in group discussions.	K5
CO3	Develop the required communication skills to deliver effective presentations and interviews with clarity and impact.	K6

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

COURSE CONTENT	
UNIT I	Introduction, Consonant Sounds, Vowel Sounds
UNIT II	Rhythm and Pronunciation , Weak/strong and contrasted forms, Practice of Rhythm
UNIT III	Dialogues
UNIT IV	Group Discussions
UNIT V	Presentations & Public Speaking
UNIT VI	Interviews

PRESCRIBED LAB MANUAL FOR SEMESTER I:
_**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills' Published by Maruthi Publications.
OBJECTIVES: To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content, along with the study material, is divided into six units.

PRAGATI ENGINEERING COLLEGE
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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Applied Chemistry Laboratory
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BC1L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Basic Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of polymers and nano particles	K3
CO2	Determine the concentration of different metal ions present in water by complexometric titrations.	K2
CO3	Evaluate the accurate value of P^H and conductivity of given solutions and to estimate the viscosity and surface tension of given solutions.	K5

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
Any 10 of the following listed 13 experiments	
Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis	
1.	Estimation of HCI using standard Na_2CO_3 solutions
2.	Determination of alkalinity of a sample containing Na_2CO_3 and NaOH
3.	Estimation of $KmnO_4$ using standard Oxalic acid solution
4.	Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
5.	Determination of Temporary and permanent Hardness of water using standard EDTA solution
6.	Determination of % moisture content in a coal sample
7.	Determination of Mg^{2+} present in an antacid
8.	Estimation of HCl using standard NaOH Solution by Conductometric titration
9.	Estimation of Vitamin – C
10.	Preparation of Phenol – Formaldehyde Resin
11.	Determination of viscosity of a liquid
12.	Determination of surface tension of a liquid
13.	Preparation of Nano particles.(Cu/Zn)

TEXT BOOKS	
1.	Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel‘s Quantitative Chemical Analysis 6/e, Pearson publishers (2000)
2.	N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007)
REFERENCE BOOKS	
1.	Vogel‘s Textbook of Quantitative chemical analysis, J. Mendham et.al.
2.	College designed manual
WEB RESOURCES	

1.	www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness
2.	https://pubs.acs.org/doi/abs/10.1021/i560133a023

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Programming for Problem solving using C Laboratory
(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT)

Course Category	Engineering Science	**Course Code**	20CS1L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Apply the principles of C language in problem solving.
2	To design flowcharts, algorithms and knowing how to debug programs.
3	To design & develop of C programs using arrays, strings pointers & functions.
4	To review the file operations, preprocessor commands.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Knowledge on various concepts of a C language.	K3
CO2	Draw flowcharts and write algorithms.	K3
CO3	Design and development of C problem solving skills.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO2	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-

COURSE CONTENT	
1.	**Exercise 1:** 1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters. 2. Write a C program to compute the perimeter and area of a rectangle with a

	height of 7 inches and width of 5 inches. 3. Write a C program to display multiple variables.
2.	**Exercise 2:** 1. Write a C program to calculate the distance between the two points. 2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".
3.	**Exercise 3:** 1. Write a C program to convert a string to a long integer. 2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape. 3. Write a C program to calculate the factorial of a given number.
4.	**Exercise 4:** 1. Write a program in C to display the n terms of even natural number and their sum. 2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms. 3. Write a C program to check whether a given number is an Armstrong number or not.
5.	**Exercise 5:** 1. Write a program in C to print all unique elements in an array. 2. Write a program in C to separate odd and even integers in separate arrays. 3. Write a program in C to sort elements of array in ascending order.
6.	**Exercise 6:** 1. Write a program in C for multiplication of two square Matrices. 2. Write a program in C to find transpose of a given matrix.
7.	**Exercise 7:** 1. Write a program in C to search an element in a row wise and column wise sorted matrix. 2. Write a program in C to print individual characters of string in reverse order.
8.	**Exercise 8:** 1. Write a program in C to compare two strings without using string library functions. 2. Write a program in C to copy one string to another string.
9.	**Exercise 9:** 1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation 2. Write a program in C to demonstrate how to handle the pointers in the program.
10.	**Exercise 10:** 1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator. 2.Write a program in C to add two numbers using pointers
11.	**Exercise 11:** 1. Write a program in C to add numbers using call by reference. 2. Write a program in C to find the largest element using Dynamic Memory

	Allocation.
12.	**Exercise 12:** 1. Write a program in C to swap elements using call by reference. 2. Write a program in C to count the number of vowels and consonants in a string using a pointer.
13.	**Exercise 13:** 1. Write a program in C to show how a function returning pointer. 2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.
14.	**Exercise 14:** 1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs 2. Write a program in C to convert decimal number to binary number using the function.
15.	**Exercise 15:** 1. Write a program in C to check whether a number is a prime number or not using the function. 2. Write a program in C to get the largest element of an array using the function.
16.	**Exercise 16:** 1. Write a program in C to append multiple lines at the end of a text file. 2. Write a program in C to copy a file in another name. 3. Write a program in C to remove a file from the disk.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Environmental Science
Common to CE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Mandatory Course	**Course Code**	20BE1T01
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites	Basic Knowledge in Environment and protection.	**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

COURSE OBJECTIVES	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.	K2
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities	K2
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century	K2
CO4	Recognize the interconnectedness of human dependence on the earth‘s ecosystems	K2
CO5	Influence their society in proper utilization of goods and services.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	1	-	1	-	-	1	2	-	-	-	1	-	-	-	-
CO 2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	1	1	3	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	3	1	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Multidisciplinary nature of Environmental Studies** Definition, Scope and Importance-International Efforts & Indian Environmentalists **Natural Resources** Forest resources : deforestation – Mining, dams and other effects on forest and tribal people. Water resources :Use and over utilization of surface and groundwater. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems. Energy resources: renewable and nonrenewable energy sources. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.
UNIT II	**Ecosystems, Biodiversity and its conservation** Definition of Ecosystem and its structure, Functions Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity, Endangered and endemic species of India.
UNIT III	**Environmental Pollution and Solid Waste Management** Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution. Solid Waste Management: Sources, effects and control measures of urban and industrial waste, e-waste management
UNIT IV	**Social Issues and the Environment** Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act-Issues involved in enforcement of environmental legislation, Rain water harvesting,

	Global Environmental challenges-case studies
UNIT V	**Human population and the Environment** Population growth, Women and child welfare, Role of Information technology in environment and human health. Impact Assessment and its significances, stages of EIA Field work: A mini project related to Environmental issues / to visit a local polluted site (Submission of project by every student)

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4.	Environmental Studies by PiyushMalaviya, Pratibha Singh, Anoopsingh: Acme Learning, New Delhi.
5.	An Introduction to Environmental Pollution by Dr.B.k.Sharma AND Dr.(Miss)H.kaur,Goel publishing House ,a unit of Krishna Prakasham Media (p) LH,Meerut –India
WEB RESOURCES	
1.	**UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES** http://www.defra.gov.uk/environment/climatechange https://www.climatesolutions.org https://en.wikibooks.org/wiki/Ecology/Ecosystems
2.	**UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION** http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	**UNIT-3: ENVIRONMENTAL POLLUTION** https://www.omicsonline.org/environment-pollution-climate-change.php and https://www.britannica.com/technology/solid-waste-management

4.	**UNIT-4: SOCIAL ISSUES AND THE ENVIRONMENT** http://www.publichealthnotes.com/solid-waste-management/
5.	**UNIT-5: HUMANPOPULATION AND THE NVIRONMENT**http://www.ecoindia.com/education/water-conservation.html https://thewaterproject.org/water_conservation\ https://legalcareerpath.com/what-is-environmental-law/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Linear Algebra and Partial Differential Equations
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BM2T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Matrices, Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix.	K3
CO2	Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	K2
CO3	Find areas and volumes using double and triple integrals	K2
CO4	Find partial derivatives of multivariable functions and apply them to find extreme values of a function.	K3
CO5	Apply a range of techniques to find solutions of standard PDEs	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Solving system of linear equations, Eigen Values and Eigen vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method, Gauss Jacobi and Gauss Seidel for solving system of equations – Eigenvalues and Eigen vectors and their properties.
UNIT II	**Cayley-Hamilton Theorem and Quadratic forms** Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Quadratic forms-Reduction to canonical form by congruent transformations- nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation.
UNIT III	**Multiple integrals** Multiple integrals: Double and triple integrals – Change of variables -Polar coordinates - Cylindrical coordinates– Change of order of integration. **Applications:** Finding Areas and Volumes.
UNIT IV	**Partial differentiation** Introduction – Homogeneous function – Euler‘s theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor‘s and Maclaurin‘s series expansion of functions of two variables – Jacobian – Functional dependence. **Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange‘s method (with constraints).

UNIT V	**Partial Differential Equations and Applications** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. **Applications:** One dimensional wave and heat equations.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**T. Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications
WEB RESOURCES	
1.	**UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors** https://en.wikipedia.org/wiki/System_of_linear_equations https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
2.	**UNIT II: Cayley-Hamilton Theorem and Quadratic forms** https://www.math.hmc.edu/calculus/tutorials/eigenstuff/ https://en.wikipedia.org/wiki/Quadratic_form
3.	**UNIT III: Multiple Integrals** https://en.wikipedia.org/wiki/Multiple_integral http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
4.	**UNIT IV: Partial Differentiation** https://en.wikipedia.org/wiki/Partial_derivative https://www.whitman.edu/mathematics/calculus_online/section14.03.html
5.	**UNIT V:Partial Differential Equations and Applications** https://en.wikipedia.org/wiki/Partial_differential_equation

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Applied Physics
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BP2T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2	Impart the knowledge of Lasers, Optical Fibers and their implications in optical communications.
3	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in emerging micro devices.
4	To explain the concepts of Quantum Mechanics and free electron theories for study of metals and semiconductors.
5	Understand the formation of bands in Semiconductors and their working mechanism for their utility in Engineering applications

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the optical applications using the concepts of Interference and diffraction.	K4
CO2	Apply the basics of Laser Mechanism and fiber optics for the communications systems.	K3
CO3	Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response.	K3
CO4	Understand the concepts of quantum mechanics for calculation of free quantum particle energies and phenomenon of electrical & thermal conductivities to sub microscopic particles.	K2
CO5	Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	-	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	2	-	-	-

COURSE CONTENT	
UNIT I	**WAVEOPTICS** **INTERFERENCE** Introduction-Principle of Superposition – Coherent Sources – Interference in parallel thin film(reflection geometry)- Newton‘s rings, Determination of Wavelength and Refractive Index & Applications. **DIFFRACTION** Introduction-Types of diffraction-Fraunhoffer diffraction due to single slit, Double slit, N Slits (Qualitative)-Rayleigh criterion of resolution and Resolving power of grating (Qualitative).
UNIT II	**LASERS** Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Schemes - Ruby laser – Helium Neon laser – Applications **FIBER OPTICS:** Introduction- Structure & Principle of Optical Fiber-Numerical Aperture and Acceptance Angle-classification of Optical fibers based on Refractive Index Profile and Modes- Block Diagram of optical fiber communication system- Advantages of Optical fibers- Applications.
UNIT III	**MAGNETICS PROPERTIES** Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials Dia,Para,Ferro,Antiiferro and Ferri Magnetic materials-Weiss Domain Theory(Qualitative Treatment)-Hysteresis-B-H Curve-soft and hard magnetic materials & applications **DIELECTRICS** Introduction - Dielectric polarization– Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations- Electronic Ionic and Orientation polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics.

UNIT IV	**QUANTUM MECHANICS** Introduction – Matter waves – de Broglie's hypothesis–Interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box **FREE ELECTRON THEORY** Classical Free Electron Theory(Qualitative with discussions of merit and demerits)-Quantum Free Electron Theory-Equation of conductivity based on quantum free electron theory-Fermi Dirac Distribution-Density of States-Fermi Energy
UNIT V	**BANDTHEORYOFSOLIDS** Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron-Classification of Crystalline Solids-Concept of hole **SEMICONDUCTOR PHYSICS** Introduction–Intrinsic Semi conductors - density of charge carriers- Electrical conductivity – Fermi level – extrinsic semiconductors - p-type & n-type - Density of charge carriers-Drift and Diffusion currents-Einstein's Equation -Hall effect - Applications of Hall effect

TEXT BOOKS	
1.	Engineering Physics by M.N.Avadhanalu,P.G.Kshirsagar & T V S Arun Murty,S Chand Pubication,11th Edition 2019
2.	–Engineering Physics‖ by M.R.Srinivasan, New Age international publishers
3.	Engineering Physics by P.K Palanisamy,Sci Tech Publication
REFERENCE BOOKS	
1.	Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition
2.	Solid State Physics ,AJ Dekker, I Edition,Macmillan Publishers India Private Limited
3.	–Solid State Physics‖ by SO Pilai., - New age International Publishers
4.	Engineering Physics by DK Bhattacharya and Poonam Tandon,Oxford Press(2018)
WEB RESOURCES	
1.	https://nptel.ac.in/courses/122/107/122107035/# https://nptel.ac.in/courses/122/107/122107035/#
2.	https://pragatiengg.org/pluginfile.php/29143/mod_folder/content/0/UNIT%20IV%20LASERS%20.pptx?forcedownload=1

	https://nptel.ac.in/courses/104/104/104104085/ https://nptel.ac.in/courses/115/107/115107095/
3.	https://nptel.ac.in/courses/113/104/113104090/ https://youtu.be/DDLljK1ODeg
4.	https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html https://nptel.ac.in/courses/115/101/115101107/ https://nptel.ac.in/courses/115/105/115105122/
5.	https://www.electronics-tutorials.ws/diode/diode_1.html https://nptel.ac.in/courses/115/105/115105099/ https://nptel.ac.in/courses/108/108/108108122/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Digital Logic Design
Common to CSE (AI&ML), CSE(AI), CSE(DS)

Course Category	Engineering Sciences	**Course Code**	20EC2T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, theory of Boolean algebra and map method for minimization of switching functions.
2	To introduce the basic tools for design of combinational and sequential digital logic.
3	To learn simple digital circuits in preparation for computer engineering.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Define different number systems, binary addition and subtraction, 2‘s complement representation and operations with this representation.	K1
CO2	Understand the different switching algebra theorems and apply them for logic functions and Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.	K2
CO3	Design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays.	K4
CO4	Design various sequential circuits starting from flip-flop and conversion of flipflops.	K4
CO5	Design registers, shift registers, synchronous counters and ring counters.	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	2	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 3	1	2	2	-	-	-	-	-	-	1	-	-	-	2	-
CO 4	2	1	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 5	2	2	3	-	-	-	-	-	-	1	-	-	-	1	-

COURSE CONTENT	
UNIT I	Digital Systems and Binary NumbersDigital Systems, Binary Numbers, Octal and Hexadecimal Numbers, Complements of Numbers,Signed Binary Numbers, Arithmetic addition and subtraction, 4-bit codes: BCD, EXCESS 3,alphanumeric codes, 9‘s complement, 2421, etc.
UNIT II	Concept of Boolean algebra: Basic Theorems and Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Minterms and Maxterms. Gate level Minimization Map Method, Three-Variable K-Map, Four Variable K-Maps. Products of Sum Simplification, Sum of Products Simplification, Don‘t – Care Conditions, NAND and NOR Implementation, Exclusive OR Function.
UNIT III	Combinational Logic: Introduction, Analysis Procedure, Binary Adder–Subtractor, Binary Multiplier, Decoders,Encoders, Multiplexers, Demultiplexers, Priority Encoder, Code Converters, MagnitudeComparator, HDL Models of Combinational Circuits. Realization of Switching Functions Using PROM, PAL and PLA.
UNIT IV	Synchronous Sequential Logic Introduction to Sequential Circuits, Storage Elements: Latches, Flip-Flops, RS- Latch Using NAND and NOR Gates, Truth Tables. RS, JK, T and D Flip Flops, Truth and Excitation Tables, Conversion of Flip Flops.
UNIT V	Registers and Counters Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter.

TEXT BOOKS	
1.	Digital Design, 5/e, M.Morris Mano, Michael D Ciletti, PEA.
2.	Fundamentals of Logic Design, 5/e, Roth, Cengage
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M.Morris Mano, PEA.
2.	Digital Logic Design, Leach, Malvino, Saha, TMH.
3.	Modern Digital Electronics, R.P. Jain, TMH.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Python Programming
Common to CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	**Course Code**	20CS2T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about Python programming language syntax, semantics, and the runtime environment.
2	To be familiarized with universal computer programming concepts like data types, containers.
3	To be familiarized with general computer programming concepts like conditional execution, loops & functions.
4	To be familiarized with general coding techniques and object-oriented programming

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Develop essential programming skills in computer programming concepts like data types, containers.	K3
CO2	Apply the basics of programming in the Python language.	K3
CO3	Solve coding tasks related conditional execution, loops.	K3
CO4	Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming.	K3
CO5	Make use of Exceptions and GUI interfaces for developing applications	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2

COURSE CONTENT	
UNIT I	Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.
UNIT II	Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement, Conditional Iteration The While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.
UNIT III	List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function**:** Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program‘s Namespace, Higher Order Function. Modules: Modules, Standard Modules, Packages.
UNIT IV	File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations Object Oriented Programming**:** Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support

	Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism.
UNIT V	Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming**:** Introduction to Programming Concepts with Scratch.

TEXT BOOKS	
1.	Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2.	Python Programming: A Modern Approach, VamsiKurama, Pearson.
REFERENCE BOOKS	
1.	Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2.	Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
WEB RESOURCES	
1.	https://www.tutorialspoint.com/python3/python_tutorial.pdf

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Structures
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Engineering Sciences	**Course Code**	20IT2T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce the fundamental concept of data structures and abstract data types
2	Emphasize the importance of data structures in developing and implementing efficient algorithms
3	Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Summarize the properties, interfaces, and behaviors of basic abstract data types	K2
CO2	Discuss the computational efficiency of the principal algorithms for sorting & searching	K2
CO3	Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs	K3
CO4	Demonstrate different methods for traversing trees	K2
CO5	Implement algorithms on Graphs	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO 2	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 3	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO 4	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 5	3	3	1	1	1	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT I	**Data Structures** - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. Searching - Linear search, Binary search, Fibonacci search. **Sorting**- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.
UNIT II	**Linked List:** Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.
UNIT III	**Queues:** Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues-Circular Queues, Deques, Priority Queues, Multiple Queues. **Stacks:** Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.
UNIT IV	**Trees:** Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion and Rotations.
UNIT V	**Graphs:** Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra‘s shortest path, Transitive closure, Warshall‘s Algorithm.

TEXT BOOKS	
1.	Data Structures Using C. 2nd Edition.Reema Thareja, Oxford.
2.	Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.
REFERENCE BOOKS	
1.	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
2.	Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.
3.	Data Structures with C, Seymour Lipschutz TMH
WEB RESOURCES	
1.	http://algs4.cs.princeton.edu/home/
2.	https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Applied Physics Laboratory
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	**Course Code**	20BP2L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	The student will have exposure to experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental results and correlate with the theoretical principles.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	K2
CO2	Determine the Magnetic and Dielectric constants of materials.	K3
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT **(Any 10 of the following listed 15 experiments):** **8 Regular mode and any two experiments in Virtual mode(Virtual Lab)**	
1.	Determination of wavelength of laser Light using diffraction grating.
2.	Determination of wavelength of a light using Diffraction Grating-Normal incidence.
3.	Newton‘s rings – Determination of Radius of Curvature of Plano - Convex Lens.
4.	Determination of thickness of a spacer using wedge film and parallel interference fringes.
5.	Magnetic field along the axis of a current carrying coil – Stewart and Gee‘s apparatus.
6.	Energy Band gap of a Semiconductor p - n junction.
7.	Characteristics of Thermistor – Temperature Coefficients
8.	Determination of dielectric constant by charging and discharging method
9.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10.	Determination of Dispersive power of diffraction grating.
11.	To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode
12.	Determination of Hall Voltage and Hall coefficients of a given semiconductor using Hall effect.
13.	Determination of Acceleration due to gravity and Radius of gyration Using Compound Pendulum.

14.	Determination of Numerical Aperture and acceptance angle of an Optical Fiber
15.	Estimation of Planck‘s Constant using Photoelectric Effect.
TEXT BOOKS	
1.	College customized manual
WEB RESOURCES	
1.	www.vlab.co.in (virtual lab link)

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Python Programming Laboratory
Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Engineering Sciences	**Course Code**	20CS2L03
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To acquire programming skills in core Python and to acquire Object Oriented Skills in Python
2	To develop the skill of designing Graphical user Interfaces in Python
3	To develop the ability to write database applications in Python

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Write, Test and Debug Python Programs and Use Conditionals and Loops for Python Programs	K4
CO2	Use functions and represent Compound data using Lists, Tuples and Dictionaries	K3
CO3	Use various applications using python	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2
CO3	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2

COURSE CONTENT

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user‘s name the specified number of times.
5) Use a *for*loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

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

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde*and*ABCDE* the program should print out *AaBbCcDdEe*.
10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
11) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and

then inserts multiplication symbols where appropriate.

12) Write a program that generates a list of 20 random numbers between 1 and 100.
(a) Print the list.
(b) Print the average of the elements in the list.
(c) Print the largest and smallest values in the list.
(d) Print the second largest and second smallest entries in the list
(e) Print how many even numbers are in the list.

13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.

14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.

15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].

16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements,it is much shorter with lists and it is also easier to add new conversions if you use lists.

17) Write a function called *sum_digits*that is given an integer num and returns the sum of the digits of num.

18) Write a function called *first_diff*that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.

19) Write a function called *number_of_factors*that takes an integer and returns how many factors the number has.

20) Write a function called *is_sorted*that is given a list and returns True if the list is sorted and False otherwise.

21) Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.

22) Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.

23) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
(a) Do this using the sort method. (b) Do this without using the sort method.

24) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can‘t exceed the number of occurrences of the letter in the user‘s

word.

25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
26) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

27) Write a class called Product. The class should have fields called name, amount, and price, holding the product‘s name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price*that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase*that receives the number of items to be bought and decreases amount by that much.
28) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes*that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours*that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.
30) Write a Python class to implement pow(x, n).
31) Write a Python class to reverse a string word by word.
32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.
33) Write a program to demonstrate Try/except/else.
34) Write a program to demonstrate try/finally and with/as.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Structures Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	**Course Code**	20IT2L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Demonstrate the different data structures implementation.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Use basic data structures such as arrays and linked list.	K3
CO2	Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.	K2
CO3	Use various searching and sorting algorithms.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO2	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO3	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

COURSE CONTENT	
Exercise -1 (Searching)	a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list. b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.
Exercise -2 (Sorting-I)	a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order b) Write C program that implement Quick sort, to sort a given list of integers in ascending order c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order
Exercise -3 (Sorting-II)	a) Write C program that implement radix sort, to sort a given list of integers in ascending order b) Write C program that implement merge sort, to sort a given list of integers in ascending order
Exercise -4 (Singly Linked List)	a) Write a C program that uses functions to create a singly linked list b) Write a C program that uses functions to perform insertion operation on a singly linked list c) Write a C program that uses functions to perform deletion operation on a singly linked list d) Write a C program to reverse elements of a single linked list.
Exercise -5 (Queue)	a) Write C program that implement Queue (its operations) using arrays. b) Write C program that implement Queue (its operations) using linked lists
Exercise -6 (Stack)	a) Write C program that implement stack (its operations) using arrays b) Write C program that implement stack (its operations) using Linked list c) Write a C program that uses Stack operations to evaluate postfix expression
Exercise -7 (Binary Tree)	Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.
Exercise -8 (Binary Search Tree)	a) Write a C program to Create a BST b) Write a C program to insert a node into a BST. c) Write a C program to delete a node from a BST.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Constitution of India
Common to CE, EEE, MECH, ECE, CSE, CSE (DS), CSE (AI&ML), CSE(AI), IT

Course Category	Mandatory Course	**Course Code**	20HM2T05
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the evolution of Constitution of India	K2
CO2	Make use of one‘s Fundamental rights.	K3
CO3	Understand the functioning of the Union Government	K2
CO4	Understand the functioning of the State and local self Government.	K2
CO5	Understand the value of Indian Constitution in functioning of the country.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO 1	-	-	-	-	-	3	-	3	-	1	-	2	-	-	-
CO 2	-	-	-	-	-	1	-	2	1	1	-	1	-	-	-
CO 3	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO 4	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO 5	-	-	-	-	-	1	1	1	1	1	-	2	-	-	-

COURSE CONTENT	
UNIT I	**Introduction to Indian constitution:** Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.
UNIT II	**Fundamental Rights:** Individual and Collective Rights – Limitations of the fundamental Rights – Fundamental Rights Vs Duties
UNIT III	**Union Government:** Union Legislature – Lok Sabha and Rajya Sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).
UNIT IV	**State Government:**State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions) **Local Self Government:** Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)
UNIT V	The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

REFERENCE BOOKS	
1.	_Indian Polity‘ by Laxmikanth
2.	_Indian Administration‘ by Subhash Kashyap
3.	_Indian Constitution‘ by D.D. Basu
4.	_Indian Administration‘ by Avasti and Avasti
WEB RESOURCES	
1.	https://www.clearias.com/historical-background-of-indian-constitution/
2.	https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html
3.	https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Transforms and Vector Calculus
Common to CE, ME, ECE, CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Basic Sciences	**Course Code**	20BM3T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Examine the properties of Laplace transformation	K3
CO2	Solve ordinary differential equations by using Laplace transformation technique	K2
CO3	Expand a periodic function as a Fourier series and find Fourier transform of a given function.	K3
CO4	Understand vector differential properties of scalar and vector point functions and their applications	K2
CO5	Apply Green‘s, Stokes and Divergence theorem to evaluate line, surface and volume integrals.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function.
UNIT II	**Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.
UNIT III	**Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms.
UNIT IV	**Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities.
UNIT V	**Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India

REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline.
7.	**Shanti Narayan**, Integral Calculus – Vol. 1 & II
WEB RESOURCES	
1.	**UNIT I: Laplace transforms** https://en.wikipedia.org/wiki/Laplace_transform https://web.stanford.edu/~boyd/ee102/laplace.pdf
2.	**UNIT II: Inverse Laplace transforms** https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php
3.	**Unit – III: Fourier Analysis** https://www.mathsisfun.com/calculus/fourier-series.html https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html
4.	**UNIT IV: Vector Differentiation** https://en.wikipedia.org/wiki/Vector_calculus
5.	**UNIT V: Vector Integration** https://en.wikipedia.org/wiki/Divergence_theorem http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Advanced Data Structures through C
Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Professional Core	**Course Code**	20CS3T04
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Comprehensive understanding of dictionaries, hashing mechanism which supports faster data retrieval and skip lists
2	Illustration of Balanced trees and their operations.
3	Comprehension of heaps, queues and their operations Priority Queues.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Develop symbol table using hashing techniques	K3
CO2	Implement priority queues using Binary heap and Binomial Queue and their applications	K3
CO3	Analyze algorithms for Height balanced trees such as AVL trees, red-black trees.	K3
CO4	Analyze algorithms for Height balanced trees B-trees and B+ trees	K3
CO5	Develop algorithms for digital search trees, binary tries and patricia	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2

COURSE CONTENT	
UNIT I	**HASHING:** Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic, Hashing.
UNIT II	**PRIORITY QUEUES (HEAPS):** Model, Simple Implementation, Binary Heap-Structure Property-Heap-Order Property-Basic Heap Operations- Other Heap Operation, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation Implementation of Binomial Queues
UNIT III	**EFFICIENT BINARY SEARCH TREES:** Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Definition- Representation of a RedBlack Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a RedBlack Tree- Joining Red-Black Trees, Splitting a Red-Black tree
UNIT IV	**MULTIWAY SEARCH TREES:** M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree.
UNIT V	**DIGITAL SEARCH STRUCTURES:** Digital Search Trees, Definition- Search, Insert and Delete- Binary tries and Patricia, Binary Tries, Compressed Binary Tries- Patricia, Multiway Tries- Definitions- Searching a Trie- Sampling Strategies- Insertion into a Trie- Deletion from a Trie- Keys with Different Length- Height of a TrieSpace Required.

TEXT BOOKS	
1.	Fundamentals of DATA STRUCTURES in C: 2nd ed. Horowitz , Sahani, Anderson-freed,

	Universities Press
2.	Data structures and Algorithm Analysis in C, 2nd ed. Mark Allen Weiss, Pearson
REFERENCE BOOKS	
1.	Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
2.	File Structures :An Object oriented approach with C++, 3rd ed, Michel J Folk, Greg Riccardi, Bill Zoellick
3.	Data Structures and Algorithms : Concepts, Techniques and Applications, GAV Pai, Tata McGraw Hill Corporation, ISBN: 9780070667266, 9780070667266, 2008
WEB RESOURCES	
1.	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
2.	http://utubersity.com/?page_id=878
3.	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
4.	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
5.	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
6.	http://utubersity.com/?page_id=878
7.	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
8.	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Science through Python
CSE(DS)

Course Category	Professional Core	Course Code	20CS3T06
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide a comprehensive knowledge of data science using Python.
2	To learn the essential concepts of data analytics and data visualization.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply principles of NumPy to the analysis of data.	K3
CO2	Apply principles of Pandas to the analysis of data.	K3
CO3	Make use of various file formats in loading and storage of data.	K2
CO4	Identify and apply the need and importance of pre-processing techniques.	K1
CO5	Show the results and present them in a pictorial format.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	2	-	-	1	-	-	-	3	2	1
CO2	2	2	3	2	3	1	-	-	1	-	-	-	3	2	1
CO3	2	2	2	2	3	1	-	-	1	-	-	-	3	2	1
CO4	2	2	2	2	3	1	-	-	1	-	-	-	3	2	1
CO5	3	3	3	2	3	1	-	-	-	-	-	-	3	2	1

COURSE CONTENT	
UNIT I	**Data science:** definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process. **NumPy Basics:** The NumPy ndarray: 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 II	**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.
UNIT III	**Data Loading, Storage, and File Formats :** Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB .
UNIT IV	**Data Wrangling:** Combining and Merging Data Sets, Database style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.
UNIT V	**Plotting and Visualization**: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File,Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

TEXT BOOKS	
1.	Wes McKinney, –Python for Data Analysis‖,O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2.	Rachel Schutt & O'neil, –Doing Data Science‖, O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
REFERENCE BOOKS	
1.	Joel Grus, —Data Science from Scratch: First Principles with Python‖, O'Reilly Media, 2015
2.	Matt Harrison, –Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.
WEB RESOURCES	
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

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Database Management Systems
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20IT3T02
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	To introduce about database management systems
2	To give a good formal foundation on the relational model of data and usage of RelationalAlgebra
3	To introduce the concepts of basic SQL as a universal Database language
4	To demonstrate the principles behind systematic database design approaches by coveringconceptual design, logical design through normalization
5	To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Describe a relational database and object-oriented database	K2
CO2	Create, maintain, and manipulate a relational database using SQL	K3
CO3	Describe ER model for database design	K1
CO4	Design a database with understanding on Normalization.	K2
CO5	Understand the storage, recovery and accessing mechanisms	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	3	3	-	-	-	-	-	1	-	-	1	1	1	2
CO3	3	3	3	2	-	-	-	-	1	-	2	1	1	1	1
CO4	3	3	3	-	-	-	-	-	1	-	3	1	1	1	2
CO5	3	2	1	-	-	-	-	-	1	-	-	1	1	1	2

COURSE CONTENT	
UNIT I	Introduction: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.
UNIT II	Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).
UNIT III	SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational setoperations. Indexing Techniques: B+ Trees: Search, Insert, Delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning
UNIT IV	Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth

	normal form(4NF), Fifth Normal Form (5NF).
UNIT V	Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
TEXTBOOKS	
1.	Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
2.	Database System Concepts,5/e, Silberschatz, Korth, TMH
REFERENCE BOOKS	
1.	Introduction to Database Systems, 8/e C J Date, PEA.
2.	Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
3.	Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://www.geeksforgeeks.org/introduction-to-nosql/

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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Mathematical Foundations For Computer Science
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20IT3T03
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce the students to the topics and techniques of discrete methods and combinatorialreasoning
2	To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close tiesbetween this discipline and the area of computer science

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate skills in solving mathematical problems	K2
CO2	Comprehend mathematical principles and logic	K2
CO3	Practice problems related to fundamental theorems	K2
CO4	Solve recurrence relations of various types	K2
CO5	Represent graphs as mathematical structure and apply graph theory in solving computer science problems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	1	1	1

COURSE CONTENT	
UNIT I	Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.
UNIT II	Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.
UNIT III	Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat‘s and Euler‘s Theorems
UNIT IV	Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations
UNIT V	Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler‘s Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim‘s and Kruskal‘s Algorithms, BFS and DFS Spanning Trees
TEXTBOOKS	
1.	Discrete Mathematical Structures with Applications to Computer Science, J. P.

	Tremblay and P.Manohar, Tata McGraw Hill.
2.	Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3.	Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.
REFERENCE BOOKS	
1.	Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2.	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3.	Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4.	Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/106/106106094/

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Computer Science and Engineering
(Data Science)

Advanced Data Structures through C Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20CS3L04
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Data Structures Laboratory	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To make the student implement efficient data structures for maintenance of data
2	To make the student implement rigid data structures for faster lookup
3	To make the student develop balanced trees and their various operations.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Implement programs for efficiently retrieving records with Hash tables and Heaps.	K3
CO2	Develop programs for, efficient data storage and text processing applications.	K3
CO3	Develop programs for implementing balanced trees and their Operations.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-

COURSE CONTENT	
1	Implement functions of Dictionary usingHashing (division method, Multiplication method, Universal hashing)
2	Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client_s telephone number
3	Implement various operations on Priority Queue
4	Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure.
5	Implement insertion operation on AVL trees.
6	Implement deletion operation on AVL trees.
7	Implement insertion operation on Red Black trees.
8	Implement deletion operation on Red Black trees.
9	Implement various operations on M-way search tree.
10	Implement various operations on B Trees
11	Implement various operations on B+ Trees
12	Implement Search Operation with Trie
13	Given an array of integers, with Trie structure find out two elements whose XOR is maximum.

TEXT BOOKS	
1.	Introduction to Algorithms," T.H. Cormen, C.E. Leiserson ,R.L. Rivest, and C. Stein, Third Edition.
2.	Data Structures with C (Schaum's Outline Series) by Seymour Lipschutz, July 2017.
REFERENCE BOOKS	
1.	Data Structures & Algorithm Analysis in C,SecondEdition,Mark Allen Weiss,PearsonEducation,India,January 2002 Edition.
2.	Algorithm Design and Applications, Michael T Goodrich, Roberto Tamassia, John Wiley,2002.
3.	Data Structures and Algorithms in C,Adam Drozdek,2004 Edition.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/102/106102064/
2.	https://www.tutorialspoint.com/advanced_data_structures/index.asp
3.	https://www.geeksforgeeks.org/advanced-data-structures/#SelfbalancingBSTs
4.	https://www.geeksforgeeks.org/trie-insert-and-search/
5.	https://www.cs.yale.edu/homes/aspnes/pinewiki/C(2f)HashTables.html?highlight=%28CategoryAlgorithmNotes%29

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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Science through Python Laboratory
CSE (DS)

Course Category		**Course Code**	20CS3L06
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Inculcate the basic understanding of Data Science and it‘s practical implementation using Python

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Perform various operations on numpy arrays	K3
CO2	Importing data from different file formats using pandas	K5
CO3	Draw different types of charts using matplotlib	K1

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	2	3	3	2	-	-	1	-	-	-	3	2	1
CO2	2	2	3	2	3	1	-	-	1	-	-	-	3	2	1
CO3	3	3	3	2	3	1	-	-	-	-	-	-	3	2	1

COURSE CONTENT	
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	Expanding and Squeezing a NumPy Array a. Expanding a NumPy array b. Squeezing a NumPy array c. Sorting in NumPy Arrays
4	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
5	Stacking and Concatenating Numpy Arrays a. Stacking ndarrays b. Concatenating ndarrays c. Broadcasting in Numpy Arrays
6	Perform following operations using pandas a. Creating dataframe b. concat() c. Setting conditions d. Adding a new column
7	Perform following operations using pandas a. Filling NaN with string b. Sorting based on column values c. groupby()
8	Read the following file formats using pandas a. Text files b. CSV files c. Excel files d. JSON files
9	Read the following file formats a. Pickle files

	b. Image files using PIL c. Multiple files using Glob d. Importing data from database
10	Demonstrate web scraping using python
11	Perform following preprocessing techniques on loan prediction dataset a. Feature Scaling b. Feature Standardization c. Label Encoding d. One Hot Encoding
12	Perform following visualizations using matplotlib a. Bar Graph b. Pie Chart c. Box Plot d. Histogram e. Line Chart and Subplots f. Scatter Plot

TEXT BOOKS	
1.	Wes McKinney, –Python for Data Analysis‖,O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2.	Rachel Schutt & O'neil, –Doing Data Science‖, O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
REFERENCE BOOKS	
1.	Joel Grus, —Data Science from Scratch: First Principles with Python‖, O'Reilly Media, 2015
2.	Matt Harrison, –Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.
WEB RESOURCES	
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

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Computer Science and Engineering
(Data Science)

Database Management Systems Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20IT3L04
Course Type	Laboratory	**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Populate and query a database using SQL DDL/DML Commands
2	Declare and enforce integrity constraints on a database
3	Writing Queries using advanced concepts of SQL
4	Programming PL/SQL including procedures, functions, cursors, and triggers

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Create database tables and perform various operations	K3
CO2	Implement PL/SQL programs	K3
CO3	Create stored packages for variables and cursors	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO2	3	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1	2	2	1

LIST OF EXPERIMENTS

Note: For performing the experiments consider any case study (ATM/ Banking/ Library/Hospitalmanagement systems)

1	Creation, altering and dropping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command.
2	Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS,

	UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3	Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4	Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5	i. Create a simple PL/SQL program which includes declaration section, executable section, and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raisedif no records were found) ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6	Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7	Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
8	Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9	Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10	Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11	Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12	Create a table and perform the search operation on table using indexing and non-indexingtechniques.
TEXTBOOKS/SUGGESTED READING:	
1	Oracle: The Complete Reference by Oracle Press
2	Nilesh Shah, "Database Systems Using Oracle‖, PHI, 2007
3	Rick F Vander Lans, –Introduction to SQL‖, Fourth Edition, Pearson Education, 2007

PRAGATI ENGINEERING COLLEGE
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Computer Science and Engineering
(Data Science)

Skill Oriented Course
Mobile App Development through Android
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Skill Oriented Course	**Course Code**	20CS3S03
Course Type	Laboratory	**L-T-P-C**	0-0-4-2
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2	To understand how to work with various mobile application development frameworks.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	**Discuss** the components and different Layout for mobile application development framework for android.	K6
CO2	**Design** Simple GUI application with the **Use** of Built in components and widgets.	K6
CO3	**Define** a solution for complex problems	K1

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	-	-	-	2	-	-	-	-	-	-	-	3	-	-
CO2	2	2	-	-	2	-	-	-	-	1	-	-	3	3	-
CO3	2	2	1	-	2	-	-	-	-	1	-	-	3	3	-

COURSE CONTENT	
1	Introduction to mobile technologies and devices , Android platform and applications overview
2	Setting Android development environments
3	Writing Android applications, Understanding anatomy of an Android application
4	Develop an application that uses GUI components, Font and Colours
5	Develop an application that uses Layout Managers and event listeners.
6	Write an application that draws basic graphical primitives on the screen.
7	Develop an application that makes use of databases.
8	Develop an application that makes use of Notification Manager
9	Implement an application that uses Multi-threading
10	Develop a native application that uses GPS location information
11	Implement an application that writes data to the SD card.
12	Implement an application that creates an alert upon receiving a message
13	Write a mobile application that makes use of RSS feed
14	Develop a mobile application to send an email.
15	Develop a Mobile application for simple needs (Mini Project)

TEXT BOOKS	
1.	Build Your Own Security Lab, Michael Gregg, Wiley India.
REFERENCE BOOKS	
1.	Android Programming unleashed , B.M. Harwani, Pearson, 2013.
2.	Android Programming (Big Nerd Ranch Guide), by Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, Pearson, 2016
3.	Android Programming – Pushing the limits by Hellman by Erik Hellman, WILEY, 2013

WEB RESOURCES	
1.	The Complete Android N Developer Course –Udemy https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526
2.	Android Development Courses on Google developers training https://developers.google.com/training/android/
3.	Mobile Computing - Video course- NPTEL https://nptel.ac.in/courses/106/106/106106147/#
4.	Android Tutorial – Tutorial Point https://www.tutorialspoint.com/android/index.htm

PRAGATI ENGINEERING COLLEGE
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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Essence of Indian Traditional Knowledge
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Humanities and Social Sciences	**Course Code**	20HM4T06
Course Type	Mandatory	**L-T-P-C**	2-0-0-0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the concept of Traditional knowledge and its importance	Understanding
CO2	Know the need and importance of protecting traditional knowledge	Understanding
CO3	Know the various enactments related to the protection of traditional knowledge	Understanding
CO4	Understand the concepts of Intellectual property to protect the traditional knowledge	Understanding
CO5	Understand the importance of Traditional Knowledge in the development of different sectors	Understanding

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	1	2	-	-	3	-	1	-	2	-	-	-	-	-
CO2	-	-	2	-	-	2	-	2	1	-	-	2	-	-	-
CO3	-	-	1	-	-	3	2	3	1	2	-	1	-	-	-
CO4	-	-	-	-	-	2	1	3	1	1	-	1	-	-	-
CO5	1	-	1	-	-	3	1	1	1	3	-	1	-	-	-

COURSE CONTENT	
UNIT I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge
UNIT II	Protection of Traditional Knowledge: The need for protecting traditional knowledge - Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge
UNIT III	Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003.
UNIT IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.
UNIT V	Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

REFERENCE BOOKS	
1.	Traditional Knowledge System in India, by Amit Jha, 2009.
2.	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3.	Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4.	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5.	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6.	Pramod Chandra, India Arts, Howard Univ. Press, 1983.

7.	Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.
WEB RESOURCES	
1.	https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html
2.	http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf
3.	https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering

(Data Science)

Probability & Statistics
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Basic Sciences	**Course Code**	20BM4T05
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	To familiarize the students with the foundations of probability and statistical methods
2	To impart probability concepts and statistical methods in various applications

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Classify the concepts of data science and its importance.	K2
CO2	Interpret the association of characteristics and through correlation and regression tools.	K3
CO3	Make use of the concepts of probability and their applications Apply discrete and continuous probability distributions .	K3
CO4	Design the components of a classical hypothesis test.	K4
CO5	Infer the statistical inferential methods based on small and large sampling tests .	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Descriptive statistics and methods for data science**: Data science – Statistics Introduction – Population vs Sample – Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability (spread or variance) – Skewness Kurtosis.
UNIT II	**Correlation and Curve fitting**: Correlation – correlation coefficient – rank correlation – regression coefficients and properties – regression lines – Method of least squares – Straight line – parabola – Exponential – Power curves.
UNIT III	**Probability and Distributions**: Probability – Conditional probability and Baye‘s theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.
UNIT IV	**Sampling Theory**: Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate
UNIT V	**Tests of Hypothesis:** Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

TEXTBOOKS	
1.	Miller and Freund‘s, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2.	S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

REFERENCE BOOKS	
1.	Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
2.	Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage
3.	Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4.	Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

WEB RESOURCES	
1.	**UNIT I:** https://en.wikipedia.org/wiki/List_of_probability_distributions https://en.wikipedia.org/wiki/Binomial_distribution
2.	**UNIT II:**

	https://en.wikipedia.org/wiki/Normal_distribution
3.	**UNIT III:** https://en.wikipedia.org/wiki/Sampling_(statistics) https://nptel.ac.in/courses/111104073/
4.	**UNIT IV:** https://en.wikipedia.org/wiki/Statistical_hypothesis_testing https://machinelearningmastery.com/statistical-hypothesis-tests/
5.	**UNIT V:** https://en.wikipedia.org/wiki/Regression_analysis https://www.surveysystem.com/correlation.htm

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Computer Organization
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Engineering Sciences	**Course Code**	20EC4T12
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will learn	
1	Principles and the Implementation of Computer Arithmetic
2	Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
3	Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
4	Memory System and I/O Organization
5	Principles of Operation of Multiprocessor Systems and Pipelining

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop a detailed understanding of computer systems	K2
CO2	Cite different number systems, binary addition and subtraction, standard, floating-pointand micro-operations	K2
CO3	Develop a detailed understanding of architecture and functionality of central processing unit	K4
CO4	Exemplify in a better way the I/O and memory organization	K3
CO5	Illustrate concepts of parallel processing, pipelining and inter processor communication	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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Computer Science and Engineering
(Data Science)

Contribution of Course Outcomes towards achievement of ProgramOutcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	1							1				
CO2	1	2	2							1			1	
CO3	2	1	2							1				2
CO4	2	3	2							1			2	
CO5	1	2	1											1

COURSE CONTENT	
UNIT-I	Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.
UNIT-II	Register Transfer Language and Micro-operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.
UNIT-III	Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer. Microprogrammed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.
UNIT-IV	Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access
UNIT-V	Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration. Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

TEXT BOOKS	
1.	Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
2.	Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5/e, McGrawHill, 2002.
REFERENCE BOOKS	
1.	Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2.	Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3.	Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer,2006.

PRAGATI ENGINEERING COLLEGE
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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Mining
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Professional Core	**Course Code**	20 CS4T07
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand and implement classical models and algorithms in data ware housing and data mining.
2	To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3	To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Summarize the architecture of data warehouse	Understanding
CO2	Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.	Applying
CO3	Construct a decision tree and resolve the problem of model overfitting	Applying
CO4	Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation	Understanding
CO5	Apply suitable clustering algorithm for the given data set	Applying

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	2	1	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
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 II	**Data Mining:** Introduction, What is 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 III	**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 IV	**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 V	**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)

TEXT BOOKS	
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, 2013, 3rd edition,
WEB RESOURCES	
1.	NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview
2.	https://www.javatpoint.com/data-mining
3.	https://www.tutorialspoint.com/data_mining/index.htm

PRAGATI ENGINEERING COLLEGE
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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Java Programming
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20CS4T10
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
2	To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
3	To understand how to design applications with threads and JDBC connections in Java

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Differentiate the application of decision and iteration control structures.	K2
CO2	Implements the concepts of Java such as classes, method overloading and various keywords.	K3
CO3	Apply the concept of inheritance and interfaces.	K3
CO4	Able to implements the concepts of Packages and Exception handling.	K3
CO5	Able to Analyze & Implement the concepts of Multi threading and JDBC Connections.	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2

COURSE CONTENT	
UNIT I	Program Structure in Java: Introduction, Writing Simple Java Programs, Tokens in Java Programs, Command Line Arguments, Comments. Data Types, Variables, and Operators: Introduction, Data Types in Java, Static Variables and Methods, Attribute Final, Operators. Control Statements: If Expression, Switch Statement, Loops.
UNIT II	Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this. Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.
UNIT III	Arrays: Introduction, Operations on Array Elements, Sorting and Searching, Two-dimensional Arrays Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces
UNIT IV	Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Java.lang Package and its Classes, class Math, Wrapper Classes, Java util Classes and Interfaces, Time Package, Class Instant (java.time.Instant). Exception Handling: Introduction, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions
UNIT V	String Handling in Java: Introduction, Interface Char Sequence, Class String, String Methods, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder. Introducing the AWT: Graphics,Text, Layout Managers, Menus and Images Swing: Origins, Features, MVC Connection, Components and Containers Multithreaded Programming: Introduction, Thread Class, Main Thread- Creation of New

	Threads, Thread States Java Database Connectivity: Introduction, JDBC Architecture, Establishing JDBC Database Connections

TEXT BOOKS	
1.	Introduction to Java Programming, 7th edition by Y Daniel Liang, Pearson
2.	The complete Reference Java, 8th edition, Herbert Schildt, TMH.
REFERENCE BOOKS	
1.	JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2.	Murach's Java Programming, Joel Murach
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://www.w3schools.com/java/java_data_types.asp
3.	https://docs.oracle.com/javase/tutorial/java/index.html

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Managerial Economics and Financial Analysis
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Humanities and Social Sciences	**Course Code**	20HM4T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services	Applying
CO2	Assess the functional relation among production, cost of production, cost concepts and Break-Even Analysis.	Evaluating
CO3	Classify market structures for price and output decisions and Appraise the forms of business organizations and trade cycles in economic growth.	Understanding
CO4	Make use of the final accounting statements in financial decision making	Applying
CO5	Apply capital budgeting techniques in financial decision making	Applying

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	1	-	-	-	-	-	-	2	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	3	2	-	-	-

COURSE CONTENT	
UNIT I	Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Demand forecasting and Methods of demand forecasting (Opinion survey methods, Trend line by observation, least squares method and barometric techniques)
UNIT II	Production and Cost Analysis: Production function- Law of Variable proportions- Iso-quants and Isocosts- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems).
UNIT III	Introduction to Markets, Pricing Policies and Types of Business Organizations: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price and Output Determination. Pricing Policies: Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing. Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycles.
UNIT IV	Introduction to Accounting and Capital Budgeting: Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Final Accounts (Simple Problems)
UNIT V	Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods(Simple Problems)

TEXT BOOKS	
1.	Dr. A. R. Aryasri – Managerial Economics and Financial Analysis – TMH- 2018
2.	Dr. N. Appa Rao, Dr. P. Vijay Kumar - _Managerial Economics and Financial Analysis‘ - Cengage Publications – 2012
REFERENCE BOOKS	
1.	V. Maheswari -Managerial Economics - Sultan Chand & Sons – 2014.
2.	Suma Damodaran - Managerial Economics - Oxford - 2011.
3.	Vanitha Agarwal - Managerial Economics - Pearson Publications- 2011.

4.	V.Maheswari - Financial Accounting- Vikas Publications – 2018.
5.	S. A. Siddiqui & A. S. Siddiqui - Managerial Economics and Financial Analysis - New Age International Publishers - 2012

WEB RESOURCES

1.	https://economictimes.indiatimes.com/definition/law-of-supply
2.	https://sites.google.com/site/economicsbasics/managerial-theories-of-the-firm
3.	https://www.managementstudyguide.com/capitalization.htm

PRAGATI ENGINEERING COLLEGE
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B.Tech **R-20**

Computer Science and Engineering
(Data Science)

R Programming Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category		**Course Code**	20CS4L10
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	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		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Implement basic concepts of R programming, and its different module that includes conditional, looping, lists, Strings, Functions, Frames, Arrays, and File programming.	K3
CO2	Implement the concepts of R Script to extract the data from data frames and file operations.	K4
CO3	Implement the various statistical techniques using R. Extend the functionality of R by using add-on packages. Use R Graphics and Tables to visualize results of various statistical operations on data.	K6

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO2	2	2	3	3	3	-	-	-	-	-	-	3	3	3	3
CO3	2	3	3	3	3	-	-	-	-	-	-	3	3	3	3

COURSE CONTENT	
Week 1	Installing R and RStudio 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 eligiblefor voting ornot. c) Implement R script to find biggest number between two numbers. d) Implement R script to check the given year is leap year ornot.
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. 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& cars datasets. b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset
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 toggplot2 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, Binomial distributions. b) Implement R Script to perform correlation, Linear and multiple regression.
Week 10	Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

Week 11	Introduction 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

TEXT BOOKS	
1.	The R Book, by Michael J. Crawley, 2012. Wiley, 1076 p. ISBN-13: 978-0470973929
2.	An Introduction using R, by Michael J. Crawley, 2014. John Wiley & Sons, 360 p. ISBN-13: 978-1118941096
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 JorisMeysAndrie 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, ThomasLumely.
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 RESOURCES	
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/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Data Mining using Python Laboratory
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category		**Course Code**	20CS4L11
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Practical exposure on implementation of well-known data mining algorithms
2	Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply preprocessing techniques on real world datasets	K3
CO2	Apply apriori algorithm to generate frequent itemsets	K3
CO3	Apply Classification and clustering algorithms on different datasets.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3
CO2	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3

COURSE CONTENT 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.

TEXT BOOKS	
1.	Data Mining Concepts and Techniques Third Edition, Jiawei Han, Micheline Kamber, Jian Pei
REFERENCE BOOKS	
1.	Hands-On Machine Learning with Scikit-Learn and TensorFlow, OREILLY Concepts Tools and Techniques to build Intelligent systems
2.	Python for Everybody *By Dr Charles R. Severance*
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

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Java Programming Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT, ECE

Course Category		**Course Code**	20CS4L12
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Practice programming in the Java
2	Gain knowledge of object-oriented paradigm in the Java programming language
3	Learn use of Java in a variety of technologies and on different platforms

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Evaluate default value of all primitive data type, Operations, Expressions, Controlflow, Strings	K3
CO2	Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism	K3
CO3	Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3
CO2	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3
CO3	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3

COURSE CONTENT	
1	**Exercise - 1** (Basics) a) Write a JAVA program to display default value of all primitive data type of JAVA b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root. c) 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 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.
2	**Exercise - 2** (Operations, Expressions, Control-flow, Strings) a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort c) Write a JAVA program to sort for an element in a given list of elements using merge sort. d) Write a JAVA program using StringBuffer to delete, remove character.
3	**Exercise - 3** (Class, Objects) a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. b) Write a JAVA program to implement constructor.
4	**Exercise - 4** (Methods) a) Write a JAVA program to implement constructor overloading. b) Write a JAVA program implement method overloading.
5	**Exercise - 5** (Inheritance) a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi level Inheritance c) Write a java program for abstract class to find areas of different shapes
6	**Exercise - 6** (Inheritance - Continued) a) Write a JAVA program give example for –super‖ keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
7	**Exercise - 7** (Exception) a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses
8	**Exercise – 8 (**Runtime Polymorphism) a) Write a JAVA program that implements Runtime polymorphism b) Write a Case study on run time polymorphism, inheritance that implements in above problem
9	**Exercise – 9** (User defined Exception) a) Write a JAVA program for creation of Illustrating throw b) Write a JAVA program for creation of Illustrating finally c) Write a JAVA program for creation of Java Built-in Exceptions d) d)Write a JAVA program for creation of User Defined Exception

10	**Exercise – 10** (Threads) a) Write a JAVA program that creates threads by extending Thread class .First thread display –Good Morning –every 1 sec, the second thread displays –Hello –every 2 seconds and the third display –Welcome‖ every 3 seconds ,(Repeat the same by implementing Runnable) **b)** Write a program illustrating **isAlive** and **join ()** c) Write a Program illustrating Daemon Threads.
11	**Exercise - 11** (Threads continuity) a) Write a JAVA program Producer Consumer Problem b) Write a case study on thread Synchronization after solving the above producer consumer problem
12	**Exercise – 12** (Packages) a) Write a JAVA program illustrate class path b) Write a case study on including in class path in your os environment of your package. c) Write a JAVA program that import and use the defined your package in the previous Problem
13	**Exercise - 13** (Applet) a) Write a JAVA program to paint like paint brush in applet. b) Write a JAVA program to display analog clock using Applet. c) Write a JAVA program to create different shapes and fill colors using Applet.
14	**Exercise - 14** (Event Handling) a) Write a JAVA program that display the x and y position of the cursor movement using Mouse. b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.
15	**Exercise-15** (AWT & Swings) a) Write a Java Program to create a frame with three buttons and Radio Button b) Write a Java Program to print text in different colors c) Write a JAVA program that to create a single ball bouncing inside a JPanel.
16	**Exercise-16** (JDBC) a) Write a Java program to Connect database b) Write a Java Program to insert, update, delete & select records

TEXT BOOKS	
1.	JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2.	The complete Reference Java, 8th edition, Herbert Schildt, TMH.
REFERENCE BOOKS	
1.	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2.	Murach's Java Programming, Joel Murach
WEB RESOURCES	

1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://www.w3schools.com/java/java_data_types.asp

PRAGATI ENGINEERING COLLEGE
(Autonomous)
B.Tech **R-20**

Computer Science and Engineering
(Data Science)

Skill Oriented Course
Applications of Mongo DB
CSE (DS)

Course Category	Professional Core	**Course Code**	20CS4S06
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	DBMS	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Comprehensive understanding of dictionaries, hashing mechanism which supports faster data retrieval and skip lists
2	Illustration of Balanced trees and their operations.
3	Comprehension of heaps, queues and their operations Priority Queues.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Installing and configuring mongoDB in windows	K3
CO2	Perform all database operations using mongoDB	K3
CO3	Develop applications by integrating mongoDBwith java/PHP	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO2	2	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3

COURSE CONTENT	
1	MongoDB installation and configuration in windows.

2	Demonstrate how to create and drop a database in MongoDB
3	Creating the Collection in MongoDB on the fly
4	Creating collection with options before inserting the documents and drop the collection created.
5	MongoDB insert document a. Insert single document b. Insert multiple documents in collection
6	Querying all the documents in json format and Querying based on the criteria.
7	MongoDB update document a. Using update() method. b. Using save() method.
8	MongoDB delete document from a collection. a.Using remove() method. b.Remove only one document matching your criteria c. Remove all documents
9	MongoDB Projection
10	limit() ,skip(), sort() methods in MongoDB
11	MongoDB indexing a. Create index in MongoDB b. Finding the indexes in a collection c. Drop indexes in a collection d. Drop all the indexes
12	MongoDB with java and PHP a. Create a simple application that uses MongoDB with Java b. Create a simple application that uses MongoDB with PHP

TEXT BOOKS	
1.	Mongo DB: The Definitive Guide, 3rd Edition by Shannon Bradshaw, Eoin Brazil, Kristina Chodorow Released December 2019Publisher(s): O'Reilly Media, Inc.ISBN: 9781491954461
REFERENCE BOOKS	
1.	Mongo DB Fundamentals A hands-on guide to using Mongo DB and Atlas in the real world Amit Phaltankar, J uned Ahsan, Michael Harrison, Liviu Nedov
WEB RESOURCES	

1.	https://beginnersbook.com/2017/09/mongodb-tutorial
2.	https://www.oreilly.com/library/view/building-node-applications/9781449337735/ch04.html

Automata Theory & Compiler Design

CSE (DS)

Course Category	Professional Core	**Course Code**	20IT5T05
Course Type	Theory	**L-T-P-C**	3–0–0–3
Prerequisites	Mathematical Foundations of Computer Science	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	To learn fundamentals of Regular and Context Free Grammars and Languages
2	To understand the relation between Contexts free Languages, PDA and TM
3	To study the various phases in the design of a compiler
4	To understand the design of top-down and bottom-up parsers
5	To understand syntax directed translation schemes
6	To learn to develop algorithms to generate code for a target machine

COURSE OUTCOMES

Upon successful completion of the course , the student will be able to:		**Cognitive Level**
CO1	Design DFA and NFA to accept given languages	K3
CO2	Able to use LEX and YACC tools for developing a scanner and a parser and to design and implement LL and LR parsers	K3
CO3	Able to design SDT	K3
CO4	Able to design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity	K3
CO5	Ability to design algorithms to generate machine code	K3

K1:Remember, K2:Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Out comes towards achievement of Program: Outcomes (1–Low,2-Medium,3–High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Formal Language and Regular Expressions:** Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA .Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, l ex tools.
UNIT II	**Context Free grammars and parsing :**Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LAL R parsing, parsing ambiguous grammars, YACC programming specification.
UNIT III	**Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree , translation of simple statements and control flow statements. **Context Sensitive features –** Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.
UNIT IV	**Run time storage**: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. **Code optimization:** Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.
UNIT V	**Code generation:** Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.
TEXT BOOKS	
1.	Introduction to Automata Theory, Languages and Computation, J.E. Hopcroft, R. Motwani and J.D. Ullman, 3rd Edition, Pearson,2008.
2.	Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.
REFERENCE BOOKS	
1.	Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi , Pearson Education.
2.	Tremblay JP, Sorenson GP:"The Theory & Practice of Compiler writing",1stEdition,BSP publication,2010.
3.	TheoryofComputation,V.Kulkarni,OxfordUniversityPress,2013
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/104/106104028/
2.	https://nptel.ac.in/courses/106/104/106104123/

Operating Systems
CSE (DS)

Course Category	Professional Core	**Course Code**	20IT5T04
Course Type	Theory	**L-T-P-C**	3–0–0–3
Prerequisites	Computer Organization, Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce to the internal operation of modern operating systems
2	Define, explain, processes and threads, mutual exclusion CPU scheduling, deadlock, memory management, and file systems
3	Understand File Systems in Operating System like UNIX/Linux and Windows
4	Understand Input Output Management and use of Device Driver and Secondary Storage (Disk) Mechanism
5	Analyze Security and Protection Mechanism in Operating System

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Describe various generations of Operating System and functions of Operating System	K2
CO2	Comprehend the concept of program, process and thread and compare various CPU Scheduling Algorithms and Inter Process Communication problems	K2
CO3	Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques	K2
CO4	Apply process synchronization techniques to avoid deadlocks	K3
CO5	Outline File Systems in Operating System like UNIX/Linux and Windows	K2

K1:Remember, K2:Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Out comes towards achievement of Program: Outcomes (1–Low,2-Medium,3–High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	1	-	-	-	-	-	-	-	2	1	-
CO2	3	3	3	2	1	-	-	-	-	-	-	2	3	1	1
CO3	3	3	2	-	1	-	-	-	-	-	-	2	3	1	-
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	1	3
CO5	3	3	3	3	1	-	-	-	-	-	-	2	3	1	3

COURSE CONTENT	
UNIT I	**Operating Systems Over view**: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. **System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.
UNIT II	**Process Concept**: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multi threading models, Thread libraries, Threading issues. **Process Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. **Inter-process Communication:** Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes , Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem
UNIT III	**Memory- Management Strategies:** Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. **Virtual Memory Management**: Introduction, Demand paging, Copy on -write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.
UNIT IV	**Deadlocks:** Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. **File Systems:** Files, Directories, File system implementation, management and optimization. **Secondary-Storage Structure:** Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.
UNIT V	**System Protection**: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. **System Security**: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Fire walling to protect systems and networks, Computer security classification. **Case Studies**: Linux, Microsoft Windows.
TEXT BOOKS	
1.	Silbers chatz A, Galvin PB, and Gagne G, Operating System Concepts, 9th edition,Wiley,2013.
2.	Tanenbaum AS, Modern Operating Systems, 3rd edition, Pearson Education,2008.(for Inter process Communication and File systems.)
REFERENCE BOOKS	
1.	Dhamdhere DM, Operating Systems A Concept Based Approach ,3rd edition, TataMcGraw-Hill,2012.
2.	StallingsW,OperatingSystems-InternalsandDesignPrinciples,6thedition,PearsonEducation,2009
3.	Nutt G, Operating Systems,3rdedition, Pears on Education,2004.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105214/

Machine Learning

CSE (DS)

Course Category	Professional Core	**Course Code**	20AM5T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Probability and Statistics, Data Mining	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

The student will:

1	Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
2	Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the fundamental usage of the concept Machine Learning system.	K1
CO2	Demonstrate on various regression Technique.	K2
CO3	Analyze the Ensemble Learning Methods.	K3
CO4	Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.	K4
CO5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning.	K5

K1:Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	--	--	--	--	--	--	--	--	2	2	2	1
CO2	3	2	1	--	--	--	--	--	--	--	--	1	1	1	1
CO3	3	2	1	--	--	--	--	--	--	--	--	--	1	1	1
CO4															
CO5															

COURSE CONTENT	
UNIT-I	**Introduction-** Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. **Statistical Learning**: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.
UNIT-II	**Supervised Learning**: (Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbors , Decision Trees, Naive Bayes. **Linear Models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines. Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.
UNIT-III	**Ensemble Learning and Random Forests**: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. **Support Vector Machine:** Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.
UNIT-IV	**Unsupervised Learning Techniques**: Clustering , K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. **Dimensionality Reduction:** The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.
UNIT-V	**Neural Networks**: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing Tensor Flow 2, Loading and Preprocessing Data with Tensor Flow.
TEXT BOOKS	
1.	"Machine Learning" , Tom M. Mitchell, Tata Mc – Graw Hill Publications, 2nd Edition, 2021
2.	Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow, 2nd Edition, O'Reilly Publications, 2019.
REFERENCE BOOKS	
1.	Data Science and Machine Learning Mathematical and Statistical Methods, Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020.
2.	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.
WEB RESOURCES:	
1.	https:// https://onlinecourses.nptel.ac.in/noc21-cs24/preview

Open Elective-I
Surveying
CSE (DS)

Course Category	Open Elective	**Course Code**	20CE5T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	----------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce the students to basic principles of surveying.
2	Demonstrate the basic surveying skills.
3	Perform various methods of linear and angles measurements.
4	Enable the students to use surveying equipment's
5	Integrate the knowledge and produce to pographical map.
COURSEOUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Illustrate the fundamentals in chain and planet able surveying.
CO2	Identify the angles on filed by compass survey.
CO3	Apply knowledge of leveling in surveying.
CO4	Measure the horizontal and vertical angles by using The odolite and Total Station instruments.
CO5	Estimate the volume and area of irregular boundaries of filed.

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low, 2-Medium, 3 –High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	1	--	--	--	--	3	--	--	2	3	--	3
CO2	3	3	1	2	--	--	--	--	2	--	--	3	3	--	3
CO3	2	--	--	3	--	--	--	--	3	--	--	--	2	--	2
CO4	2	3	1	3	3	--	--	--	3	--	--	3	3	--	3
CO5	3	3	3	3	--	--	--	--	--	--	--	3	3	3	3

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Definition-Uses of surveying ,Objectives, Principles and Classifications of Surveying– Errors in survey measurements. **DISTANCEMEASUREMENTCONVENTIONSANDMETHODS:** Use of chain and tape, Errors and corrections to linear measurements, overview of planet able surveying.
UNIT II	**COMPASS SURVEY:** Definition- Principles of Compass survey - Meridians, Azimuths and Bearings, declination. Computations of angle - Purpose and types of Traversing – traverse adjustments–Local attraction.
UNIT III	**LEVELING:** Concept and Terminology, Leveling Instruments and their Temporary and permanent adjustments-method of leveling. **CONTOURING:** Characteristics and uses of contours-methods of conducting contour surveys and their plotting.
UNIT IV	**THEODOLITE:** Theodolite, description, principles-uses–temporary and permanent adjustments, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Omitted Measurements. Introduction to geodetic surveying - Total Station and Global Positioning System. **CURVES:** Types of curves, design and setting out. **TACHEOMETRIC SURVEYING:** Stadia and tangential methods of Tachometry. **MODERN SURVEYING METHODS:** Principle and types of E.D.M. Instruments, TotalstationadvantagesandApplications.IntroductiontoGlobalPositioning System.
UNIT V	**COMPUTATION OF AREAS AND VOLUMES:** Computation of areas along irregular boundaries and regular boundaries. Embankments and cutting for a level section and two level section with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.
TEXTBOOKS	
1.	Surveying(VolNo.1,2&3)byB.C.Punmia,AshokKumarJainandArunKumarJain–Laxmi Publications(P)ltd, New Delhi.
2.	Textbook of Surveying by C. Venkataramaiah, University press, India (P) limited.
REFERENCEBOOKS	
1.	Textbook of Surveying by S.K.Duggal (VolNo.1&2),Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2.	Textbook of Surveying by Arora (VolNo.1&2), Standard Book House, Delhi.
WEBRESOURCES	
1.	https://lecturenotes.in/notes/2827-note-for-surveying-1-s-1-by-swadhina-priyadarsini
2.	https://nptel.ac.in/courses/105107122/1
3.	https://nptel.ac.in/courses/105107158/

Renewable Energy Engineering

CSE (DS)

Course Category	Professional Core Courses	**Course Code**	20EE5T13
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	-----	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES

1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics
2	To understand the concept of Wind Energy Conversion & its applications
3	To study the principles of biomass and geothermal energy
4	To understand the principles of Ocean Thermal Energy Conversion (OTEC), motion of waves and power associated with it
5	To study the various chemical energy sources such as fuell cell and hydrogen energy along with their operation and equivalent circuit

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage	K4
CO2	Illustrate the components of wind energy systems	K3
CO3	Illustrate the working of biomass, digesters and Geothermal plants	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves	K3
CO5	Evaluate the concept and working of Fuel cells & MHD power generation	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO3	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO4	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO5	3	1	1	1	-	-	1	-	-	-	-	1	2	2

COURSE CONTENT	
UNIT 1	**Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar **Energy Collectors:** Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.
UNIT 2	**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.
UNIT 3	**Biomass and Geothermal Energy:** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems.
UNIT 4	**Energy From oceans, Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves**: Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.
UNIT 5	**Chemical Energy Sources:** **Fuel Cells:** Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy**: Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation**: Principle of Operation - Types.
TEXT BOOKS	
1	G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011
2	John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013
REFERENCE BOOKS	
1	S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011
2	John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013
3	Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

Entrepreneurship
CSE (DS)

Course Category	Humanities including Management	**Course Code**	20HM5T03
Course Type	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites	------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
On successful completion of the course, the student will be able to		**Cognitive Level**
CO 1	Understand different Entrepreneurial traits.	K2
CO 2	Identify and compare the financial institutions supporting entrepreneurship.	K4
CO 3	Understand the functioning and problems faced by MSMEs (Micro Small Medium Enterprises)	K2
CO 4	Identify Entrepreneurial opportunities for women.	K3
CO 5	Analyze different market, technical factors and prepare a project report based on guidelines.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program											
Outcomes: 1 – Low, 2 - Medium, 3 – High											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	1	0	3	2	1	3	3
CO2	0	0	0	0	0	1	0	3	0	2	3	1
CO3	0	0	0	0	0	1	1	3	1	1	0	3
CO4	0	0	0	0	0	1	0	3	1	1	0	3
CO5	0	1	1	0	0	1	2	3	1	3	3	3

COURSE CONTENT	
UNIT I	**Introduction to Entrepreneurship** Introduction to Entrepreneurship: Definition of Entrepreneur Entrepreneurial Traits. Entrepreneur vs. Manager, Creating and Starting the venture: Sources of new ideas, methods of generating ideas, creative problem solving – Writing Business Plan, Evaluating Business Plans.
UNIT II	**Institutional and financial support to Entrepreneurship** Institutional/financial support: Schemes and functions of Directorate of Industries, IFCI, District Industries Centers (DICs), Industrial Development Corporation (IDC), State Financial Corporation (SFCs), Small Scale Industries Development Corporations (SSIDCs). Khadi and Village Industries Commission (KVIC), Technical Consultancy Organization (TCO), Small Industries Service Institute (SISI), National Small Industries Corporation (NSIC), Small Industries Development Bank of India (SIDBI).(short answers only), Start up culture.
UNIT III	**Micro, Small and Medium Enterprises**: Importance and role of MSMEs in economic development, Types of MSMEs, Policies and their support to MSMEs growth and growth strategies. Sickness in small business and remedies – small entrepreneurs in International business.
UNIT IV	**Women Entrepreneurship and Start up Culture** Role & importance, profile of women Entrepreneur, problems of women Entrepreneurs, women Entrepreneurship Development in India -Steps taken by the Government to promote women entrepreneurship in India, Associations supporting women entrepreneurs. Successful Entrepreneurs (case studies).
UNIT V	**Project Formulation and Appraisal** Preparation of Project Report –Content; Guidelines for Report preparation – Project Appraisal techniques –economic – Steps Analysis; Financial Analysis; Market Analysis; Technical Feasibility
TEXTBOOKS	
1.	Vasanth Desai – Fundamentals of Entrepreneurship and Small business management – Himalaya publishing house – 2019
2.	Robert Hisrich, Michael Peters, Dean A. Sheperd, Sabyasachi Sinha – Entrepreneurship - TMH – 2020.
REFERENCEBOOKS	
1.	Vasant Desai – Entrepreneurship Management - Himalaya Publishing House- 2018.
2.	Robert J.Calvin - Entrepreneurial Management – TMH - 2009.
3.	Gurmeet Naroola - The entrepreneurial Connection – TMH - 2009.
4.	.ArunaKaulgud - Entrepreneurship Management - Vikas publishing house - 2009.
WEBRESOURCES	
1.	https://nptel.ac.in/courses/110105067/50
2.	http://www.yourarticlelibrary.com/project-management/5-methods-of-project-appraisal-explained/40771
3.	https://springhouse.in/government-schemes-every-entrepreneur/

Optimization Techniques
CSE (DS)

Course Category	Open Elective	**Course Code**	20ME5T29
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
To make the students learn about	
1	Classical optimization techniques
2	Numerical methods for optimization
3	Genetic algorithm and Genetic programming
4	Multi-Objective Genetic algorithm
5	Optimization in design and manufacturing systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the Classical optimization techniques for single and multi-variable problems with and with and without constraints.	K4
CO2	Apply numerical methods for optimization of manufacturing related problems	K3
CO3	Apply the Principles of genetic algorithm and genetic programming to manufacturing related problems	K3
CO4	Analyze the Multi-Objective Genetic algorithm for industrial problems	K4
CO5	Solve engineering problems by using optimization techniques in design and manufacturing systems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2	2	1	-	-	-	-	-	-	-	2	1
CO2	2	3	2	2	1	-	-	-	-	-	-	1	2	1
CO3	2	3	2	2	1	-	-	-	-	-	-	1	2	1
CO4	2	3	2	2	1	-	-	-	-	-	-	1	2	1
CO5	2	3	2	2	1	-	-	-	-	-	-	1	2	1

COURSE CONTENT	
UNIT I	**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.
UNIT II	**NUMERICAL METHODS FOR OPTIMIZATION**: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.
UNIT III	**GENETIC ALGORITHM (GA):** Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA. **GENETIC PROGRAMMING (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.
UNIT IV	**MULTI-OBJECTIVE GA**: Pareto's analysis, non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems.
UNIT V	**APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS**: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

TEXT BOOKS	
1.	Engineering Optimization Theory & Practice, Singiresu S. Rao New Age International Publishers, Ltd.
2.	Optimization for Engineering Design, Kalyanmoy Deb, PHI Publishers.

REFERENCE BOOKS	
1.	Genetic algorithms in Search, Optimization, and Machine learning, D.E.Goldberg, Addison-Wesley Publishers
2.	Multi objective Genetic algorithms, Kalyanmoy Deb, PHI Publishers
3.	Optimal design, Jasbir Arora, Mc Graw Hill (International) Publishers
4.	Optimum Design of Mechanical Elements, Ray C. Johnson, John Wiley & sons, Inc., New York.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/111/105/111105039/
2.	https://nptel.ac.in/courses/106/108/106108056/
3.	https://nptel.ac.in/courses/112/105/112105235/
4.	https://onlinecourses.nptel.ac.in/noc21_me43/preview
5.	https://www.nptel.ac.in/content/syllabus_pdf/112103301.pdf

Professional Elective-I
Software Engineering
CSE (DS)

Course Category	Professional Core	**Course Code**	20CS5T05
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Give exposure to phases of Software Development ,common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process
2	Give exposure to a variety of Software Engineering practices such as requirements analysis And specification, code analysis, code debugging, testing, traceability, and version control
3	Give exposure to Software Design techniques

COURSE OUT COMES		**BTL**
Up on successful completion of the course, the student will be able to:		
CO1	Ability to transform an Object-Oriented Design in to high quality, Executable code	K3
CO2	Skills to design, implement, and execute test cases at the Unit and Integration level	K3
CO3	Compare conventional and agile software methods	K4
CO4	Skills to design Software Architectural components.	K3
CO5	Analyze the interface analysis and Testing strategies.	K4

K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6 Creating

Contribution of Course Out comes towards achievement of Program Outcomes(1–Low, 2-Medium, 3–High)

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-	3	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	3	2	-	-	-	2	-	-	2	3	-	3
CO4	3	2	3	2	3	-	-	-	2	-	-	2	3	3	3
CO5	3	3	3	2	3	-	-	-	2	-	-	3	3	3	3

COURSE CONTENT	
UNIT I	The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.
UNIT II	Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Ground work, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.
UNIT III	Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow- Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modeling, Requirements Modeling for Web Apps.
UNIT IV	Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for Web Apps, Designing Traditional Components, Component-Based Development.
UNIT V	The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Web App Interface Design, Design Evaluation, Elements of Software Quality Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for Web Apps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing ,Basis Path Testing.

TEXT BOOKS	
1.	Software Engineering a practitioner‘s approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2.	Software Engineering, Ian Sommer ville, Ninth Edition, Pearson.
REFERENCE BOOKS	
1.	Software Engineering, A PreciseApproach,PankajJalote,WileyIndia,2010.
2.	Software Engineering, Ugrasen Suman, Cengage.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105182/
2.	https://nptel.ac.in/courses/106/105/106105182/
3.	https://nptel.ac.in/courses/106/101/106101061/
4.	https://www.coursera.org/learn/software-processes-and-agile-practices
5.	http://www.geeksforgeeks.org/software-engineering-gq/

Object Oriented Analysis and Design
CSE (DS)

Course Category	Professional Core	**Course Code**	20CS5T16
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Become familiar with all phases of OOAD
2	Master the main features of the UML.
3	Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains
4	Learn the Object design Principles and understand how to apply them towards Implementation

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the nature of complex system and its solutions	K4
CO2	Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships	K2
CO3	Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications	K4
CO4	Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams	K4
CO5	Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT	
UNIT I	**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation
UNIT II	**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.
UNIT III	**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.
UNIT IV	**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System
UNIT V	**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams **Case Study:** Weather Forecasting

TEXT BOOKS	
1.	Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, KelliaHouston , “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2022, PEARSON.
2.	Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
REFERENCE BOOKS	
1.	Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2.	Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3.	Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4.	Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.
WEB RESOURCES	
1.	http://www.digimat.in/nptel/courses/video/106105153/L51.html

DevOps
CSE (DS)

Course Category	Job Oriented	**Course Code**	20IT5T07
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES

The objective of the course is to

1	DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.	K2
CO2	Describe DevOps & DevSecOps methodologies and their key concepts.	K2
CO3	Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models.	K2
CO4	Set up complete private infrastructure using version control systems and CI/CD tools.	K2
CO5	Know about DevOps maturity model.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO2	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO3	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO4	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO5	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2

COURSE CONTENT	
UNIT I	Phases of Software Development life cycle. Values and principles of agile software development.
UNIT II	Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.
UNIT III	DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes.
UNIT IV	CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices
UNIT V	DevOps Maturity Model: Key factors of DevOps maturity model, stages of DevOps maturity model, DevOps maturity Assessment

TEXT BOOKS	
1.	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. Gene Kim, Jez Humble, Patrick Debois, and John Willis
2.	Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, Jez Humble and David Farley
3.	Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davis &Ryn Daniels.

REFERENCE BOOKS	
1.	Httermann, Michael, “DevOps for Developers”, Apress Publication.
2.	Joakim Verona, “Practical DevOps”, Pack publication

WEB RESOURCES	
1.	https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises.
2.	http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration)
3.	https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat.
4.	https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps.
5.	https://mva.microsoft.com/training-topics/devops#!lang=1033 – Lists no. of courses related to DevOps and various tools, methods used.
6.	http://devops.com/ - A good blog, has lots of contents.
7.	https://dzone.com/devops-tutorials-tools-news - Lots of l links and tutorials

Game Theory

CSE (DS)

Course Category	Professional Core	**Course Code**	20AM6T05
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Probability and Statistics	**InternalAssessmentSemesterEnd ExaminationTotal Marks**	30 70 100

COURSE OBJECTIVES

The student will:

1	Learn the various methods of Game Theory and how to get the solutions.
2	Learn about Mixed and Correlated Equilibrium Interpretations.
3	Learn about the various models of Knowledge and Equilibrium.
4	Apply Extensive games with perfect information.
5	Know about the Repeated games and its strategies.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Discuss the various methods of Game Theory concepts and how to get the solutions.	K1
CO2	Discuss about Mixed and Correlated Equilibrium Interpretations**.**	K2
CO3	Explain about the various models of Knowledge and Equilibrium.	K3
CO4	Learn about Extensive Games with Perfect Information.	K4
CO5	Implement about Repeated Games and its various strategies.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	1	1	--	--	--	--	--	--	2	2	2	3
CO2	2	2	2	1	1	--	--	--	--	--	--	2	1	1	2
CO3	2	1	1	2	2	--	--	--	--	--	--	1	1	1	2
CO4	2	2	2	1	1	--	--	--	--	--	--	1	1	1	2
CO5	3	2	1	1	1	--	--	--	--	--	--	1	1	1	3

COURSE CONTENT	
UNIT-I	**Introduction**: Game Theory, Games and Solutions, Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation Nash Equilibrium- Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games.
UNIT-II	**Mixed, Correlated, and Evolutionary Equilibrium -** Mixed Strategy, Nash Equilibrium Interpretations of Mixed Strategy, Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium, Rationalizability and Iterated Elimination of Dominated Actions. - Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.
UNIT-III	**Combinatorial games**: Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games.
UNIT-IV	**Extensive Games with Perfect Information** – Extensive Games with Perfect Information Sub game Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated Strategies.
UNIT-V	Cournot's Oligopoly, Bertrand's Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg's model of Duopoly, Buying Votes, Committee Decision making, Repeated Games, Prisoner's Dilemma, Super modular Game and Potential games.

TEXT BOOKS	
1.	M. J. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994.
2.	Martin Osborne, An Introduction to Game Theory, Oxford University Press. 1994
REFERENCE BOOKS	
1.	D. Fudenberg and J. Tirole, Game Theory, MIT Press. 1991.
2.	J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, New York:n John Wiley and Sons.
3.	R.D. Luce and H. Raiffa, Games and Decisions, New York: John Wiley and Sons.
4.	G. Owen, Game Theory, (Second Edition), New York: Academic Press.
WEB RESOURCES:	
1	Swayam NPTEL: Game Theory: https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Operating Systems & Compiler Design Lab
CSE (DS)

Course Category	Professional Core	**Course Code**	20AI5L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment Semester** **End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
The student will:	
1	To provide an understanding of the language translation peculiarities by designing a complete translator for a mini language.
2	To provide an understanding of the design aspects of operating system

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze important algorithms eg. Process scheduling and memory management algorithms	K3
CO2	Categorize the operating system's resource management techniques, dead lock management techniques, memory management techniques	K4
CO3	To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO2	1	3	3	3	3	-	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3

List of Experiments	
Part-A (OS)	
1	Simulate the following CPU scheduling algorithms a) Round Robin b) Shortest Job First c) Priority
2	Multiprogramming-Memory management- Implementation of fork (), wait (), exec() and exit(), System calls
3	Simulate the following a) Multiprogramming with a fixed number of tasks (MFT) b) Multiprogramming with a variable number of tasks (MVT)
4	Simulate Bankers Algorithm for Dead Lock Avoidance
5	Simulate Bankers Algorithm for Dead Lock Prevention
6	Simulate the following page replacement algorithms. a) First In First Out b) Least Recently Used
7	Simulate the following File allocation strategies a) Sequenced b) Indexed
Part-B (CD)	
1	Write a Lex program to implement a Lexical Analyzer using LEX-tool.
2	Write a C Program to simulate Lexical Analyzer to validate a given input string.
3	Write a C Program to implement Brute force technique of Top down parsing.
4	Write a C Program to compute the First and Follow sets for the given Grammar.
5	Write a C Program to check the validity of input string using predictive parser.
6	Write a C program to implement LR Parser to accept the given input string.
7	Simulate the calculator using LEX and YACC tool.
8	Write a C program to implement Code Generation Algorithm for a given expression.

Machine Learning using Python Lab
CSE (DS)

Course Category	Professional Core	**Course Code**	20AM5L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Python Programming	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES

The student will:

1	This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Implement procedures for the machine learning algorithms.	**K1**
CO2	Design and Develop Python programs for various Learning algorithms	**K2**
CO3	Apply appropriate data sets to the Machine Learning algorithms	**K3**
CO4	Develop Machine Learning algorithms to solve real world problems	**K4**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	3	2	1	--	--	--	--	--	--	--	--	2	2	2	3
CO2	3	2	1	--	--	--	--	--	--	--	--	1	1	1	3
CO3	3	2	1	--	--	--	--	--	--	--	--	--	1	1	3

List of Experiments	
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier
5	Develop a program for Bias, Variance, Remove duplicates , Cross Validation
6	Write a program to implement Categorical Encoding, One-hot Encoding
7	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
8	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
11	Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
12	Exploratory Data Analysis for Classification using Pandas or Mat plot lib.
13	Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
14	Write a program to Implement Support Vector Machines and Principle Component Analysis.
15	Write a program to Implement Principle Component Analysis.

Skill Oriented Course – III

Continuous Integration and Continuous Delivery using DevOps

CSE (DS)

Course Category	Skill Oriented	**Course Code**	20IT5S05
Course Type	Laboratory	**L-T-P-C**	1-0-2-2
Prerequisites		**Total Marks**	**50**

COURSE OBJECTIVES

The objectives of the course is to

1	To understand the concept of DevOps with associated technologies and methodologies.
2	To be familiarized with Jenkins, which is used to build& test software Applications & Continuous integration in Devops environment.

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Remember the importance of DevOps tools used in software development life Cycle	K1
CO2	Understand the importance of Jenkins to Build, Deploy and Test Software Applications	K2
CO3	Examine the test results of a java program in Jenkins	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO2	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2
CO3	1	1	2	1	3	-	-	-	-	-	-	-	0	3	2

COURSE CONTENT	
0	**Prerequisite:** To Understand the Concept of DevOps with related technologies which are used to Code, Build, Test, Configure & Monitor the Software Applications.
1	Installation of Jenkins
2	Configuration of Jenkins i.e. creating a first admin user and installing required plugins.
3	To Create a Freestyle project in Jenkins to test, and deploy Java or Web Applications using Net beans or eclipse.
4	To Create a Pipeline project in Jenk in stotest, and deploy Javaor Web Applications using Net beans or eclipse.
5	To do Source code management from GIT in Jenkins while developing a Java application
6	To do a Controller test in Jenkins while developing a Java application
TEXT BOOKS	
1.	John Ferguson Smart, "Jenkins, The Definitive Guide ",O' Reilly Publication.
2.	Learn to Master DevOps by Star Edu Solutions.
REFERENCE BOOKS	
1.	Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies ",Wiley Publication
2.	Httermann, Michael, "DevOps for Developers", A press Publication.
3.	Joakim Verona,"Practical DevOps", Pack publication
WEB RESOURCES	
1.	https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises.
2.	http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration)
3.	https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat.
4.	https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps.

Helical Insight
CSE (DS)

Course Category	Professional Core	**Course Code**	20DS5S02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Data Mining	**Internal Assessment** **Semester End Examination** **Total Marks**	0 50 50

COURSEOBJECTIVES	
1.	The main objective of the course is to understand a business intelligence tool Helical Insight- the a new frame work for data analysis
2.	To understand the process of generating reports and dashboards

COURSEOUTCOMES **Upon successful completion of the course, the student will be able to:**		**Cognitive level**
CO1	develop data analysis on top of your data and embed it	K3
CO2	support better business decision-making	K3
CO3	implement their own custom business processes very easily	K3

K1:Remember,K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	-	2	1	1
3	3	2	3	2	2	-	-	-	-	-	-	-	2	2	1

COURSECONTENT	
1.	Installation of Helical Insight
2.	Develop a Helical Insight application with various Filters
3.	Develop a Helical Insight application to export Reports and Dashboards
4.	Develop a Helical Insight application to Export Reports and Dash Boards
5.	Develop a Helical Insight application to Integrate using iFrame
6.	Develop a Helical Insight application to customize Tables with Drill Down Function
7.	Develop a Helical Insight application to customize Adhoc Charts with Drill Down Functions, Axis Chart, Non-Axis Chart and Gauge Chart
8.	Develop a Helical Insight application with various operations in Dashboard Designer
9.	Develop a Helical Insight application with Geographical Maps
10.	Develop a Helical Insight application on Tomcat with MySQL
11.	Develop a Helical Insight application with SQL Server database
12.	Develop a Helical Insight application with SQlite database
13.	Develop a Helical Insight application with HBase
14.	Develop a Helical Insight application with MongoDB using Apache Drill
15.	Develop a Helical Insight application with Hive

WEB RESOURCES	
1.	https://www.helicalinsight.com/guide/
2.	https://helicalinsight.github.io/helicalinsight/#/
3	https://www.helicalinsight.com/helical-insight-installation-guide
4	https://www.helicalinsight.com/deploy-helical-insight-application-tomcat-mysql
5	https://www.helicalinsight.com/installation-of-sql-server-on-windows-creating-data-source-connection-in-helical-insight-to-sql-server
6	https://www.helicalinsight.com/open-source-bi-to-sqlite/
7	https://www.helicalinsight.com/open-source-business-intelligence-bi-tool-for-hbase
8	https://www.helicalinsight.com/connecting-mongodb-using-apache-drill/
9	https://www.helicalinsight.com/open-source-bi-tool-for-hive

Employability Skills-I

CSE (DS)

Course Category	Humanities	**Course Code**	**20HE5T02**
Course Type	Theory	**L-T-P-C**	2 –0 – 0-0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

COURSE OBJECTIVE:	
1	To get employment in corporate world.

COURSE OUTCOMES		**LEVEL**
Upon successful completion of the course, the student will be able to:		
CO1	Enables the student to be aware of integrated word building to use in communication.	**K -I**
CO2	Grooms the learner in their mental flexibility to be fit in team for an organization.	**K –II**
CO3	Strengthens in syntactic construction of the language.	**K -II**
CO4	Empowers the learner in the language comprehension skills.	**K -II**
CO5	Assists the learner to present academic and professional abilities through writing skills.	**K-I**

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO 1	0	0	0	0	0	0	0	0	0	2	0	0
CO 2	0	0	0	0	0	0	0	0	2	0	0	0
CO 3	0	0	0	0	0	0	0	0	0	1	0	0
CO 4	0	0	0	0	0	0	0	0	0	1	0	1
CO 5	0	0	0	0	0	0	0	0	0	1	0	0

Course contents:

UNIT – I

Vocabulary building /Language fluency.

Connotations - Synonyms and Antonyms - Prefix and Suffix - Phrasal Verbs – Collocations.

UNIT-II:

Attitude/ Team Building

Types of attitudes – Positive attitude – Importance of team work- advantages of team work.

UNIT-III:

Sentence Completion

Restatement – Comparison – Contrast - Cause and effect

UNIT-IV:

Reading comprehension

Literal Comprehension - Interpretative Comprehension - Applied Comprehension - Affective Comprehension

UNIT-V:

Resume Writing

Chronological resume - Functional resume

Reference Books:

TEXT BOOKS	
1.	**Soft Skills - Enhancing Employability: Connecting Campus with Corporate** by M. S. RaoI K International Publishing House Pvt. Ltd.
2.	**Enhancing Employability @ Soft Skills** by Shalini Verma Pearson Education.
3.	**Soft Skills at Work: Technology for Career Success: 0** by Beverly Amer
4.	**Resume To HR Interview Prep (Employability Enhancement Series)** by Rajesh Vartak
WEB RESOURCES	
1.	https://www.twinkl.co.uk/search?q=employability
2.	https://www.realityworks.com/product/online-employability-skills-programs/
3.	https://connectingcredentials.org/resources/interactive-employability-skills-framework/
4.	https://oklahoma.gov/careertech/educators/resource-center/employability-and-adult-basic-education-resources.html
5.	https://barclayslifeskills.com/educators

Computer Networks

CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20CS5T08
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Understand the basic taxonomy, terminology and architectures of the computer networks
2	Analyze the services, protocols and features of the various layers of computer networks.
3	Understand the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the basic concepts of Computer Networks	K1
CO2	Analyze protocols implemented in Data Link Layer for error and flow control.	K4
CO3	Design applications using internet protocols.	K3
CO4	Implement routing and congestion control algorithms.	K3
CO5	Develop application layer protocols and understand socket programming.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	2	2	0	0	0	0	1	0	3	3	0
CO2	3	3	3	3	2	3	0	0	0	0	3	0	3	3	0
CO3	3	2	2	1	1	3	0	0	0	0	1	0	3	2	0
CO4	3	3	3	3	3	0	0	0	0	0	0	0	3	3	0
CO5	3	3	3	3	3	0	0	0	0	0	0	0	3	3	0

COURSE CONTENT	
UNIT I	**Introduction:** Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History. **Physical Layer –**Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.
UNIT II	**Data link layer:** Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's

	complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. **Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi link PPP.
UNIT III	**Media Access Control: Random Access**: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA). **Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.
UNIT IV	**The Network Layer Design Issues** – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices
UNIT V	**The Transport Layer:** Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP. **Application Layer** –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet ,- Resolution-Caching- Resource Records- DNS messages-Registrars-security of DNS Name Servers, SNMP.

TEXT BOOKS	
1.	Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2.	Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.
REFERENCE BOOKS	
1.	Data Communications and Networks- Achut S Godbole, AtulKahate ,Second Edition ,McGraw Hill Education
2.	Computer Networks, Mayank Dave, CENGAGE, First Edition,2017
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106105081
2.	https://nptel.ac.in/courses/106105183

Big Data Analytics

CourseCategory	ProfessionalCore	**CourseCode**	**20DS6T02**
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Mining	**InternalAssessment** **SemesterEndExamination** **TotalMarks**	**30** **70** **100**

COURSEOBJECTIVES	
1	To optimize business decisions and create competitive advantage with Big Data analytics
2	To learn to analyze the big data using intelligent techniques
3	To introduce programming tools PIG & HIVE in Hadoop echo system

COURSEOUTCOMES		**Cognitive level**
Uponsuccessfulcompletionofthecourse,thestudentwillbeableto:		
CO1	Illustrate big data challenges in different domains including social media, transportation, finance and medicine	K2
CO2	Enumerate and apply the features of Cassandra	K2
CO3	Design and develop Hadoop and Map Reduce programs	K3
CO4	Perform data analysis using Apache Spark	K2
CO5	Analyze the data analytics process with a case study	K3

K1:Remember,K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSECONTENT	
UNITI	**Types of Digital Data:** Classification of Digital Data. Introductionto Big Data: Characteristic of Data, Evolution of Big Data,Definition of Big Data, Challenges with Big Data, What is BigData? **Big Data Analytics:** Where do we Begin?, What is BigData Analytics?, What Big Data Analytics isn't?, Classification ofAnalytics, Terminologies Used in Big Data Environments. TheBig Data Technology Landscape: NoSQL.**(Text Book 1)**
UNITII	**Introduction to Cassandra:** Apache Cassandra – An Introduction,Features of Cassandra, CQL Data Types, CQLSH, Keyspaces,CRUD, Collections, Using a Counter, Time to Live, AlterCommands, Import and Export.**(Text Book 1)**
UNITIII	**Hadoop** : Hadoop Overview, HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources andApplications with Hadoop YARN (Yet another ResourceNegotiator). **MAPREDUCE:**Introduction to MAPREDUCE Programming: Introduction,Mapper, Reducer, Combiner, Partitioner, Searching, Sorting,Compression.**(Text Book 1)**
UNITIV	**Introduction to Data Analysis with Spark**: What is Apache Spark,A unified Spark, Who uses Spark and for what?, A Brief Historyof Spark, Spark version and releases, Storage layers for Spark. **Programming with RDDs:** RDD Basics, Creating RDDs, RDDOperations, Passing functions to Spark, Common Transformationsand Actions, Persistence.**(Text Book 2)**
UNITV	**JasperReport using Jaspersoft:** Introduction to JasperReports, Connecting to MongoDB NoSQL Database, Connecting to Cassandra NoSQL Database. **Few Interesting Differences:** Difference between Data Warehouse and Data Lake, Difference between RDBMS and HDFS, Difference between HDFS and HBase, Difference between Hadoop MapReduce and Spark, Difference between Pig and Hive**(Text Book 1)**
TEXTBOOKS	
1.	Big Data and Analyticsby Seema Acharya,SubhashiniChellappan, Second Edition, Wiley India Pvt. Ltd., 2019
2.	Learning Spark:Lightning-Fast Big DataAnalysisby Andy Konwinski,HoldenKarau,MateiZaharia,Patrick Wendell, First Edition, O'Reilly, 2015
REFERENCEBOOKS	
1.	Big Data Analytics, by RadhaShankarmani, MVijayalakshmi, Second Edition, Wiley India Pvt. Ltd., 2016
2.	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams

	with Advanced Analytics", John Wiley& sons, 2012.
3.	Hadoop: The Definitive Guideby Tom White, O'Reilly Media, Inc., 2009
4.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.
WEBRESOURCES	
1.	http://hadoop.apache.org/
2.	https://nptel.ac.in/courses/106104189/
3.	https://www.edx.org/course/big-data-fundamentals
4.	https://www.coursera.org/specializations/big-data
5.	https://www.wileyindia.com/big-data-and-analytics-2ed.html

Design and Analysis of Algorithms

CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20CS5T09
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Able to interpret algorithms and their time complexity
2	Able to interpret Greedy and Divide and Conquer methods using algorithms
3	Able to solve backtracking and dynamic programming problems
4	Able to identify NP-Hard & NP-Complete classes

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms	K4

CO2	List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method	K3
CO3	Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.	K3
CO4	Analyze design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches	K4
CO5	Demonstrate NP-Hard and NP-Complete classes, Cook's theorem	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-

COURSE CONTENT	
UNIT I	**Introduction:** Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms.
UNIT II	**Divide and Conquer:** General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort. **The Greedy Method:** The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.
UNIT III	**Dynamic Programming:** The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, The traveling salesperson problem.
UNIT IV	**Backtracking:** The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.
UNIT V	**P and NP problems:** Basic concepts, Class P, Fractional Knapsack problem in P, Class NP, Fractional Knapsack problem in NP **NP-Hard and NP-Complete problems:** Basic concepts, non-deterministic algorithms, NP -

	Hard and NP-Complete classes, Cook's theorem.

TEXT BOOKS	
1.	Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press,2010.
2.	Introduction to Algorithms Thomas H. Cormen, PHI Learning,Fourth Edition 2020.
REFERENCE BOOKS	
1.	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press 2015.
2.	Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publications,2010

3.	S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press,2014.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105164/

DeepLearning

CSE (AIML),CSE(DS)

IIIBTechIISemester

CourseCategory	ProfessionalCore	**CourseCode**	20AM6T04
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	MachineLearning	**Internal Assessment** **SemesterEndExaminationTotal Marks**	30 70 100

COURSEOBJECTIVES	
Thestudentwill:	
1	Learndeeplearningmethodsforworkingwithsequentialdata.
2	Learndeeprecurrentandmemorynetworks.
3	LearndeepTuringmachines.
4	Applysuchdeeplearningmechanismstovariouslearningproblems.
5	Knowtheopenissuesindeeplearning,and haveagraspofthecurrentresearchdirections.

COURSEOUTCOMES		
Uponsuccessfulcompletion ofthecourse,thestudent willbeableto:		**CognitiveLevel**
CO1	DemonstratethefundamentalconceptslearningtechniquesofArtificialIntelligence, MachineLearningandDeepLearning.	K1
CO2	Discuss theNeuralNetworktraining,variousrandommodels**.**	K2
CO3	ExplaintheTechniquesofKeras,TensorFlow,TheanoandCNTK.	K3
CO4	ClassifytheConceptsofCNNandRNN.	K4
CO5	ImplementInteractiveApplicationsofDeepLearning.	K5

K1:Remember,K2:Understand,K3: Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium,3–High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	1	--	--	--	--	--	--	2	2	2	3
CO2	2	2	2	1	1	--	--	--	--	--	--	2	1	1	2
CO3	2	1	1	2	2	--	--	--	--	--	--	1	1	1	2
CO4	2	2	2	1	1	--	--	--	--	--	--	1	1	1	2
CO5	3	2	1	1	1	--	--	--	--	--	--	1	1	1	3

COURSECONTENT	
UNIT-I	**Fundamentals of Deep Learning**: Artificial Intelligence, History of Machine learning: ProbabilisticModeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and GradientBoostingMachines, **Fundamentals of Machine Learning**: Four Branches of Machine Learning, Evaluating MachinelearningModels,OverfittingandUnderfitting.[**TextBook2**]
UNIT-II	**IntroducingDeepLearning**:BiologicalandMachineVision,HumanandMachineLanguage, ArtificialNeuralNetworks,TrainingDeep Networks,ImprovingDeep Networks.[**RefBook1**]
UNIT-III	**Neural Networks**: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, TheanoandCNTK,SettingupDeepLearningWorkstation,ClassifyingMovieReviews,BinaryClassification,Classifyingnewswires,MulticlassClassification.[**Text Book2**]
UNIT-IV	**ConvolutionalNeuralNetworks**:NerualNetworkandRepresentationLearing,ConvolutionalLayers,MultichannelConvolutionOperation. **RecurrentNeuralNetworks**:IntroductiontoRNN,RNNCode,PyTorchTensors:DeepLearningwithPyTorch,CNNinPyTorch.[**RefBook1**]
UNIT-V	**InteractiveApplicationsofDeepLearning**:MachineVision,NaturalLanguageprocessing,GenerativeAdversialNetworks,DeepReinforcementLearning.[**TextBook1**] **DeepLearningResearch**:Autoencoders,DeepGenerativeModels:BoltzmannMachinesRestrictedBoltzmannMachines,DeepBeliefNetworks.[**Text Book1**]

TEXTBOOKS	
1.	DeepLearning-IanGoodfellow,YoshuaBengioandAaronCourvile,MITPress,2016
2.	DeepLearningwithPython-FrancoisChollet,ReleasedDecember 2017,Publisher(s):ManningPublications,ISBN:9781617294433.
REFERENCEBOOKS	
1.	DeepLearningIllustrated:AVisual,InteractiveGuidetoArtificialIntelligence-JonKrohn,GrantBeyleveld,AglaéBassens,ReleasedSeptember2019,Publisher(s):Addison-WesleyProfessional,ISBN:9780135116821
2.	DeepLearningfromScratch-SethWeidman,ReleasedSeptember2019,Publisher(s):O'ReillyMedia,Inc.,ISBN:9781492041412
3.	ArtificialNeuralNetworks,Yegnanarayana,B.,PHILearningPvt. Ltd, 2009.
4.	MatrixComputations,Golub,G.,H.,andVanLoan,C.,F,JHUPress,2013.
5.	NeuralNetworks:AClassroomApproach,SatishKumar,TataMcGraw-HillEducation,2004.
WEBRESOURCES:	
1	SwayamNPTEL:DeepLearning:https://onlinecourses.nptel.ac.in/noc22_cs22/preview

Software Project Management

CSE, CSE(AI), CSE(AI&ML), CSE(DS)

Course Category	Professional Core	**Course Code**	20CS5T12
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2	To compare and differentiate organization structures and project structures
3	To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply the process to be followed in the software development life-cycle models	K3
CO2	Apply the concepts of project management & planning	K3
CO3	Develop the project plans through managing people, communications and change	K3
CO4	Conduct activities necessary to successfully complete and close the Software projects	K2
CO5	Implement communication, modeling, and construction & deployment practices in software development	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	3	-	-	1	2	2	3	2	2	2	3
CO2	1	2	2	2	1	-	-	1	2	2	3	2	2	2	2
CO3	1	1	2	1	2	-	-	1	2	2	3	2	1	2	3
CO4	1	2	2	2	1	-	-	1	2	2	3	2	3	1	2
CO5	1	2	1	2	3	-	-	1	2	2	3	2	3	2	3

COURSE CONTENT	
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, improving team effectiveness, improving automation, Achieving required quality, peer inspections. **The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative 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.
UNIT III	**Model based software architectures:** A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows. **Checkpoints of the process: Major** mile stones, 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, Metrics automation.
UNIT V	Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

TEXT BOOKS	
1.	Software Project Management, Walker Royce, PEA, 2005.
2.	Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.7/e 2013.
REFERENCE BOOKS	
1.	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
2.	Software Project Management, Bob Hughes,6/e, Mike Cotterell, TMH,2017
3.	Software Project Management, Joel Henry, PEA,2003
4.	Software Project Management in practice, Pankaj Jalote, PEA, 2005
5.	Effective Software Project Management, Robert K.Wysocki, Wiley,2006
6.	Project Management in IT, Kathy Schwalbe, Cengage,Third Edition 2004
WEB RESOURCES	

1.	https://nptel.ac.in/courses/106/105/106105218/

DATA WRANGLING IN DATA SCIENCE

Course Category	Professional Core	**Course Code**	**20DS6T03**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Science through Python	**Internal Assessment Semester End Examination Total Marks**	**30 70 100**

COURSE OBJECTIVES	
1	To get exposure to the exploratory data analysis
2	To understand the need for web scraping
3	To be aware of various data storage file formats

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Identify and execute the basic data format.	K2
CO2	Perform the computations with Excel and pdf files	K2
CO3	Understand the concepts of data cleanup	K3
CO4	Explore and analyze the Image and video data	K2
CO5	Understand the concepts web scraping	K3

K1: Remember, K2: Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNIT I	**Introduction to Data Wrangling and Data Quality:** What Is "Data Wrangling"?, What Is "Data Quality"?, Data Integrity, Data "Fit". Understanding Data Quality : Assessing Data Fit, Assessing Data Integrity, Improving Data Quality**(Text Book 2)** Data Meant to be Read by Machines-CSV Data-JSON Data-XML Data**. (Text Book 1)**
UNIT II	**Working With Excel Files And Pdfs**: Installing Python Packages, Parsing Excel Files, Parsing Excel Files, Getting Started with Parsing. PDFs and Problem Solving in Python: Programmatic Approaches to PDF Parsing, Converting PDF to Text-Parsing PDFs Using pdfminer. Acquiring and Storing Data-Databases: A Brief Introduction, Relational Databases: MySQL and PostgreSQL, Non-Relational Databases: NoSQL, When to Use a Simple File, Alternative Data Storage(**Text Book 1)**
UNIT III	**Data Cleanup:** Why Clean Data?- Data Cleanup Basics-Identifying Values for Data Cleanup-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates-Fuzzy Matching-RegEx Matching-Normalizing and Standardizing the Data-Saving the Data-Determining suitable Data Cleanup-Scripting the Cleanup Testing with New Data**(Text Book 1)**
UNIT IV	**Data Exploration And Analysis:**Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers-Creating Groupings-Analyzing Data-Separating and Focusing the Data, Presenting Data-Visualizing the Data-Charts-Time-Related Data-Maps-Interactives-Words-Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open Source Platforms**(Text Book 1)**
UNIT V	**Web Scraping**: What to Scrape and How-Analyzing a Web Page-Network/Timeline-Interacting with JavaScript-In-Depth Analysis of a Page-Getting Pages-Reading a Web Page-Reading a Web Page with LXML-XPath-Advanced Web Scraping-Browser-Based Parsing-Screen Reading with Selenium-Screen Reading with Ghost.Py. Spidering the Web-Building a Spider with Scrapy-Crawling Whole Websites with Scrapy**(Text Book 1)**

TEXTBOOKS	
1.	Data Wrangling with Python, Jacqueline Kazil& Katharine Jarmul, O'Reilly Media, Inc,2016
2	**Practical Python Data Wrangling and Data Quality by Susan E. McGregor, O'Reilly Media, Inc., Released December 2021, ISBN: 9781492091509**

REFERENCEBOOKS	
1.	Hands-On Data Analysis with Pandas, Stefanie Molin, Packt Publishing Ltd,2019
2.	Practical Data Wrangling, Allan Visochek, Packt Publishing Ltd,2017
3.	Principles of Data Wrangling: Practical Techniques for Data Preparation, TyeRattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras, , O'Reilly Media, Inc,2017

WEBRESOURCES	
1.	https://www.udemy.com/course/data-wrangling-with-python/
2.	https://www.openculture.com/free-online-data-science-courses
3.	https://www.classcentral.com/course/dataanalysiswithpython-11177
4.	https://www.gbv.de/dms/ilmenau/toc/827365454.PDF

ETL PRINCIPLES

Course Category	Professional Core	**Course Code**	**20DS6T04**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Mining	**Internal Assessment Semester End Examination Total Marks**	**30 70 100**

COURSEOBJECTIVES	
1	To identify the differences between Fact Tables and Dimension Tables
2	To understand Business Rules in the ETL Process
3	To Compare various Slowly Changing Dimensions

COURSEOUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Differentiate between Fact Tables and Dimension Tables	K2
CO2	Collect Business Rules in the ETL Process	K2
CO3	Compare various Slowly Changing Dimensions	K2
CO4	Loading Fact Tables	K3
CO5	Enumerate various ETL Operations	K2

K1: Remember, K2: Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNITI	**ETL Data Structures:** To Stage or Not to Stage, Designing the Staging Area, Data Structures in the ETL System: Flat files, XML Data Sets, Relational Tables, Independent DBMS Working Tables, Third Normal Form Entity/Relation Models, Nonrelational Data Sources, Dimensional Data Models, Fact Tables, Dimension Tables, Atomic and Aggregate Fact Tables, Surrogate Key Mapping Tables
UNITII	**Extracting:** Logical Data Map, Components of the Logical Data Map, Using Tools for the Logical Data Map, Building the Logical Data Map- Data Discovery Phase, Data Content Analysis, Collecting Business rules in the ETL Processes, Integrating Heterogeneous Data Sources, Challenge of Extracting from Disparate Platforms, Flat files, XML Sources, Web Log Sources, ERP System Sources
UNITIII	**Cleaning and Conforming:** Defining Data Quality, Cleaning Deliverables, Known Table Row Counts, Column Nullity, Column Numeric and Date Ranges, Column Length Restriction, Column Explicit Valid Values, Column Explicit Invalid Values, Conformed Dimensions, Designing the Conformed Dimensions, Conformed Facts **Delivering Dimension Tables:** The Basic Structure of a Dimension, The Grain of a Dimension, Flat Dimensions and Snowflaked Dimensions, Date and Time Dimensions, Big Dimensions, Small Dimensions, Dimensional Roles, Degenerate Dimensions, Slowly Changing Dimensions, Multivalued Dimensions and Bridge Tables
UNITIV	**Delivering Fact Tables:** Basic Structure of a Fact Table, Surrogate Key Pipeline, Fundamental Grains: Transaction Grain Fact Tables, Periodic Snapshot Fact Table, Accumulating Snapshot Fact Tables, Managing Indexes, Managing Partitions, Outwitting the Rollback Log, Loading the Data, Incremental Loading, Inserting Facts, Updating and Correcting Facts, Negating Facts, updating Facts, Deleting Facts, Factless Fact Tables
UNITV	**Operations:** Scheduling and Support, Migrating to Production, Achieving optimal ETL performance: Estimating Load Time, Vulnerabilities of Long-Running ETL processes, Minimizing Risk of Load Failures, Purging Historic Data, Monitoring ETL System: Measuring ETL Specific Performance Indicators, Measuring Infrastructure Performance Indicators, Tuning ETL Processes, ETL System Security

TEXTBOOKS	
1.	Ralph Kimball, Joe Caserta, "The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data," Wiley, 2004.
2	The Data Warehouse Lifecycle Toolkit by Becker, Bob, Ross, Margy, Kimball, Ralph, Mundy, Joy, Thornthwaite, Warren, 2nd edition, John Wiley & Sons, 2011

REFERENCEBOOKS	
1.	Silvers, Fon, "Building and Maintaining a Data Warehouse," Ukraine: CRC Press, 2008.
2.	**Building a Data Warehouse With Examples in SQL Server by Vincent Rainardi, Apress, 2007**

WEBRESOURCES	
1.	https://www.integrate.io/blog/etl-data-warehousing-explained-etl-tool-basics/
2.	https://cloud.google.com/dataflow
3.	https://hevodata.com/learn/etl-data-warehouse/
4.	https://www.coursera.org/learn/extract-transform-and-load-data
5.	https://en.wikipedia.org/wiki/Extract,_transform,_load

DISASTER MANAGEMENT

CourseCategory	OpenElective	**CourseCode**	20CE6T40
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	----------	**InternalAssessment** **SemesterEndExamination** **TotalMarks**	30 70 100

COURSEOBJECTIVES	
1	Toprovidebasicconceptualunderstandingof disasters.
2	TounderstandapproachesofDisasterManagement.
3	Tobuildskillstorespondtodisaster.
4	Tounderstand to reducetheintensityoffuturedisasters.
5	Tounderstand the Restoration ofhumanlifeintheregion.

COURSEOUTCOMES	
Uponsuccessfulcompletionofthecourse,thestudentwillbeableto:	
CO1	Knowledgeoncharacteristicsofnaturaldisasters
CO2	PlanningonapproachesofDisasterManagement
CO3	Abilitytoplanand design the new skills in disasterresponse
CO4	Roleofremotesensingsystem in disasterarearesponse
CO5	KnowledgeontheRestorationofhumanlifein the region.

ContributionofCourseOutcomestowardsachievementof Program Outcomes(1–Low, 2-Medium, 3 –High)

	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO 1**	**PSO2**	**PSO 3**
CO1	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO2	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO3	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO4	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO5	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1

ZZTEXTBOOKS	
1.	"DisasterManagement guidelines",GOI-UNDDisasterRiskprogram (2009-2012)

COURSECONTENT	
UNITI	**NaturalHazardsandDisasterManagement**:Introductionof DM–Interdisciplinarynature of the subject– Disaster Management cycle – Five priorities for action. Case studymethodsofthefollowing:VegetalCoverfloods,droughts–Earthquakes–landslides– globalwarming,cyclones&Tsunamis–PostTsunamihazardsalongtheIndiancoast.
UNITII	**Man Made Disaster and Their Management Along With Case Study Methods Of TheFollowing:**Firehazards–transporthazarddynamics –solidwastemanagement–postdisaster– bioterrorism-threatinmegacities,railandaircraftaccidents,groundwater, industries-Emerginginfectiousdiseases and Aidsandtheirmanagement.
UNITIII	**Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmentalvulnerability–Macro-economicmanagementandsustainabledevelopment, Climatechangerisk rendition –Financialmanagementofdisaster– related losses
UNITIV	**Role of Technology in Disaster Managements:** Disaster management for infra structures,taxonomy of infra structure – treatment plants and process facilities-electrical substations-roads and bridges mitigation programme for earth quakes – flowchart, geospatial informationinagriculturedroughtassessment- MultimediaTechnologyindisasterriskmanagementand training-TransformableIndigenousKnowledgeindisasterreduction–RoleofRS &GIS
UNITV	**Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster onpoverty and deprivation - Climate change adaptation and human health - Exposure, healthhazardsand environmentalrisk-Forestmanagementanddisasterriskreduction-TheRedcross and red crescent movement - Corporate sector and disaster risk reduction- Education indisaster risk reduction Essentials of school disaster education- Community capacity anddisasterresilience-Communitybaseddisasterrecovery-Communitybaseddisaster managementand social capital-Designingresilience-building communitycapacityfor action

TEXTBOOKS	
1.	"DisasterManagement guidelines",GOI-UNDDisasterRiskprogram (2009-2012)
2.	ModhS.(2010)"ManagingNaturalDisasters",MacMillanpublishersIndia LTD.
REFERENCEBOOKS	
1.	MurtyD.B.N.(2012)"DisasterManagement",DeepandDeepPublicationPVT.Ltd.NewDelhi
WEBRESOURCES	

1	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

INTRODUCTION TO AUTOMOBILE ENGINEERING

(for CE, EEE, ECE, CSE, CSE(AIML), CSE(AI), CSE(DS), IT)

Course Category	Open Elective	**Course Code**	20ME6T25
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn functions of different components in Automobiles
2	To impart knowledge on Transmission systems and Steering Systems.
3	To impart the knowledge on ignition system & suspension systems.
4	To impart the knowledge of Braking system and Engine specification.
5	To understand the concept of safety and Engine emission control systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the function of various components of automobile.	K2
CO2	Identify the merits and demerits of the various transmission and steering systems.	K2
CO3	Describe the concept of Ignition and Suspension systems.	K2
CO4	Explain the features of Braking system and Engine specification.	K3
CO5	Analyze the Engine emission control standards.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	2	2	-	-	-	-	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	1	-	2	2	-	-	-	-	-	2	1
CO5	2	2	1	-	-	-	2	-	-	-	-	1	3	-

COURSE CONTENT

UNIT I

INTRODUCTION: Components of four-wheeler automobile-chassis and body-power unit-types of automobile engines, engine construction, oil filters, oil pumps, air filters, Fuel pump, nozzle, Types of carburetors.

UNIT II

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, Propeller shaft-Hotch-Kiss drive, Torque tube drive, universal joint, differential rear axles-types-wheels and tires.

STEERING SYSTEM: Steering geometry-camber, castor, king pin rake, combined angle toe-in, center point steering. steering gears – types, steering linkages.

UNIT III

IGNITION SYSTEM: Function of an ignition system, auto transformer, electronic ignition using contact triggers-spark advance and retard mechanism.
SUSPENSION SYSTEM: Objects of suspension systems-rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT IV

BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, pneumatic and vacuum brakes.
ENGINE SPECIFICATION: Introduction-engine specifications with regard to power, speed, torque, no. of cylinders and arrangement.

UNIT V

SAFETY SYSTEMS: Introduction, safety systems - seat belt, air bags, bumper, wind shield, suspension sensors, traction control, mirrors.
ENGINE EMISSION CONTROL: Introduction-types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification.

TEXT BOOKS

1. Automotive Mechanics / Heitner.
2. Automobile Engineering / William Crouse, TMH Distributors.
3. Automobile Engineering- P.S Gill, S.K. Kataria& Sons, New Delhi.

REFERENCE BOOKS

1. Automotive Engines Theory and Servicing, James D. Halderman and Chase D. Mitchell Jr., Pearson education inc.
2. Automotive Engineering / Newton Steeds & Garrett.
3. Automotive Mechanics – Vol. 1 & Vol. 2 / Kripal Singh, standard publishers.

WEB RESOURCES

1. https://nptel.ac.in/courses/107/106/107106080/
2. http://gabook.cyou/file/nptel-automobile-engineering
3. https://nptel.ac.in/courses/107/106/107106088/

Sensors and Transducers
(Open Elective)

III Year II Semester

Course Category	Open Elective	**Course Code**	20EC6T26
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	control systems	**Internal Assessment** **Semester End Examination** **Total Marks**	25 75 100

COURSE OBJECTIVES: By studying this course the student will learn	
1	the principle of various Transducers and their construction
2	the transducer construction, classification, principle of operation and characteristics
3	about transducers for measurement of physical parameters
4	Temperature measurement using transducers
5	Applications and principles of operation, standards and units of measurements

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	discuss role of transducers and Sensor in instrumentation	K1
CO2	Descriptive view for the transducer construction, classification, principle of operation and characteristics.	K2
CO3	Gain knowledge about transducers for measurement of displacement, strain, velocity, analyze transducers for measurement of pressure , force and flow	K3
CO4	analyze transducers for measurement of Temperature	K4
CO5	Analyze sensors used in industrial applications	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2		1							
CO2	1	2	2		1							
CO3	2	2	2		2							
CO4	2	3	2		2							
CO5	3	3	3		2							

COURSE CONTENT	
UNIT I	**Introduction:**Functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input

UNIT II	**Transducers for motion and dimensional measurements:** Relative displacement, translation and rotational resistive potentiometers, resistance strain gauges, LVDT, synchros, capacitance transducers, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers, Gyroscopic sensors
UNIT III	**Transducers For Force Measurement**: Bonded strain gauge transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers. **Transducers For Flow Measurement:** Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter **Transducers For Pressure Measurement:** Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers.
UNIT IV	**Transducers For Temperature Measurement:** Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors.
UNIT V	**Smart sensors:** Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation Sensors –Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for Environmental Monitoring

TEXT BOOKS	
1.	Sensors and Transducers, D. Paranaiba ,PHI Learning Private Limited.
2.	Mechatronics,W. Bolton ,Pearson Education Limited.
REFERENCE BOOKS	
1.	Transducers and Instrumentation, by D.V.S. Murthy (PHI)
2.	Instrumentation Measurement & Analysis, by B.C. Nakra, K.K. Choudry, (TMH)
WEB RESOURCES	
1.	https://youtu.be/hv-aBonZMRQ
2.	https://www.youtube.com/watch?v=qSa3GNjIyy0

Fundamentals of Electric Vehicles

(Open Elective – II offered to other departments)

Course Category	Professional Core Courses	**Course Code**	20EE6T19
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NIL**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2	To understand various power converters used in electric vehicles.
3	To know various architecture of hybrid electric vehicles.
4	To be familiar all the different types of motors suitable for electric vehicles.
5	To have knowledge on latest developments in strategies and other storage systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate different types of electric vehicles..	K3
CO2	Select suitable power converters for EV applications.	K2
CO3	Design HEV configuration for a specific application.	K4
CO4	Choose an effective method for EV and HEV applications.	K3
CO5	Analyze a battery management system for EV and HEV	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO 1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO1	1	-	-	-	-	2	2	-	-	-	-	2	1	1
CO2	2	3	-	-	-	1	1	-	-	-	-	-	2	2
CO3	-	3	-	-	-	1	-	-	-	-	2	2	1	2
CO4	3	2	-	-	-	2	1	-	-	-	2	-	1	2
CO5	2	-	-	-	-	2	-	-	-	-	-	2	2	2

COURSE CONTENT	
UNIT 1	**Introduction** Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles.
UNIT 2	**Components of Electric Vehicles** Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.
UNIT 3	**Hybrid Electric Vehicles** Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.
UNIT 4	**Motors for Electric Vehicles**

	Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)
UNIT 5	**Energy Sources for Electric Vehicles** Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it's working.

TEXT BOOKS	
1	Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2	Denton - Tom. Electric and hybrid vehicles. Rutledge - 2020.
REFERENCE BOOKS	
1	Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2	Chau - Kwok Tong. Electric vehicle machines and drives: design - Analysis and Application. John Wiley & Sons - 2015.
3	Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108106170
2	https://inverted.in/blog/fundamentals-of-electric-vehicles

Computer Networks Laboratory
CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT

Course Category		**Course Code**	20CS5L09
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Develop various data link layer functionalities	K3
CO2	Analyze and identify appropriate routing algorithm for the network	K4
CO3	Analyze the network simulations in NS2	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	0	0	0	0	0	0	0	2	3	0
CO2	3	3	3	3	2	0	0	0	0	0	0	0	2	3	0
CO3	3	3	3	3	2	0	0	0	0	0	0	0	2	3	0

COURSE CONTENT	
List of Experiments	
1	Study of Network devices in detail and connect the computers in Local Area Network.
2	Write a Program to implement the data link layer farming methods such as i) Character stuffing ii) bit stuffing.
3	Write a Program to implement data link layer farming method checksum.
4	Write a program for Hamming Code generation for error detection and correction.
5	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6	Write a Program to implement Sliding window protocol for Goback N.

7	Write a Program to implement Sliding window protocol for Selective repeat.
8	Write a Program to implement Stop and Wait Protocol.
9	Write a program for congestion control using leaky bucket algorithm
10	Write a Program to implement Dijkstra‘s algorithm to compute the Shortest path through a graph.
11	Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12	Write a Program to implement Broadcast tree by taking subnet of hosts.
13	Wireshark i. Packet Capture Using Wire shark ii. Starting Wire shark iii. Viewing Captured Traffic iv. Analysis and Statistics & Filters.
14	Execution of Nmap scan
15	Operating System Detection using Nmap
16	Do the following using NS2 Simulator i. NS2 Simulator-Introduction ii. Simulate to Find the Number of Packets Dropped iii. Simulate to Find the Number of Packets Dropped by TCP/UDP iv. Simulate to Find the Number of Packets Dropped due to Congestion v. Simulate to Compare Data Rate& Throughput.

Big Data Analytics Lab

Course Category	Professional Core	**Course Code**	20DS6L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Data Mining	**Internal** **Assessment Semester** **End Examination** **Total Marks**	25 50 75

COURSEOBJECTIVES	
1.	ImpartingthearchitecturalconceptsofHadoopandintroducingmapreduceparadigm
2.	Introducing Java concepts required for developing Map Reduce programs.
3.	To understand the applications using Map Reduce Concepts.

COURSEOUTCOMES **Upon successful completion of the course, the student will be able to:**		**Cognitive level**
CO1	Applying data modeling techniques to large datasets.	K3
CO2	Creating applications for Big Data Analytics.	K3
CO3	Building a complete business data analytic solution.	K3

K1:Remember, K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	-	2	1	1
3	3	2	3	2	2	-	-	-	-	-	-	-	2	2	1

COURSECONTENT	
1.	Week 1, 2: Implement the following Data structures in Java a) Linked Lists b) Stacks c) Queues d) Set e) Map
2.	Week 3: (i)Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed (ii)Use web based tools to monitor your Hadoop setup.
3.	Week 4: Implement the following file management tasks in Hadoop: • Adding files and directories • Retrieving files • Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
4.	Week 5:

	Run a basic Word Count MapReduce program to understand MapReduce Paradigm.
5.	Week 6: Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate foranalysis with Map Reduce, since it is semi structured and record-oriented.
6.	Week 7: Use MapReduce to find the shortest path between two people in a social graph. Hint: Use an adjacency list to model a graph, and for each node store the distance from the original node, as well as a back pointer to the original node. Use the mappers to propagate the distance to the original node, and the reducer to restore the state of the graph. Iterate until the target node has been reached.
7.	Week 8: Implement Friends-of-friends algorithm in MapReduce. Hint: Two MapReduce jobs are required to calculate the FoFs for each user in a social network .The first job calculates the common friends for each user, and the second job sorts the common friends by the number of connections to your friends.
8.	Week 9: Implement an iterative PageRank graph algorithm in MapReduce. Hint: PageRank can be implemented by iterating a MapReduce job until the graph has converged. The mappers are responsible for propagating node PageRank values to their adjacent nodes, and the reducers are responsible for calculating new PageRank values for each node, and for re-creating the original graph with the updated PageRank values.
9	Week 10: Perform an efficient semi-join in MapReduce. Hint: Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.
10	Week 11: Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
11	Week 12: Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

WEB RESOURCES	
1.	https://hadoop.apache.org/release/2.7.6.html
2.	https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3	https://www.eclipse.org/downloads/
4	https://spark.apache.org/docs/latest/rdd-programming-guide.html

Deep Learning with Tensorflow
LaboratoryCommon to CSE(AIML),CSE(AI)and CSE(DS)

B.Tech IISemester

CourseCategory	ProfessionalCore	**CourseCode**	20AM6L04
CourseType	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	PythonProgramming	**InternalAssessment** **SemesterEndExamination** **TotalMarks**	15 35 50

COURSEOBJECTIVES	
Thestudentwill:	
1	Haveabetterknowledgeaboutsoftwares likeKeras,Tensorflowetc…

COURSEOUTCOMES		
Uponsuccessfulcompletion ofthecourse,thestudent willbeableto:		**Cognitive Level**
CO1	Implementdeepneuralnetworkstosolverealworldproblems.	K1
CO2	Chooseappropriatepre-trainedmodeltosolverealtimeproblem.	K2
CO3	Interprettheresultsoftwodifferentdeeplearningmodels.	K3

K1:Remember,K2:Understand,K3: Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium,3–High)

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	1	1	1	--	--	--	--	--	--	--	2	2	3
CO 2	2	2	1	1	1	--	--	--	--	--	--	--	2	2	2
CO 3	2	2	1	1	1	--	--	--	--	--	--	--	2	2	2

SoftwarePackagesrequired:

- Keras
- Tensorflow
- PyTorch

ListofExperiments	
1	Implementmultilayerperceptron algorithmforMNISTHandwrittenDigitClassification..
2	Designaneuralnetworkforclassifyingmoviereviews(Binary Classification)usingIMDBdataset.
3	DesignaneuralNetworkforclassifyingnewswires(Multiclassclassification)usingR eutersdataset.

4	Designaneuralnetworkforpredictinghousepricesusing BostonHousing Pricedataset.
5	BuildaConvolutionNeuralNetworkforMNISTHandwrittenDigit Classification.
6	BuildaConvolutionNeuralNetworkforsimpleimage(dogsandCats) Classification.
7	Useapre-trainedconvolutionneuralnetwork(VGG16)forimage classification.
8	Implement onehotencoding ofwordsor characters.
9	ImplementwordembeddingsforIMDBdataset.
10	ImplementaRecurrentNeuralNetworkforIMDBmoviereviewclassification problem.

TextBooks:

1. RezaZadehandBharathRamsundar,"Tensorflowfor DeepLearning",O'Reillypublishers,2018

References:

1. **https://github.com/fchollet/deep-learning-with-python-notebooks**

Soft skills and Interpersonal Communication

III-I for EEE, MECH, ECE (Subject code: 20HE5S01)

III-II for C E, CSE AI&ML, CSE DS, CSE AI, & IT (Subject code: 20HE6S01)

Course Category	Humanities	**Course Code**	**20HE5S01//20HE6S01**
Course Type	Skill Oriented Course	**L-T-P-C**	1 – 0 – 2 – 2
Prerequisites	Life skills for better life	**Internal Assessment** **Semester End Exam** **Total Marks**	00 50 50

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Empowers the personality traits which help for the setting goal and improving quality of life.	**K -2**
CO2	Enhances the required methods and strategies to develop public speaking skills among the learners.	**K -1**
CO3	Builds the confidence in verbal and non-verbal communication besides life skills.	**K -2**
CO4	Strengthens various inter and intra personal abilities to lead better personal and professional career.	**K -2**
CO5	Improves the innate abilities which help for decision-making and problem-solving with emotional intelligence.	**K -1**

(K1 – Remember, K2 – Understand, K-3 Apply, K4 -Analysis, K5 – Evaluate, K6 – Create)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1**
CO1	-	-	-	-	-	-	-	1	-	-	-	1
CO2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	-	-	-	1	-	1	-
CO5	-	-	-	-	-	-	-	-	-	-	-	1

	Syllabus
UNIT - I	1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. 2. Self-Discovery:Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinkingand Attitude; Driving out Negativity; Meaning andTheories of Motivation; Enhancing Motivation Levels.
UNIT-II	1. Interpersonal Communication: Interpersonal relations; communication models,process and barriers; team communication; developing interpersonal relationshipsthrough effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. 2. Public Speaking:Skills, Methods, Strategies and Essential tips for effective public speaking. 3. Non-Verbal Communication: Importance and Elements; Body Language.
UNIT-III	1. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, OvercomingNervousness. 2. Group Discussion: Importance, Planning, Elements, Skills assessed; effectivelydisagreeing, Initiating, Summarizingand Attaining the Objective. 3. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 4. Teamwork and Leadership Skills: Concept of Teams;Building effective teams; Concept of Leadership and honing Leadership skills
UNIT - IV	1. Etiquette and Manners – Social and Business. 2. Time Management – Concept, Essentials, Tips. 3. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills. 4. Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types ofLeaders; Leadership Behaviour; Assertiveness Skills.
UNIT- V	1. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence 2. Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods 3. Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. 4. Stress Management: Stress - Definition, Nature, Types, Symptoms and

	Causes; Stress Analysis Models andImpact of Stress; Measurement and Management of Stress.

Text books :	
1.	Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2.	English and Soft Skills – S.P.Dhanavel, Orient BlackswanIndia, 2010

WEB RESOURCES	
1.	https://nptel.ac.in/courses/109107121/
2.	https://www.goskills.com/Soft-Skills

Employability Skills – II
for CSE, CSE AI&ML, CSE DS, CSE AI, and IT Branches.

Course Category	Humanities	**Course Code**	**20HE6T03**
Course Type	Theory	**L-T-P-C**	2 – 0 – 0 – 0
Prerequisites	Basic Language Knowledge.	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVE:

1	To present language ability in the interview for employment.

COURSE OUTCOMES		**LEVEL**
Upon successful completion of the course, the student will be able to:		
CO1	Endues an ability of an accurate usage of words in language.	**K -II**
CO2	Develops logical inter-relation of words in usage.	**K -II**
CO3	Helps to develop compendious usage in communication.	**K -II**
CO4	Determines to concentrate on Non-Verbal interpretation.	**K -I**
CO5	Enriches the ability in vocabulary usage.	**K-I**

(K1 – Remember, K2 – Understand, K-3 Apply, K4 -Analysis, K5 – Evaluate, K6 – Create)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	0	0	0	0	1	0	0
CO2	0	0	0	0	0	0	0	0	0	1	0	0
CO3	0	0	0	0	0	0	0	0	0	1	0	0
CO4	0	0	0	0	0	0	0	0	0	1	0	0
CO5	0	0	0	0	0	0	0	0	0	1	0	0

Course contents:

Unit – I
Words often confused.
Commonly Confused Words – Homonym – Homograph- Homophone.

Unit –II
Analogies/Jumbled Sentences
Opposite Analogy - Cause and Effect Analogy - Problem and Solution Analogy - Effort and Result Analogy.**Spotting the transition words or the linking words- Identify the Theme of the paragraph.**

Unit –III
One-word substitutions, sentence corrections
Subject-Verb Agreement -Verb form- Logical Predication and Modifiers – Comparisons.

Unit – IV
Body Language
Facial expressions - Body movement and posture – Gestures - Eye contact – Space – Voice.

Unit – V
Development of Verbal Ability.

Vocabulary- Word analogy – Antonyms and Synonyms - Verbal Coherence & Cohesion

Reference Books:

TEXT BOOKS	
1.	**Teaching Offender Education: Employability Activities: 14 Activities to Develop the Soft Skills for Working Life** by Teresa Maria O'Hara, Nutcracker Press UK.
2.	**BEST: Basic Employability Skills Training: Volume 1** by Sally J. Vonada
3.	**Skills** by Dr. Rabindranath Athri
WEB RESOURCES	
1.	https://www.collegiateparent.com/academics/build-employable-skill-sets-online/
2.	https://cte.ed.gov/initiatives/employability-skills-framework
3.	https://www.collegiateparent.com/academics/build-employable-skill-sets-online/
4.	https://www.skillsyouneed.com/general/employability-skills.html
5.	https://www.realityworks.com/product/online-employability-skills-programs/

Reinforcement Learning

CourseCategory	ProfessionalCore	**CourseCode**	20AM7T06
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	MachineLearning	**Internal Assessment** **SemesterEndExamination** **TotalMarks**	30 70 100

COURSEOBJECTIVES	
Thestudentwill:	
1	Learnvariousapproaches to solvedecision problemswithfunctionalmodelsandalgorithmsfor taskformulation,Tabularbasedsolutions,Functionapproximationsolutions,policygradientsandmodelbasedreinforcementlearning.
2	LearnVariouspoliciesregardingDynamicProgramming.
3	LearnthevariousmethodsofMonteCarloMethods.
4	LearnaboutvariousmethodsinOff–policywithapproximation.
5	LearnthevariousPolicyGradientMethodsanditsapplications.

COURSEOUTCOMES		
Uponsuccessfulcompletion ofthecourse,thestudent willbeableto:		**CognitiveLevel**
CO1	Rememberthebasicconceptsof Reinforcementlearning.	K1
CO2	UnderstandbasicconceptsofDynamicProgramming**.**	K2
CO3	Understandvariousmethodsandapplicationsofreinforcementlearning.	K2
CO4	Analyze variousoff-policymethodswithapproximations.	K4
CO5	UnderstandaboutPolicyGradientMethods.	K2

K1:Remember,K2:Understand,K3: Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium,3–High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	--	--	--	--	--	--	--	2	2	3
CO2	3	3	2	2	1	--	--	--	--	--	--	--	2	2	3
CO3	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2
CO4	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2
CO5	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2

COURSECONTENT

UNIT-I	**Introduction:**ReinforcementLearning,Examples,ElementsofReinforcementLearning,LimitationsandScope,AnExtendedExample: Tic-Tac-Toe **Multi-armedBandits**:Ak-armedBanditProblem,Action-valuemethods,The10-armedTestbed,Incremental Implementation,TrackingaNonstationaryProblem,OptimisticInitialValues,Upper–Confidence-BoundActionSelection,GradientBandit Algorithm
UNIT-II	**FiniteMarkov Decision Process**:TheAgent-EnvironmentInterface,Goals andRewards,Returnsand Episodes,UnifiedNotataionforEpisodicandContinuingTasks,PoliciesandValueFunctions,**DynamicProgramming** : PolicyEvaluation,PolicyImprovement,PolicyIteration,ValueIteration,AsynchronousDynamicProgramming,GeneralizedPolicyIteration,EfficiencyofDynamicProgramming
UNIT-III	**Monte Carlo Methods**: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control,MonteCarloControlwithoutExploringStarts,Off-policyPredictionviaImportanceSampling,IncrementalImplementation,Discontinuing-awareImportanceSampling, Per-decisionImportance Sampling **n-step Bootstrapping**: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods withControlVariables,AUnifying Algorithm:n-stepQ(σ)
UNIT-IV	**Off-policyMethodswithApproximation**:Semi-gradientMethods,ExamplesofOff-policy Divergence,TheDeadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is notLearnable,Gradient-TDmethods, Emphatic-TDmethods, ReducingVariance **Eligibility Traces**: The λ-return, TD(λ), n-step Truncated λ-return methods,Online λ –returnAlgorithm, TrueOnline TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with ControlVariables, Watkins'sQ(λ)toTree-Backup(λ)
UNIT-V	**Policy Gradient Methods**: Policy Approximation and its Advantages, The Policy Gradient Theorem,REINFOECE -MonteCarloPolicyGradient,REINFORCEwithBaseline,Actor-CriticMethods, PolicyGradientforContinuing Problems, Policy Parameterization fr Continuous Actions Applications and Case Studies: TD-Gammon,Samuel'sCheckersPlayer,Watson'sDailyDoubleWagering,OptimizingMemoryControl,PersonalizedWeb Services

TEXTBOOKS	
1.	R.S.SuttonandA.G.Bart,."Reinforcement Learning-AnIntroduction,"MITPress,2018.
2.	Szepesvári,Csaba,"AlgorithmsforReinforcement Learning,"United States:Morgan&Claypool, 2010.
REFERENCEBOOKS	
1.	Puterman,Martin L.,"Markov Processes: Discrete Stochastic DecisionDynamic Programming,"Germany:Wiley,2014.
WEBRESOURCES:	
1	SwayamNPTEL:https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2	https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

Nature Inspired Computing Techniques

IV B Tech I Semester

Course Category	Professional Core	**Course Code**	20AI7T08
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES

The student will:

Learn the theoretical foundations of Nature Inspired Computing techniques, how they can be used to solve problems, and in which areas are most useful and effective.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms.	K2
CO2	Apply Genetic algorithms to optimization, design and learning problems.	K3
CO3	Apply Firefly algorithms to optimization, design and learning problems.	K3
CO4	Apply Bat Algorithms algorithms to optimization, design and learning problems.	K3
CO5	Apply Flower Pollination Algorithms to optimization, design and learning problems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO2	1	2	3	3	3	-	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	1	2	3	3	3	-	-	-	-	-	-	-	2	3	-
CO5	1	2	3	3	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Analysis of Algorithms:** Analysis of Optimization Algorithms, Nature Inspired Algorithms, Parameter Tuning and Parameter Control: Parameter Tuning, Hyper optimization, Multi objective View, Parameter Control, Simulated Annealing: Algorithm, Basic Convergence Properties, Stochastic Tunneling
UNIT-II	**Genetic Algorithms:** Introduction, Role of Genetic Operators, Choice of Parameters, GA Variants, **Differential Evolution:** Introduction, Differential Evolution, Variants, Choice of Parameters, Convergence Analysis, **Particle Swarm Optimization:** Swarm Intelligence, PSO Algorithm, Accelerated PSO, Binary PSO
UNIT-III	**Firefly Algorithms:** Firefly Behavior, Standard Firefly Algorithm Variations of Light Intensity and Attractiveness, Controlling Randomization, Firefly Algorithms in Applications **Cuckoo Search:** Cuckoo Breeding Behavior, Levy Flights, Cuckoo Search: Special Cases of Cuckoo Search, Variants of Cuckoo Search, Global Convergence, Applications
UNIT-IV	**Bat Algorithms:** Echolocation of Bats: Behavior of Microbats, Acoustics of Echolocation, Bat Algorithms: Movement of Virtual Bats, Loudness and Pulse Emission, Binary Bat Algorithm, Variants of the Bat Algorithm, Convergence Analysis, Applications: Continuous Optimization, Combinatorial Optimization and Scheduling, Inverse Problems and Parameter Estimation, Classifications, Clustering and Data Mining, Image Processing, Fuzzy Logic and Other Applications
UNIT-V	**Flower Pollination Algorithms:** Introduction, Characteristics of Flower Pollination, Flower Pollination Algorithms, Multi-Objective Flower Pollination Algorithms, Validation and Numerical Experiments: Single-Objective Test Functions, Multi-Objective Test Functions, Applications: Single-Objective Design Benchmarks, Multi-Objective Design Benchmarks

TEXT BOOKS	
1.	"Nature-Inspired Optimization Algorithms", Yang, Xin-She, Elsevier Science, 2014.
2.	"Nature-Inspired Computing and Optimization: Theory and Applications," Germany: Springer International Publishing, 2017.
REFERENCE BOOKS	
1.	"Nature-Inspired Computing Research and its Applications", T.Subashini M Krishna Veni, Notion Press
2.	"Handbook of Nature-Inspired and Innovative Computing: Springer-Verlag New York Inc.
WEB RESOURCES:	
1	https://youtu.be/3OkQ72y77LM

Social Media Analytics

Course Category	Professional Core	**Course Code**	**20DS7T05**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Science through Python	**Internal Assessment Semester End Examination Total Marks**	**30 70 100**

COURSEOBJECTIVES	
1	Understand and deal with any social media network, strategy, or campaign
2	Understand how insights can be generated from data
3	Enumerate different types of analytics in social media

COURSEOUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Understand social media categories and types of social media analytics	K2
CO2	Analyze a Social Media Post	K2
CO3	Describe the Advertising Analytics	K3
CO4	Compare and contrast Dedicated vs. Hybrid Tools	K2
CO5	List out the features of Social Networks	K2

K1: Remember, K2: Understand, K3: Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNIT I	**Introduction:** Foundation for Analytics, Evolution of Data and the Digital Gap, Social Media Data Sources: Offline and Online, Definition of Social Media, Data Sources in Social Media Channels, Estimated vs. Factual Data Sources, Public and Private Data, Data Gathering in Social Media Analytics, Social Media Network Support of Data Collection, API: Application Programming Interface, Web Crawling or Scraping
UNIT II	**From Data to Insights:** Example of a Single Metric Giving Actionable Insight, An Example of a Metric Leading to New Questions, Creating a Plan to Shape Data into Insights, The Planning Stage: Projecting Possible Insights, Analysis of a Social Media Post, The process of Comparison, Data Aggregation, Calculations and Display, Data Display, Social Media and Big Data, Potential Challenges
UNIT III	**Analytics in Social Media:** Types of Analytics in Social Media, Analytics or Channel Analytics, Social Media Listening: Keyword and Mention-Based Analysis, Demographics, Interests and Sentiment, Advertising Analytics: Focus on Conversions and ROI of Paid Social Media Campaigns, Conversions: The Key to Digital and Social Advertising, CMS Analytics: Measuring the Performance of the Content Management Team, CRM Analytics: Customer Support and Sales via Social Media
UNIT IV	**Dedicated vs. Hybrid Tools :**Common to all Tools, Dedicated Tools, Advantages of Dedicated Tools, Disadvantages of Dedicated tools, Hybrid Tools, Dedicated Tools with Hybrid Features, Advantages of Hybrid Tools, Disadvantages of Hybrid Tools, Data Integration Tools, Advantages of Data Integration Tools, Disadvantages of Data Integration Tools
UNIT V	**Social Network Landscape:** Concept and UX on Social Networks, Features and Their Strategic Value, Interactivity: How Social is the Network, Content Flow on Social Network **The Analytics Process:** Analysis is Comparison, Investigation beyond Social Analytics, Shaping a Method: The End Game for an Analyst, The Analysis Circle, Dynamic Cycles, The Analyst Mindset: Making the Right Questions and Running the Right Experiments

TEXT BOOKS	
1.	Alex Goncalves, "Social Media Analytics Strategy-Using Data to Optimize Business Performance," Apress, 2017
2.	Qiu, Liangfei., Kumar, Subodha, "Social Media Analytics and Practical Applications: The Change to the Competition Landscape," United States: CRC Press, 2021

REFERENCEBOOKS	
1.	Python Social Media Analytics: Analyze and visualize data from Twitter, Youtube, GitHub, and more by Siddhartha Chatterjee, Michal Krystyanczuk, Packt Publishing, 2017
2.	Sponder, Marshall, "Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics," United Kingdom: McGraw-Hill Education, 2011

WEBRESOURCES	
1.	https://www.ibm.com/in-en/topics/social-media-analytics
2.	https://www.coursera.org/learn/social-media-analytics-introduction

BLOCK-CHAIN TECHNOLOGIES
IT, CSE

Course Category	Professional Elective	**Course Code**	20IT7T16
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES
The objective of the course is to

1	**To understand block chain technology and Cryptocurrency works**

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Demonstrate the block chain basics, Crypto currency	K2
CO2	To compare and contrast the use of different private vs. public block chain and use cases	K2
CO3	Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins	K3
CO4	Classify Permission Block chain and use cases – Hyper ledger, Corda	K2
CO5	Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO2	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO3	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO4	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO5	3	3	1	1	1	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT I	**Introduction:Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets.**

UNIT II	**Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment**
UNIT III	**Introduction to Bitcoin: BitcoinBlock chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc. Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics.**
UNIT IV	**Ethereum, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency**
UNIT V	**Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems, Supply chain management.**

TEXT BOOKS

1.	Blockchain Blue print for Economy by Melanie Swan

REFERENCE BOOKS

1.	Blockchain Basics: A Non-Technical Introduction in 25 Steps,1st Edition, by Daniel Drescher

WEB RESOURCES

1.	https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
2.	https://www.coursera.org/learn/social-network-analysis

SNOW FLAKE CLOUD ANALYTICS

Course Category	Professional Core	**Course Code**	**20DS7T06**
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Data Mining	**Internal Assessment**	**30**
		Semester End Examination	**70**
		Total Marks	**100**

COURSE OBJECTIVES	
1	To understand the importance of Snowflake Data Cloud
2	To get exposure to various layers of Snowflake Cloud Architecture
3	To understand the execution of SQL Queries in Snowflake Worksheets

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	load & transform data in Snowflake	K2
CO2	scale virtual warehouses for performance and concurrency	K2
CO3	share data and work with semi-structured data	K3
CO4	gain a thorough knowledge of query constructs, DDL & DML operations	K2
CO5	managing and monitoring Snowflake accounts and Snowflake's continuous data protection methods.	K3

K1: Remember, K2: Understand, K3: Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNIT I	**Cloud Computing:** Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing. **(Text Book 1)**
UNIT II	**Cloud Services and Platforms:** Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud Software**(Text Book 1)**
UNIT III	Getting Started with Cloud Analytics - Key Cloud Computing Concepts Getting Started with Snowflake – Planning, Deciding on a Snowflake Edition, Choosing a Cloud Provider and Region, Examining Snowflake's Pricing Model, Other Pricing Considerations, Examining Types of Snowflake Tools, Creating a Snowflake Account, Connecting to Snowflake.(**Text Book 2)**
UNIT IV	Building a Virtual Warehouse - Overview of Snowflake Virtual Warehouses, Warehouse Sizes and Features, Multicluster Virtual Warehouses, Virtual Warehouse Considerations, Building a Snowflake Virtual Warehouse. Loading Bulk Data into Snowflake - Overview of Bulk Data Loading, Bulk Data Loading Recommendations, Bulk Loading with the Snowflake Web Interface, Data Loading with SnowSQL (**Text Book 2)**
UNIT V	Snowflake Administration - Administering Roles and Users, Administering Resource Consumption, Administering Databases and Warehouses, Administering Account Parameters, Administering Database Objects, Administering Data Shares, Administering Clustered Tables, Snowflake Materialized Views **(Text Book 2)**

TEXTBOOKS	
1.	ArshadeepBhaga, Vijay Madisetti, "Cloud Computing AHandson Approach", Universities Press, 2018
2	Jumpstart Snowflake A Step-by-Step Guide to modern cloud analytics by Dmitry Anoshin, Dmitry Shirokov, Donna Strok, Apress, 2020

REFERENCEBOOKS	
1.	Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. TharamaiSelvi, Mc Graw Hill Education (India) Pvt. Limited, 2013.
2.	Snowflake Essentials Getting Started with Big Data in the Cloud, Apress
3.	Snowflake: The Definitive Guide Architecting, Designing, and Deploying on the Snowflake Data Cloud – ORIELLY
4.	Mastering Snowflake Solution Supporting Analytics and Data Sharing, Apress

WEBRESOURCES	
1.	https://www.snowflake.com/
2.	https://www.analytics.today/blog/what-is-the-snowflake-cloud-data-platform
3.	https://aws.amazon.com/financial-services/partner-solutions/snowflake/
4	https://docs.snowflake.com/en/

MINING MASSIVE DATASETS

Course Category	Professional Core	**Course Code**	**20DS7T07**
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Mining	**Internal** **Assessment Semester** **End Examination** **Total Marks**	**30** **70** **100**

COURSEOBJECTIVES	
1	To provide a comprehensive knowledge of mining massive data
2	To learn the essential concepts of set similarity and data streams
3	To understand the Link Analysis and On-Line Advertising

COURSEOUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the limits on statistical data mining	K2
CO2	Apply various set similarity functions	K3
CO3	Describe a Stream Data Model	K2
CO4	Perform the Computation of PageRank	K3
CO5	List out the Issues in On-Line Advertising	K2

K1:Remember,K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6:Create.

ContributionofCourseOutcomestowardsachievementofProgramOutcomes(1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENTS	
UNIT I	**Statistical Limits on Data Mining:** Total Information Awareness, Bonferroni's Principle, An Example of Bonferroni's Principle. **Things Useful to Know:** Importance of Words in Documents, Hash Functions, Indexes, Secondary Storage, The Base of Natural Logarithms, Power Laws
UNIT II	**Applications of Set Similarity: Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filtering as a Similar-Sets Problem.** **Shingling of Documents: k-Shingles, Choosing the Shingle Size, Hashing Shingles, Shingles Built from Words.** **Locality-Sensitive Hashing for Documents: LSH for Minhash Signatures, Analysis of the Banding Technique, Combining the Techniques.**
UNIT III	**Mining Data Streams: The Stream Data Model, A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing, Sampling Data in a Stream, The General Sampling Problem, Varying the Sample Size, Filtering Streams, A Motivating Example, The Bloom Filter, Analysis of Bloom Filtering**
UNIT IV	**Link Analysis: PageRank, Early Search Engines and Term Spam, Definition of PageRank, Structure of the Web, Avoiding Dead Ends, Spider Traps and Taxation, Using PageRank in a Search Engine, Efficient Computation of PageRank, Representing Transition Matrices, PageRank Iteration Using MapReduce**
UNIT V	**Advertising on the Web:** Issues in On-Line Advertising, Advertising Opportunities, Direct Placement of Ads, Issues for Display Ads, The Matching Problem, Matches and Perfect Matches, The Greedy Algorithm for Maximal Matching, The Adwords Problem, Definition of the Adwords Problem, The Greedy Approach to the Adwords Problem, The Balance Algorithm

TEXTBOOKS	
1.	**Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Cambridge University Press, Third Edition, 2020.**
2.	UnderstandingComplex Datasets by David Skillicorn, Chapman & Hall/CRC, Taylor & Francis Group, 2007

REFERENCEBOOKS	
1.	Algorithms and Data Structures for Massive Datasets, DzejlaMedjedovic, EminTahirovic, and Ines Dedovic, Manning Publications Co.,2022

WEBRESOURCES	
1.	https://online.stanford.edu/courses/soe-ycs0007-mining-massive-data-sets
2.	http://www.mmds.org/#top

INFORMATION RETRIEVAL SYSTEMS

Course Category	Professional Elective	**Course Code**	**20DS7T08**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	To provide the foundation knowledge in information retrieval
2	To equip students with sound skills to solve computational search problems
3	To appreciate how to evaluate search engines
4	To appreciate the different applications of information retrieval techniques in the Internet or Web environment
5	To provide hands-on experience in building search engines and/or hands-on experience in evaluating search engines

COURSEOUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Identify basic theories in information retrieval systems	K2
CO2	Classify the analysis tools as they apply to information retrieval systems	K2
CO3	Illustrate the problems solved in current IR systems	K2
CO4	Discuss the advantages of current IR systems	K4
CO5	Summarize the difficulty of representing and retrieving documents	K3

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2-Medium,3–High)														
	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO3**
CO1	1	2	1	2	-	-	-	-	-	-	-	-	2	1	-
CO2	1	2	1	3	-	-	-	-	-	-	-	-	3	2	-
CO3	2	2	2	3	-	-	-	-	-	-	-	-	2	3	-
CO4	2	2	2	1	-	-	-	-	-	-	-	-	2	2	-
CO5	2	3	2	1	-	-	-	-	-	-	-	-	2	3	-

COURSECONTENT	
UNITI	**Boolean retrieval:**An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval
UNIT II	**Vocabulary of terms:** Tokenization, Dropping common terms: stop words, Normalization Stemming and lemmatization. **Dictionaries and tolerant Retrieval**: Search structures for dictionaries, Wildcard queries
UNIT III	**Index construction:** Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing **XML retrieval:**Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval
UNIT IV	**Web search basics:** Web characteristics, Advertising as the economic model, The search user experience. **Web crawling and indexes:** Overview, Crawling, Crawler architecture, DNS resolution, Distributing indexes
UNIT V	**Link analysis:** The Web as a graph, PageRank, Markov chain, The PageRank computation, Topic-specific PageRank, Hubs and authorities, Choosing the subset of theWeb

TEXTBOOKS	
1.	Introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press, 2008
2.	Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997
REFERENCEBOOKS	
1.	Information retrieval Algorithms and Heuristics, 2ed, Springer

2.	Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992
WEBRESOURCES	
1.	http://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html
2.	https://people.ischool.berkeley.edu/~hearst/irbook/
3.	https://www.csee.umbc.edu/csee/research/cadip/readings/IR.report.120600.book.pdf

NOSQL Databases

Course Category	Professional Core	**Course Code**	**20DS7T09**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Database Management Systems	**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph)
2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases
3	Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases

COURSEOUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Discuss about Aggregate Data Models	K2
CO2	Explain about Master-Slave Replication, Peer-to-Peer Replication	K2
CO3	Describe the Structure of Data, Scaling, Suitable Use Cases	K2
CO4	Make use of Complex Transactions Spanning Different Operations	K2
CO5	Identify Routing, Dispatch and Location-Based Services	K2

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2-Medium,3–High)															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO12**	**PSO 1**	**PSO2**	**PSO3**
CO1	1	1	2	-	-	-	-	-		-	-	-	-	3	-
CO2	2	3	3	1		-	-	-	1	-	-	1	1	1	2
CO3	1	1	2	1	1	-	-	-	1	-	-	1	1	1	1
CO4	3	3	1	3		-	-	-	1	-	-	1	1	1	2
CO5	3	3	1	3	1	1	-	-	1	1	-	-	1	1	2

COURSE CONTENT	
UNITI	**Introduction:** Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL. **Aggregate Data Models:** Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.
UNIT II	**More Details on Data Models:** Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access **Distribution Models:** Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication.
UNIT III	**Key-Value Databases:** What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.
UNIT IV	**Document Databases:** What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure
UNIT V	**Graph Databases:** What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use

TEXTBOOKS	
1.	Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
2.	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
REFERENCEBOOKS	
1.	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)

2.	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)
WEB RESOURCES	
1.	https://www.guru99.com/nosql-tutorial.html\
2.	https://www.w3resource.com/mongodb/nosql.php

SOCIALNETWORKANALYSIS
IT, CSE

Course Category	Professional Elective	**Course Code**	20IT7T15
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES
The objectives of the course is to

1	Formalize different types of entities and relationships as nodes and edges and represent thisinformation as relational data
2	Plan and execute network analytical computations
3	Use advanced network analysis software to generate visualizations and perform empiricalinvestigations of network data
4	Interpret and synthesize the meaning of the results with respect to a question, goal, or task
5	Collect network data in different ways and from different sources while adhering to legalstandards and ethics standards

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Know basic notation and terminology used in network science	K2
CO2	Be able to visualize, summarize and compare networks	K2
CO3	Illustrate basic principles behind network analysis algorithms	K3
CO4	Develop practical skills of network analysis in R programming language	K3
CO5	Be capable of analyzing real work networks	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO 2	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 3	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO 4	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 5	3	3	1	1	1	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT

UNIT I	**Social Network Analysis: Preliminaries and definitions, ErdosNumberProject, Centrality measures, Balance and Homophily.**
UNIT II	**Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.**

UNIT III	**Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.**
UNIT IV	**Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.**
UNIT V	**Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.**

TEXT BOOKS

1.	S. Wasserman and K. Faust. "Social Network Analysis: Methods and Applications", CambridgeUniversity Press.
2.	D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highlyconnected world" , Cambridge University Press, 1st edition,2010

REFERENCE BOOKS

1.	Maarten van Steen. "Graph Theory and Complex Networks. An Introduction", 2010.
2.	Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction".Cambridge University Press 2014.
3.	Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'ReillyMedia, 2011.

WEB RESOURCES

1.	https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
2.	https://www.coursera.org/learn/social-network-analysis

Recommender Systems

CourseCategory	ProfessionalCore	**CourseCode**	20AM7T08
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	MachineLearning	**Internal Assessment** **SemesterEndExaminationTotalMarks**	30 70 100

COURSEOBJECTIVES	
Thestudentwill:	
1	Todevelopstate-of-the-artrecommendersystemsthatautomatesavariety of choice-making strategieswiththe goalofprovidingaffordable,personal,andhigh-qualityrecommendations.

COURSEOUTCOMES		
Uponsuccessfulcompletion ofthecourse,thestudent willbeableto:		**CognitiveLevel**
CO 1	Understandthebasicconceptsofrecommendersystems.	K1
CO 2	Carryoutperformanceevaluationofrecommendersystemsbasedonvariousmetrics.	K2
CO 3	Implementmachine-learninganddata-miningalgorithmsinrecommendersystems datasets.	K3
CO 4	Designandimplementasimplerecommendersystem	K4
CO 5	ImplementvariousrecommendersystemslikeParadigmsetc..	K5

K1:Remember,K2:Understand,K3: Apply,K4:Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium,3–High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	2	2	2	--	--	--	--	--	--	1	1	1	3
CO 2	3	1	1	2	2	--	--	--	--	--	1	--	--	1	3
CO 3	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO 4	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO 5	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3

COURSECONTENT

UNIT-I	**An IntroductiontoRecommenderSystems**:GoalsofRecommenderSystems,BasicModelsofRecommenderSystems,CollaborativeFilteringModels,Content-BasedRecommenderSystems,Knowledge-BasedRecommenderSystems,Domain-SpecificChallengesinRecommenderSystems, AdvancedTopicsandApplications.
UNIT-II	**Neighborhood-Based Collaborative Filtering**: Key Properties of Ratings Matrices, Predicting RatingswithNeighborhood-BasedMethods,ClusteringandNeighborhood-BasedMethods,DimensionalityReductionandNeighborhoodMethods,ARegression ModelingViewofNeighborhoodMethods,Graph Modelsfor Neighborhood-BasedMethods
UNIT-III	**Model-BasedCollaborativeFiltering**:DecisionandRegressionTrees,Rule-BasedCollaborativeFiltering,NaïveBayesCollaborativeFiltering,LatentFactorModels,IntegratingFactorizationand NeighborhoodModels
UNIT-IV	**Content-Based Recommender Systems**: Basic Components of Content-Based Systems, PreprocessingandFeatureExtraction,LearningUserProfilesandFiltering,Content-BasedVersusCollaborativeRecommendations **Knowledge-BasedRecommenderSystems**:Constraint-BasedRecommenderSystems,Case-BasedRecommenders,Persistent PersonalizationinKnowledge-BasedSystems.
UNIT-V	**EvaluatingRecommenderSystems**:EvaluationParadigms,GeneralGoalsofEvaluationDesign,Design Issuesin OfflineRecommenderEvaluation,AccuracyMetricsin OfflineEvaluation,Limitations ofEvaluationMeasures**..**

TEXTBOOKS	
1.	Charu.C.Aggarwal,RecommenderSystems:TheTextbook,Springer,2016.
2.	JannachD.,ZankerM.andFelFeringA.,RecommenderSystems:AnIntroduction, CambridgeUniversityPress,(2011),1sted.
REFERENCEBOOKS	
1.	Ricci F.,RokachL.,ShapiraD.,KantorB.P.,RecommenderSystemsHandbook,Springer(2011),1st ed.
2.	ManouselisN.,DrachslerH.,VerbertK.,DuvalE.,RecommenderSystemsForLearning,Springer(2013),1st edition.
3.	J.Leskovec,A.RajaramanandJ.Ullman,Miningofmassivedatasets,2nd Ed.,Cambridge,2012
WEBRESOURCES:	
1.	SwayamNPTEL:https://nptel.ac.in/courses/106105152w

AI Chatbots

Common to CSE (AI), CSE (AI&ML), CSE (DS)

IV B Tech I Semester

Course Category	Professional Core	**Course Code**	20AI7T07
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment Semester** **End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, ar study different types of bots and use cases.
2	Identify best practices for defining a chatbot use case, and use a rapid prototyping framework to develop a u case for a personalized chatbot.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop an in-depth understanding of conversation design, including on Boarding	K3
CO2	Develop an in-depth understanding of conversation design, including on flows, utterances	K3
CO3	Develop an in-depth understanding of conversation design, including on entities, and personality.	K3
CO4	Design, build, test, and iterate a fully-functional, interactive chatbot using a commercial platform.	K3
CO5	Deploy the finished chatbot for public use and interaction.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	2	3	-	-	-	-	-	-	-	-	2	2
CO2	2	3	3	2	3	-	-	-	-	-	-	-	1	2	3
CO3	2	3	3	2	3	-	-	-	-	-	-	-	-	-	3
CO4	2	3	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	-	-	3	-	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Introduction:** Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal

	Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR)
UNIT-II	**Chatbot Development Essentials:** Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent
UNIT-III	**Building a Chatbot Solution:** Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots
UNIT-IV	**Natural Language Processing, Understanding, and Generation:** Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.
UNIT-V	**Introduction to Microsoft Bot, RASA, and Google Dialog flow:** Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module

TEXT BOOKS	
1.	Abhishek Singh, Karthik Ramasubramanian, ShreyShivam, "Building an Enterprise Chatbot: Work with Prot Enterprise Data Using Open Source Frameworks", ISBN 978-1-4842-5034-1, Apress,2019
2.	. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
REFERENCE BOOKS	
1.	Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
2.	. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed Columbia University Press, 2013. ISBN 978- 0231168564.
3.	Abhishek Singh, Karthik Ramasubramanian and ShreyShivam, Building an Enterprise Chatbot (1 ed.), Springe 2019. ISBN 978-1484250334
WEB RESOURCES:	
1	Introduction to Chatbot | Artificial Intelligence Chatbot Tutorial (mygreatlearning.com)

DATA VISUALIZATION TECHNIQUES

Course Category	Professional Core	**Course Code**	**20DS7T10**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Science through Python	**Internal Assessment Semester End Examination Total Marks**	**30 70 100**

COURSEOBJECTIVES	
1	Understand the visualization process and visual representations of data
2	Learn visualization techniques for various types of data.
3	Explore the visualization techniques for graphs, trees, Networks.
4	Understand the visualization of maps, GIS and collaborative visualizations.
5	Discuss the recent trends in perception and visualization techniques.

COURSEOUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Differentiatebetween Data Visualizationand Infographics	K2
CO2	Evaluate Data Visualizations	K3
CO3	Apply various types of Visualizations	K3
CO4	Develop basic programs using D3.js	K2
CO5	Enumerate various Hierarchical patterns	K2

K1: Remember, K2: Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENTS	
UNITI	**Introducing Data Visualization:**Understanding Data Visualization, Recognizing the Traits of Good Data Viz, Embracing the Design Process, Ensuring Excellence in Your Data Visualization. **Exploring Common Types of Data Visualizations:** Understanding the Differencebetween Data Visualizationand Infographics, Picking the Right Content Type, Appreciating Interactive Data Visualizations, Observing Visualizations in Different Fields,

	Using Dashboards, Discovering Infographics**(Text Book 1)**
UNITII	**Mastering Basic Data Visualization Concepts** **Using Charts Effectively:** Deciding Which Charts to Use andWhen to Use Them **Adding a Little Context:** Making Text Useful, Exploring Text Analysis **Evaluating Real DataVisualizations:** Analyzing Data Visualizationsby Category, Evaluating Data Visualizations**(Text Book 1)**
UNITIII	**Defining an Easy-to-FollowStoryboard:** Business Intelligence Overview, Delving Into Your Story, Building Your First Storyboard. **Developing a Clear Mock-Up:**Getting Started with Your Mock-Up, Building Template Layouts. **Adding Functionality andApplyingColor:**Recognizing the Human Components, Dipping Into Color.**Exploring User Adoption:**Understanding User Adoption, Considering Five UA Measurements, Marketing to Data Viz Users. **(Text Book 1)**
UNITIV	**D3.js fundamentals** An introductionto D3.js, **How D3 works:** Data visualization is more than charts, D3 is about selecting and binding, D3 is about deriving the appearance of web page elements from bound data, **The power of HTML5:** The DOM, Coding in the console, SVG, CSS, JavaScript, Data standards: Tabular data, Nested data, Network data, Geographic data, Your first D3 app**(Text Book 2)**
UNITV	**Layouts**: Histograms, Pie charts, Stack layout, D3.js in the real world. **Complex dataVisualization** **Hierarchical visualization:**Hierarchical patterns, Working with hierarchical data, Pack layouts, Trees, Partition, Treemaps.**(Text Book 2)**

TEXTBOOKS	
1.	Data Visualization For Dummies by MicoYuk,Stephanie Diamond, John Wiley & Sons, Inc, 2014
2	D3.js in Action, Elijah Meeks, Second Edition, Manning Publications, 2018
REFERENCEBOOKS	
1.	Practical Python Data Visualization: A Fast Track Approach ToLearningData Visualization With Python by Ashwin Pajankar, Apress; 1st edition, 2020
2.	OssamaEmbarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018
3.	**Visual Data Mining: Techniques and Tools for Data Visualization and Mining by Tom Soukup, Ian Davidson, John Wiley & Sons, Inc, 2002.**
WEBRESOURCES	
2.	ibm.com/analytics/data-visualization
4.	https://www.tibco.com/reference-center/guide-to-data-visualization
5.	https://ocw.mit.edu/courses/res-6-009-how-to-process-analyze-and-visualize-data-january-iap-2012/

HIGHWAY

ENGINEERINGCIVILENG

INEERING

CourseCategory	Professionalcourse	**CourseCode**	20CE7T11
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	------	**InternalAssessment** **SemesterEndExamination** **TotalMarks**	30 70 100

COURSEOBJECTIVES	
1	Tointroducethestudentswiththeprinciplesandpracticeoftransportationengineeringwhich focusesonHighwayEngineering.
2	Abilitytomathematicallydevelopandinterpretdesignstandardsforhorizontaland vertical geometryandsuperelevation
3	Toprovidebasicknowledgeonmaterialsusedinpavementconstruction.
4	To enablethestudentstohaveastronganalyticalandpracticalknowledgeofPlanning,Designing ofPavements.
5	Toprovidebasicknowledgeintrafficengineering,andtransportationplanning.

COURSEOUTCOMES	
Uponsuccessfulcompletionofthecourse,thestudentwillbeableto:	
CO1	Planhighwaynetworkforagivenarea.
CO2	DesigntheHighwaygeometricsbasedonhighwayalignment.
CO3	Characterizethepavementmaterialslikeaggregates,Bituminousmaterials&construction.
CO4	Judgesuitabilityofpavementmaterialsanddesignflexibleandrigidpavements.
CO5	DesignIntersectionsandpreparetrafficmanagementplans.

ContributionofCourseOutcomestowardsachievementofProgram Outcomes(1–Low,2-Medium,3–High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-

COURSECONTENT

UNITI	**Highway Planning and Alignment:** Highway development in India; Classification of Roads;Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First,second,thirdroaddevelopmentplans,roaddevelopmentvision2021,RuralRoad DevelopmentPlan–Vision2025;PlanningSurveys;HighwayAlignment-Factorsaffecting

	Alignment-EngineeringSurveys–DrawingsandReports.
UNITII	**Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria-Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, OvertakingSight Distance and Intermediate SightDistance- Design of Horizontal Alignment-Design ofSuperelevationandExtrawidening-DesignofTransitionCurves-DesignofVerticalalignment-Gradients-Verticalcurves.
UNITIII	**HighwayMaterials:**Sub-gradesoil:classification–GroupIndex–Subgradesoilstrength–CaliforniaBearingRatio –ModulusofSubgradeReaction.Stoneaggregates:Desirableproperties–TestsforRoadAggregates–BituminousMaterials:Types–Desirableproperties-Testson Bitumen.
UNITIV	**Design of Pavements:** Types of pavements; Functions and requirements of different componentsofpavements;DesignFactors **Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRCmethod – Burmister method – Mechanistic method – IRC Method for Low volume Flexiblepavements. **RigidPavements:**DesignConsiderations–wheelloadstresses–Temperaturestresses–Frictionalstresses–Combinationofstresses–Designofslabs–DesignofJoints–IRCmethod–Rigidpavementsforlowvolumeroads–ContinuouslyReinforcedCementConcrete Pavements–RollerCompactedConcretePavements.
UNITV	**Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic VolumeStudies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors,Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings;TypesofIntersections;At-GradeIntersections–DesignofPlain,Flared,RotaryandChannelized Intersections;DesignofTrafficSignals–WebsterMethod–IRCmethod.

TEXTBOOKS	
1.	HighwayEngineering'byPaulH.WrightandKarenKDixon,WileyStudentEdition,WileyIndia(P)Ltd.,NewDelhi.
2.	HighwayEngineering'byKhannaS.K.,JustoC.E.GandVeeraragavanA,NemChandBros,Roorkee.
REFERENCEBOOKS	
1.	TransportationEngineeringandPlanning'byPapacostasC.S.andPDPrevedouros,PrenticeHallofIndia Pvt. Ltd;NewDelhi.
2.	'HighwayEngineering'bySrinivasaKumarR,UniversitiesPress,Hyderabad
WEBRESOURCES	
1.	https://nptel.ac.in/downloads/105101087/

Battery Management Systems and Charging Stations
(Open Elective – III offered to other departments)

Course Category	Professional Core Courses	**Course Code**	20EE7T29
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NIL**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To discuss about the different types of batteries.
2	To describe about the battery characteristic & parameters.
3	To apply the concepts of battery management system and design the battery pack.
4	To explain about the battery testing, disposal and recycling.
5	To describe different methods of EV charging

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Discuss about the different types of batteries.	K2
CO2	Describe about the battery characteristic & parameters.	K2
CO3	Apply the concepts of battery management system and design the battery pack.	K3
CO4	Explain about the battery testing, disposal and recycling.	K2
CO5	Describe different methods of EV charging	K2
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO 2**
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	2	1	1	-	1	1	1	-	-	-	-	1	1	1
CO4	2	-	-	-	1	1	1	-	-	-	-	1	1	1
CO5	2	-	-	-	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT 1	**Batteries** Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System Suggested reading: Study of different types of batteries
UNIT 2	**Battery Characteristics & Parameters** Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation- Battery design Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance.
UNIT 3	**Battery Pack and Battery Management System**

	Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests
UNIT 4	**Battery Testing, Disposal & Recycling** Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.
UNIT 5	**Charging Stations** Electric Vehicle Technology and Charging Equipment's, Basic charging Block Diagram of Charger, Difference between Slow charger and fast charger, Slow charger design rating, Fast charger design rating, AC charging and DC charging, Inboard and off board charger specification, Type of Mode of charger Mode -2, Mode-3 and Mode-4, EVSE associated charge times calculation.

TEXT BOOKS	
1	Guangjin Zhao, "Reuse and Recycling of Lithium-Ion Power Batteries", John Wiley & Sons. 2017. (ISBN: 978-1-1193-2185-9)
2	Arno Kwade, Jan Diekmann, "Recycling of Lithium-Ion Batteries: The LithoRec Way", Springer, 2018. (ISBN: 978-3-319-70571-2)
REFERENCE BOOKS	
1	Ibrahim Dinçer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle Battery Systems", John Wiley& Sons Ltd., 2016.
2	Chris Mi, Abul Masrur& David Wenzhong Gao, "Hybrid electric Vehicle- Principles & Applications with Practical Properties", Wiley, 2011.
3	G. Pistoia, J.P. Wiaux, S.P. Wolsky, "Used Battery Collection and Recycling", Elsevier, 2001. (ISBN: 0-444-50562-8)"
4	T R Crompton, "Battery Reference Book-3 rd Edition", Newnes- Reed Educational and Professional Publishing Ltd., 2000.
5	James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/108106170
2	https://www.youtube.com/watch?v=omnQN5Z5vsA

INDUSTRIAL ELECTRONICS
Open Elective

IV YEAR – I SEMESTER

Course Category	Open Elective	**Course Code**	20EC7T40
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Basic Electrical and Electronics Engineering	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
Student will learn	
1	The building block for differential amplifier and operational amplifier using DC amplifiers and applications of OP-AMP.
2	a Voltage Regulator ,Types of Voltage Regulators and their working and use of a different voltage regulators for real time applications
3	The characteristics and operation of SCR and Thyristor and techniques to turn Off a Thyristor
4	The operation and applications of important switching devices such as DIAC and TRIAC much used in power electronics
5	The different electronic devices such as Electronic timers and Electronic DC Motor and Control, Electric Welding methods, high frequency heating ,ultrasonic generation required for industrial applications

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concept of DC amplifiers.	K2
CO2	Analyze and design different voltage regulators for real time applications	K2
CO3	Describe the basis of SCR and Thyristor	K2
CO4	Determine the performance of DIAC and TRIAC	K2
CO5	Develop real time application using electronics	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	**1**	-	-	-	-	-	-	-	1	-
CO2	2	2	2	-	-	-	-	-	-	-	1	1
CO3	2	2	2	-	-	-	-	-	-	-	1	1
CO4	2	2	2	-	-	-	-	-	-	-	1	1
CO5	2	2	2	-	-	-	-	-	-	-	1	1

COURSE CONTENT	
UNIT I	**DC Amplifiers:** Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.
UNIT II	**Regulated Power Supplies:** Block diagram, Principle of voltage regulation, Series and Shunttype Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection. Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators,

	Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators - Current boosting
UNIT III	**SCR and Thyristor:** Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR.
UNIT IV	**Applications of SCR in Power Control:** Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave. DIAC, TRIAC and Thyristor Applications: Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation
UNIT V	**Industrial Applications -I:** Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital Timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control. **Industrial Applications –II**: High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications

TEXT BOOKS	
1.	Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
2.	Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972
REFERENCE BOOKS	
1.	Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edition, 2003
2.	Thyristors and applications – M. Rammurthy, East-West Press, 1977.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/108102145

Organizational Behaviour

CourseCategory	Humanities including Management	**Credits**	3
Course Type	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the meaning and importance of Organizational Behaviour to start and survive in corporate environment.	Understanding
CO 2	Demonstrate how the perception can integrate in human behaviour , attitudes and values.	Understanding
CO 3	Understand the importance of Groups and Teams in organizations for better Decision making.	Understanding
CO 4	Understand the need for change and its importance in organizations.	Understanding
CO 5	Understand the culture of organizations and to apply techniques in dealing with stress in organizations.	Applying

Contribution of Course Outcomes towards achievement of Program

Outcomes: 1 – Low, 2 - Medium, 3 – High

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	0	0	0	0	0	1	0	2	2	2	0	2
CO2	0	0	0	0	0	1	0	3	2	3	0	2
CO3	0	0	0	0	0	1	0	2	3	3	0	2
CO4	0	0	0	0	0	1	0	3	3	2	0	2
CO5	0	0	0	0	0	3	0	1	2	2	0	2

Course Content :

Unit-I Introduction to Organizational Behaviour

Concept-Nature and scope-Importance of Organizational Behaviour-Key elements of Organizational Behaviour-Role of managers in Organizational Behaviour-Approaches to Organizational Behaviour-Perspectives of Human Behaviour-Challenges and Opportunities for Organizational Behaviour.

Unit-II Perceptual Management

Nature-Process of Perception- Organization and Interpretation-Influencing factors- Importance of Perception in OB - Perceptual Errors- Attitudes and Values –Changes and Behaviour Modification Techniques-Impression Management.

Unit-III Introduction to Groups and Teams

Meaning –Importance of Groups - Foundations of Group Behaviour –Reasons for Group formation-Group and Team-Types of Groups-Stages of Group development –Meaning and Importance of Teams-Factors affecting Group and Team performance-Types of teams-Creating an effective Team.

Unit-IV Organization Change and Development

Definition and Meaning - Need for change-Forces for changes in Organization-Types of change-Organizational Resistance-Strategies overcome Resistance-Process of change-Meaning and Definition of Organization Development-OD interventions.

Unit-V Organizational Culture and Organizational Stress

Organizational culture: Meaning and Nature of Organizational Culture-Functions-Types-Creating and maintain Organizational Culture-Managing Cultural Diversity. Organizational Stress: Definition and Meaning-Sources of stress-Impact of stress on organizations-Stress Management Techniques.

Text Books:

1. K.Aswathappa: "Organizational Behaviour-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2017,
2. Stephen P. Robbins, Timothy, A. Judge: "Essentials of Organizational Behaviour" Pearson,2017
3. Pareek Udai, Sushma Khanna: "Understanding Organizational Behaviour", Oxford University Press, New Delhi, 2016.

References:

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2015
2. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma: "Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2017.

3. Jerald Greenberg and Robert A Baron: “Behavior in Organizations”, PHI Learning Private Limited, New Delhi, 2013.
4. Jai B.P.Sinha: “Culture and Organizational Behavior”, Sage Publication India Private Limited, New Delhi, 2009.
5. New strom W. John& Davis Keith, OrganisationalBehaviour--Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.

Web Resources

1.https://www.diversityresources.com/cultural-diversity-workplace/
2.https://www.chanty.com/blog/problem-solving-techniques/
3.https://www.simplypsychology.org/perspective.html#:~:text=The%20five%20major%20perspectives%20in,%2C%20behavioral%2C%20cognitive%20and%20humanistic
4.https://theintactone.com/2019/06/18/mpob-u3-topic-6-perception-process-and-errors

WATER RESOURCE ENGINEERING

CIVIL ENGINEERING

CourseCategory	ProfessionalCore	**CourseCode**	20CE7T18
CourseType	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Hydraulics andHydraulicMachinery	**InternalAssessment** **SemesterEndExamination** **TotalMarks**	30 70 100

COURSEOBJECTIVES	
1	TointroducehydrologiccycleanditsrelevancetoCivilengineering.
2	Makethestudentsunderstandphysicalprocessesinhydrologyand,componentsofthe hydrologiccycle.
3	Appreciateconceptsandtheoryofphysicalprocessesandinteractions.
4	Learnmeasurementandestimationofthecomponentshydrologiccycle.
5	Providean overview andunderstandingofUnitHydrographtheoryanditsanalysis.
6	Understandfloodfrequencyanalysis,designflood,floodrouting.
7	Appreciatetheconceptsofgroundwatermovementandwell hydraulics
8	Learn overviewoffloodroutinganditseffects.
9	Hastobeunderstoodandidentifythefloodoccurringareasnearby.

COURSEOUTCOMES	
Uponsuccessfulcompletionofthecourse,thestudentwillbeableto:	
CO1	Explainthetheoriesandprinciplesgoverningthehydrologicprocessesandlistouttheforms ofprecipitationinrealconditions.
CO2	Applykeyconceptstoseveralpracticalareasofengineering hydrology andrelateddesign aspects.
CO3	Designmajorhydrologiccomponentsforaneed-based structures.
CO4	Estimatefloodmagnitudeandcarryoutfloodrouting.
CO5	Demonstratetherecuperationtestprocessinopenwells.

ContributionofCourseOutcomestowardsachievementofProgram Outcomes(1–Low,2-Medium,3–High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO2	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO3	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO4	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO5	3	2	2	2	1	2	--	--	--	--	1	--	1	--	2

COURSECONTENT	
UNITI	INTRODUCTION:Engineeringhydrologyanditsapplications,Hydrologiccycle,hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gaugenetwork, presentation of rainfall data, average rainfall, continuity and consistency of rainfalldata, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF)curves,Depth-AreaDuration(DAD)curves,ProbableMaximumPrecipitation(PMP),design storm,problemsonaveragerainfallontowns
UNITII	ABSTRACTIONSFROMPRECIPITATION:Introduction,Initialabstractions.EVAPORATION:Factorsaffecting,measurement,reduction,AnalyticalmethodsofEvaporationestimation. EVAPOTRANSPIRATION: Factors affecting, measurement, control, PotentialEvapotranspirationoverIndia. INFILTRATION:Factorsaffecting,Infiltrationcapacitycurve,measurement,Infiltration Indices.Problemsonϕ-IndexandW-Index.
UNITIII	RUNOFF: Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve andflowdurationcurve. HYDROGRAPHANALYSIS:Componentsofhydrograph,separationofbaseflow,effectiverainfallhyetographanddirectrunoffhydrograph,unithydrograph,assumptions,derivationofunit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrographmethods,limitationsandapplicationsofunithydrograph,syntheticunit hydrograph.Problemsonunithydrograph.

UNITIV	FLOODS: Causes and effects,frequency analysis-Gumbel'sand Log-PearsontypeIIIdistribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF),floodcontrolmethodsandmanagement,Designflood,Designstorm. FLOOD ROUTING: Hydrologic storage routing, channel and reservoir routing-MuskingumandPulsmethodsofrouting,floodcontrolinIndia. ADVANCEDTOPICSINHYDROLOGY:Rainfall-RunoffModelling,InstantaneousUnit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrologicalmodels-Chow-Kulandaiswamymodel.
UNITV	GROUNDWATER: Occurrence, types of aquifers, aquifer parameters, porosity, specificyield, specific capacity, permeability, transitivity and storage coefficient, types of wells, wellloss,Darcy'slaw,Dupuit'sequation-steadyradialflowtowellsinconfinedandunconfined aquifers,yieldofaopenwell-recuperationtest.

TEXTBOOKS	
1.	„EngineeringHydrology"bySubramanya,K,TataMcGraw-HillEducationPvt.Ltd,(2013), NewDelhi.
2.	„EngineeringHydrology"byJayaramiReddy,P,LaxmiPublicationsPvt.Ltd.,(2013),NewDelhi.
3.	"IrrigationandWaterPowerEngineering"byPunmiaBC,P.B.BLal,A.K.JainandA.K.Jain (2009),LaxmiPublicationsPvt.Ltd.,NewDelhi.
REFERENCEBOOKS	
1.	'WaterResourcesEngineering',MaysL.W,WileyIndiaPvt.Ltd,(2013).
2.	'Hydrology'byRaghunath.H.M.,NewAgeInternationalPublishers,(2010).
3.	'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International,(1994).
4.	'HydrologyandWaterResourcesEngineering'byPatraK.C.,NarosaPublications,(2011).

5.	'Applied hydrology'byChowV.T.,D.RMaidmentandL.W.Mays,TataMcGrawHillEducation Pvt.Ltd.,TransportationEngineering-Id.,(2011),NewDelhi.
6.	'EngineeringHydrology'byOjhaC.S.P,R.BerndtssonandP.Bhunya,OxfordUniversity Press,(2010).
WEB REFERENCES	
1.	https://www.digimat.in/nptel/courses/video/105104103/L01.html

SUSTAINABLE ENERGY TECHNOLOGIES
(for CE, EEE, ECE, CSE, CSE(AIML), CSE(AI), CSE(DS))

Course Category	Open Elective	**Course Code**	20ME7T38
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To demonstrate the importance and solar radiation, solar energy collection and storage
2	To understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy
3	To interpret energy efficient electrical and mechanical systems
4	To develop energy efficient processes
5	To understand features and benefits of green buildings

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate the importance and solar radiation, solar energy collection and storage.	K2
CO2	Understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy.	K2
CO3	Analyze energy efficient electrical and mechanical systems.	K2
CO4	Understand features and benefits of green buildings.	K2
CO5	Understand the different types of unconventional machining methods and principles of finishing processes.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	3	-	-	-	3	-	3	-	-	2
CO2	3	2	2	-	3	-	-	-	3	-	3	-	-	2

CO3	3	2	2	-	3	-	-	-	3	-	3	-	-	2
CO4	3	2	3	-	3	-	-	-	3	-	3	-	-	2
CO5	3	2	3	-	3	-	-	-	3	-	3	-	-	2

COURSE CONTENT

UNIT I

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT II

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.

UNIT III

ENERGY EFFICIENT SYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmentally friendly and Energy efficient compressors and pumps**.**

UNIT IV

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmentally friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT V

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmentally friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

REFERENCE BOOKS

1. Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering - D.YogiGoswami, Frank Krieth& John F Kreider/Taylor & Francis
3. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies -Ramesh & Kumar /Narosa
5. Non conventional Energy Source- G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt. Ltd

BIO-MEDICAL INSTRUMENTATION
(OPEN ELECTIVE)
IV YEAR – I SEMESTER

Course Category	OE	**Course Code**	20EC7T41
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Analog circuits	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES: In this course the student will	
1	Study the physiological relation of human body – environment and Identify various errors that occur while measuring living system
2	Study various types of Electrodes and Transducers used in biomedical measurements
3	Learn Anatomy of Heart, Respiratory system and the measuring instruments.
4	Learn various fundamental blocks in patient care and monitoring
5	Study various diagnostic and therapeutic techniques

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO 1	Acquainted with the function of human body and measure active and resting potentials of cell bodies.	K2
CO 2	Measure the Bioelectric potential using appropriate electrodes and Transducers.	K2
CO 3	Know the mechanism and measurement of ECG for the Cardiac cycle and respiratory system	K2
CO 4	Monitor the Patient care monitoring system and applications of therapeutic equipment	K2
CO 5	Know the working principles of diagnostic equipment	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program

Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1										1	
CO2	2	2	1										1	
CO3	1	1	2											1
CO4		1	2	2										1
CO5		1	1	1	2								1	

COURSE CONTENT	
UNIT I	**INTRODUCTION TO BIOMEDICAL INSTRUMENTATION:** Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Problems Encountered in Measuring a Living System, Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Bio amplifiers
UNIT II	**ELECTRODES AND TRANSDUCERS:** Introduction to Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer principles, Biochemical Transducers, The Transducer and Transduction principles, Active Transducers, Passive Transducers.
UNIT III	**CARDIOVASCULAR SYSTEM AND MEASUREMENTS:** The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart sound, Plethysmography, Angiogram and Angioplasty **RESPIRATORY SYSTEM AND MEASUREMENTS:** The Physiology of the Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment.
UNIT IV	**PATIENT CARE AND MONITORING:** Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring equipmentOther Instrumentation for Monitoring Patients, Pacemakers,

	Defibrillators, Ventilators, Radio Frequency applications of Therapeutic use, ECG & EEG Recorders.
UNIT V	**DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY:** Principles of Ultrasonic Measurement, Ultrasonic imaging, Ultrasonic Applications of Therapeutic uses, Ultrasonic diagnosis, X-Ray and Radio-Isotope instrumentations, CAT Scan, Emission Computerized Tomography, MRI, and Telemedicine Technology.

TEXT BOOKS	
1.	Fundamentals of biomedical instrumentation –Dr.O.N.Pandey, S.K.Kataria& sons,4 th edition,2012
2.	Bio-Medical Instrumentation – Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 2nd edition, PHI, 2011.
REFERENCE BOOKS	
1.	Hand Book of Bio-Medical Instrumentation – R.S.Khandapur, McGrawHill, 2nd edition, 2003.
2.	Biomedical Instrumentation – Dr. M. Arumugam, Anuradha Publications, 2006
WEB RESOURCES	
1.	http://www.digimat.in/nptel/courses/video/108105101/L28.html

Marketing Management

CourseCategory	Humanities including Management	**Credits**	3
CourseType	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**Blooms Taxonomy Level**
On successfulcompletionofthecourse, thestudentwillbeableto		
CO 1	Understand the concepts of Marketing and Marketing Environment.	Understanding
CO 2	Analyze the consumer behavior and market segmentation in order to maintain better consumer relations and product positioning respectively.	Analyzing
CO 3	Make use of strategies and make decisions based on product life cycle and product mix concepts.	Application
CO 4	Understand the pricing effects and select a better distribution channel to reach the consumer.	Understanding
CO 5	Understand the promotional methods and importance.	Understanding

Contribution of Course Outcomes towards achievement of Program
Outcomes: 1 – Low, 2 - Medium, 3 – High

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	0	0	2	0	0	1	1	1	0	1	1	0
CO2	0	0	1	0	0	1	0	2	1	0	1	0
CO3	0	0	1	2	1	2	1	1	0	0	1	1
CO4	0	0	1	0	0	1	0	1	0	0	1	0
CO5	0	0	0	0	0	1	1	1	1	1	1	1

Course Content :

Unit -I

Introduction to Marketing: Market and Marketing, Functions,importance and problems of marketing – Marketing Environment, Approaches to the study of marketing – Institutional Approach, Commodity approach, Management approach, systems approach to marketing.Marketing Mix(7 p's of Marketing.)

Unit -II

Consumer Behavior and CRM

Meaning and features and Factors influencing Consumer Behavior – Theories of Buying Behavior (Economic theories – Marshallion model, psychological theories, psycho-analytic theories, socio-cultural theories) – buying decision process - Customer Relationship Management.

Market Segmentation

Market Segmentation – Bases of Segmenting Consumer Market and Industrial Market – Target Marketing – Product differentiation – Product Positioning.

Unit -III

Product decision: New product development – Product mix – management of product life cycle –

product strategies – product additions and deletions.

Branding, packaging and labeling – product differentiation – planned obsolescence.

Unit –IVPricing and Channels of distribution:
Pricing: Pricing objectives – Pricing methods – Pricing strategies.
Channels of Distribution: Nature and types of marketing channels – wholesale distribution- retail distribution – direct marketing – selection of channels, Logistics, Third Party Service providers.

Unit –VPromotion : Nature and Importance of promotion – promotional methods of personal selling : objectives and function, Advertising objectives – Message content – media selection – Advertising agency – Advertising Budgets – Measuring Advertising effectiveness; Sales promotion Techniques – Social Media Promotion

Textbooks:

1. Phil T.Kotler –Marketing Management - Pearson Education limited – 2019
2. S.A.Sherlekar – Marketing Management - Himalaya Publishing House - 2019
3. Dr. K.Karunakaran – Marketing Management Himalaya Publishing House – 2010.

Reference Books :
1. Priyanka Goel - Marketing Management – Atlantic publications - 2019.
2.Philip Kotler and Lane Keller - Marketing Management – Pearson Educaion ltd - 2017
3.L.Natarajan – Marketing Management – Margham Publications - 2012

Web Resources:

1. https://www.tutorialspoint.com/marketing_management/marketing_management_functions
2. https://keydifferences.com/difference-between-branding-and-packaging.html
3. https://smallbusiness.chron.com/product-mix-639.html

Universal Human Values-2 Understanding Harmony
(Common to Civil,EEE,Mech,ECE,CSE,IT,CSE (AI&ML),CSE (DS), CSE(AI)

CourseCategory	Humanities including Management	**Credits**	3
CourseType	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K2
CO 2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K1
CO 3	Understand the role of a human being in ensuring harmony in society and nature.	K2
CO 4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	K1
CO 5	Understand the current scenario in Technology with respect to the Professional Ethics	K2

Contribution of Course Outcomes towards achievement of Program
Outcomes: 1 – Low, 2 - Medium, 3 – High

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	0	0	0	0	0	3	0	3	0	0	0	3
CO2	0	0	0	0	0	3	0	3	3	0	0	0
CO3	0	0	0	0	0	3	2	3	3	0	0	0
CO4	0	0	0	0	0	3	0	3	3	0	0	0
CO5	0	0	0	0	0	3	0	3	3	0	0	0

Course Content :

Unit – I

Introduction to Value Education: Value Education, Definition, Concept and Need for Value Education, Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.

Unit – II

Harmony in the Human Being: Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.

Unit – III

Harmony in the Family and Society and Harmony in the Nature: Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.

Unit – IV

Social Ethics: The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities.

Unit – V

Professional Ethics: Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario, Vision for Holistic Technologies, Production System and Management Models.

Textbooks:

1. A.N Tripathy, New Age International Publishers, 2003.
2.Bajpai. B. L , , New Royal Book Co, Lucknow, Reprinted, 2004
3.Bertrand Russell Human Society in Ethics & Politics

Reference Books :

1.Corliss Lamont, Philosophy of Humanism
2.Gaur. R.R. ,Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3.Gaur. R.R. ,Sangal. R ,Bagaria. G.P, Teachers Manual Excel Books, 2009.
4.I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar
5.Mortimer. J. Adler, – Whatman has made of man
6.William Lilly Introduction to Ethic Allied Publisher

Web Resources:

1.https://www.tandfonline.com/doi/abs/10.2753/RSP1061-1967330482?journalCode=mrsp20
2.https://www.thefbcg.com/resource/building-family-harmony-starts-with-living-our-values/#:~:text=What%20does%20family%20harmony%20mean,family%20as%20a%20larger%20unit

MachineLearningwithGo

(SkillOrientedCourse)

Course Category	ProfessionalCore	**CourseCode**	20AM7S02
CourseType	Laboratory	**L-T-P-C**	1-0-2-2
Prerequisites		**InternalAssessment** **Semester EndExamination** **TotalMarks**	00 50 50

COURSEOBJECTIVES	
Thestudentwill:	
1	Toturnthestudentsintoaproductive,innovativedataanalystwho canleverageGoto buildrobustandvaluableapplications
2	To introduce the technical aspects of building predictive models in Go, but also helps youunderstandhowmachinelearningworkflowsareappliedinreal-worldscenarios.
3.	Tounderstandhowtogather,organize, andparsereal-workdatafromavarietyofsources.
4	Todevelopasolidstatisticaltoolkitthatwillallowyoutoquicklyunderstandgainintuition aboutthecontentof adataset.
5	Toimplementessentialmachinelearningtechniques(regression,classification,clustering, andsoon) withtherelevantGopackages.

COURSEOUTCOMES		
Uponsuccessfulcompletionofthecourse,thestudentwillbeableto:		**CognitiveLevel**
CO1	UnderstandthesoftwareBashShell.	K2
CO2	UnderstandthesoftwareGo–aneditor.	K2
CO3	UnderstandvariousprogramsonCSV.file	K2

K1:Remember,K2:Understand,K3:Apply,K4: Analyze,K5:Evaluate,K6:Create.

Contribution of Course Outcomes towards achievement of ProgramOutcomes (1–Low,2-Medium,3–High)														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	1	--	--	--	--	--	--	2	3	1
CO2	3	3	2	2	1	--	--	--	--	--	--	2	3	1
CO3	3	3	2	2	1	--	--	--	--	--	--	2	3	1

Prerequisites:

1. BashShell
2. Go-aneditor

ListofExperiments	
1	a) WriteaGoprogramtoreadCSVfileandfindthemaximumvalueinaparticularcolumn. b) WriteaGoprogramtoreadirisdatasetwhichisincsvformatanddemonstratehandlingofunexpected fields,typesandmanipulatingCSVdata.
2	a) DemonstratehowJSONdatacanbeparsed usingGo. b) Demonstratehowtoconnectand Querying SQLlikedatabases(Postgres MySQL,SQLLite) usingGo.
3	Demonstratehowtocachedatainmemoryusing Go.
4	a) Demonstratehowtorepresentmatricesandvectorsin Go. b) WriteaGoprogramtogetstatisticalmeasureslikemean,median,standarddeviationandsoonf oranydataset. c) WriteaGoprogramtovisualizedatadistributionsusingHistogram,Box Plots..
5	a) WriteaGoprogramtodemonstrateMean SquaredError(MSE),MeanAbsoluteError(MAE),R^2(RSquared). b) WriteaGoprogramtocomputeAccuracy,Precision,Recall,AUC(AreaUnder Cover).
6	a) Demonstratehowtobuildalinearregressionmodel usingGo. b) Demonstratehowtobuilda multiplelinearregressionmodelusingGo.
7	Demonstratehowtobuildalogisticregressionmodelusing Go.
8	Applyk-nearestneighborclassifieronirisdatasetusingGo.
9	Buildadecisiontreeonirisdatasetusing Go.
10	DemonstrateK-Meansclusteringmethodusing Go.
11	Buildautoregressivemodels fortimeseriesdatausing Go
12	Demonstratehowtobuildasimpleneuralnetworkusing Go

References:

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944292286873602333_shared/overview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF CSE - BOARD OF STUDIES

B.TECH IN CSE (DATA SCIENCE) - R20 SYLLABUS OF III AND IV YEAR COURSES

Skill Oriented Course-V

MEAN Stack Technologies- MongoDB, Express.js, Angular JS Node.js, and AJAX

CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category		**Course Code**	20CS7S07
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	 50

COURSE OBJECTIVES	
1	To design dynamic web sites and web applications with Mean Stack Technologies

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Develop a basic web server using Node.js and also working with Node Package Manager (NPM).	K3
CO2	Apply Angular built-in or custom pipes to format the rendered data	K3
CO3	Make use of MongoDB queries to perform CRUD operations on document database	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2
CO2	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2
CO3	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2

COURSE CONTENT

Software configuration and installation:

1. MongoDB

TOC - MongoDB Essentials - A Complete MongoDB Guide | Infosys Springboard (onwingspan.com)

2. Angular

Setup details: Angular Application Setup - Internal - Viewer Page | Infosys Springboard (onwingspan.com)

List of Experiments

1	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

	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
2	a) 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 b) 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_9174073856000159000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course c) 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
3	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 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 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_01303558877548544069 1_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course 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
4	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 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 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 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_905413034723449100_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course 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
5	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 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&collection

	Type=Course 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_01271291242705715290 1_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course 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_01271291087550054490 4_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course 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_01271291494064128090 6_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course
6	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_01271292186091520090 9_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course 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_01271292524427673691 0_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course 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_01271292599545856091 2_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course 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
7	a) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Installing MongoDB on the local computer, Create MongoDB Atlas Cluster Install MongoDB and configure ATLAS https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818214373130240300 83_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course b) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Introduction to the CRUD Operations Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove() https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818218741661696301 18_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course
8	a) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Create and Delete Databases and Collections Write MongoDB queries to Create and drop databases and collections. https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818216541192192301 21_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course b) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Introduction to MongoDB Queries Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate(). https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_013289081626451968250 5_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course
9	a) Course Name: Angular JS Module Name: Angular Application Setup Observe the link http://localhost:4200/welcome on which the mCart application is running. Perform the below activities to understand the features of the application. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24049616594198490000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course b) Course Name: Angular JS Module Name: Components and Modules Create a new component called hello and render Hello Angular on the page https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28217843279641040000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course c) Course Name: Angular JS Module Name: Elements of Template Add an event to the hello component template and when it is clicked, it should change the courseName. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19226434057992030000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

	d) Course Name: Angular JS Module Name: Change Detection progressively building the PoolCarz application https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2560981637120771000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
10	a) Course Name: Angular JS Module Name: Structural Directives - ngIf Create a login form with username and password fields. If the user enters the correct credentials, it should render a "Welcome <<username>>" message otherwise it should render "Invalid Login!!! Please try again..." message https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012763740226043904 2595_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course b) Course Name: Angular JS Module Name: ngFor Create a courses array and rendering it in the template using ngFor directive in a list format. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32795774277593590000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course c) Course Name: Angular JS Module Name: ngSwitch Display the correct option based on the value passed to ngSwitch directive. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_23388127475984175000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course d) Course Name: Angular JS Module Name: Custom Structural Directive Create a custom structural directive called 'repeat' which should repeat the element given a number of times. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24073319904331424000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

TEXT BOOKS	
1.	MongoDB – The Definitive Guide, 3rd Edition,2019, Kristina Chodorow, O'Reilly
2	Programming the World Wide Web, 8th Edition,2014 Robet W Sebesta, Pearson.
3	Pro Mean Stack Development, 1st Edition,2016 ELadElrom, Apress O'Reilly.
4	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition,2014 SitePoint, SitePoint Pty. Ltd., O'Reilly Media.

WEB RESOURCES	
1	Node JS Download **Node.js** from the official site Setup details : How to use Node.js - Viewer Page | Infosys Springboard (onwingspan.com)
2	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview (MongoDB)
3	https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS)