R20 COURSE STRUCTURE AND SYLLABUS

For

B. Tech.

INFORMATION TECHNOLOGY

(Applicable for batches admitted from 2020-21)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade

Recognized by UGC 2(f) and 12(b) under UGC act, 1956

1-378, ADB Road, Surampalem – 533 437 Near Peddapuram, E.G.Dist, Andhra Pradesh

VISION AND MISSION OF THE INSTITUTE

VISION: To emerge as a Premier Institution for Technical Education in the Country through Academic Excellence and to be recognized as a Centre for Excellence in Research & Development, Catering to the needs of our Country.

MISSION: To realize a strong Institution by consistently maintaining State-of-art Infrastructure and building a cohesive, World Class Team and provide need based Technical Education, Research and Development through enhanced Industry Interaction.

VISION

To provide quality technical education to the students and there by transform them into proficient and enthusiastic Information Technology (IT) engineers for the global IT industry and responsible citizens of the country.

MISSION

M1: To provide the students with sound theoretical and practical knowledge pertaining to the IT field with an emphasis on software development process.

M2: To imbibe ethical values along with awareness and responsibility towards the society.

M3: To inculcate proactive nature, organizational skills and leadership skills to handle the encountered challenges in the professional and personal life.

PEOs

PEO 1: To Provide a Strong Foundation in basic sciences, Mathematics and Engineering Fundamentals.

PEO 2: To enable students with adequate analytical and problem solving skills for designing innovative software solutions to real life problems.

PEO 3: To expose the students to the essential emerging technologies in the field of information technology and to prepare the students for a successful professional career by inculcating core ethical values, interpersonal and communication skills.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs

Engineering Graduates in Information Technology will be able to

1. Develop software programs in various programming languages learnt to create the software applications to solve the real life problems of the society.

2. Learn and understand new languages, tools and software systems that will come up in future.

3. Effectively communicate their ideas to the rest of the world and bring consensus for the transformation of the idea into a usable software product / application.

R20 COURSE STRUCTURE

Zero Semester three-week Induction Program to be conducted at the beginning of the first year.

I YEAR – I SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	BSC	20HE1T01	Professional Communicative English	3	-	-	3
2	BSC	20BM1T01	Differential Equations and Numerical Methods	3	-	-	3
3	BSC	20BP1T02	Applied Physics	3	-	-	3
4	ESC	20CS1T01	Programming for Problem Solving using C	3	-	-	3
5	PCC	20IT1L01	Computer Engineering Workshop	1	-	4	3
6	BSC	20HE1L01	Professional Communicative English Laboratory	-	-	3	1.5
7	BSC	20BP1L02	Applied Physics Laboratory	-	-	3	1.5
8	ESC	20CS1L01	Programming for Problem Solving using C Laboratory	-	-	3	1.5
			Total Credits				**19.5**

I YEAR – II SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	BSC	20BM2T02	Linear Algebra and Partial Differential Equations	3	-	-	3
2	BSC	20BC2T02	Applied Chemistry	3	-	-	3
3	ESC	20EC2T02	Computer Organization	3	-	-	3
4	ESC	20CS2T03	Python Programming	3	-	-	3
5	ESC	20IT2T01	Data Structures	3	-	-	3
6	BSC	20BC2L02	Applied Chemistry Laboratory	-	-	3	1.5
7	ESC	20CS2L03	Python Programming Laboratory	-	-	3	1.5
8	ESC	20IT2L02	Data Structures Laboratory	-	-	3	1.5
9	BSC	20BE2T01	Environment Science	2	-	-	0
			Total Credits				**19.5**

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II YEAR – I SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	BSC	20BM3T03	Transforms and Vector Calculus	3	-	-	3
2	PCC	20CS3T04	Advanced Data Structures through C	3	-	-	3
3	PCC	20CS3T05	Software Engineering	3	-	-	3
4	PCC	20IT3T02	Database Management Systems	3	-	-	3
5	PCC	20IT3T03	Mathematical Foundations for Computer Science	3	-	-	3
6	PCC	20CS3L04	Advanced Data Structures through C Laboratory	-	-	3	1.5
7	PCC	20IT3L03	Unified Modeling Language Laboratory	-	-	3	1.5
8	PCC	20IT3L04	Database Management Systems Laboratory	-	-	3	1.5
9	SOC	20IT3S01 20IT3S02	Animation – 2D Animation / NoSQL databases	-	-	4	2
10	MC	20HM3T05	Constitution of India	2	-	-	0
			Total Credits				**21.5**

II YEAR – II SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	BSC	20BM4T06	Statistics with R Programming	3	-	-	3
2	PCC	20IT4T04	Operating Systems	3	-	-	3
3	PCC	20IT4T05	Automata Theory and Compiler Design	3	-	-	3
4	PCC	20CS4T07	Java Programming	3	-	-	3
5	HSC	20HM4T01	Managerial Economics and Financial Analysis	3	-	-	3
6	PCC	20CS4L06	R Programming Laboratory	-	-	3	1.5
7	PCC	20IT4L05	Operating Systems Laboratory	-	-	3	1.5
8	PCC	20CS4L07	Java Programming Laboratory	-	-	3	1.5
9	SOC	20IT4S03 20IT4S04	Animation – 3D Animation / Web Application Development Using Full Stack - Frontend Development	-	-	4	2
			Total Credits				**21.5**

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III YEAR – I SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	PCC	20CS5T08	Computer Networks	3	-	-	3
2	PCC	20CS5T09	Design and Analysis of Algorithms	3	-	-	3
3	PCC	20IT5T06	Data Mining Techniques	3	-	-	3
4	Open Elective / Job Oriented	20CE5T01 20EE5T13 20ME5T21 20EC5T15 20HM5T03 20IT5T07	**Open Elective-I** 1. Surveying 2. Renewable Energy Engineering 3. Operations Research 4. Principles of Communication Engineering 5. Entrepreneurship **Job Oriented** DevOps	3	-	-	3
5	PE	20AI5T09 20IT5T08 20CS5T13 20IT5T09	**Professional Elective - I** 1. Artificial Intelligence 2. Agile Software Process 3. Distributed Systems 4. Advanced Unix Programming	3	-	-	3
6	PCC	20IT5L06	Data Mining Techniques Laboratory	-	-	3	1.5
7	PCC	20CS5L09	Computer Networks Laboratory	-	-	3	1.5
8	SO	20IT5S05	**Skill Oriented Course - III** Continuous Integration and Continuous Delivery using DevOps	1	-	2	2
9	MC	20HE5T02	Employability Skills – I	2	-	-	0
10	PR	20IT5I01	**Summer Internship 2 Months (Mandatory) after second year to be evaluated during V semester**	-	-	-	1.5
11	project	20IT5P01	Community Service Project	0	0	0	4
			Total Credits				**25.5**

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III YEAR – II SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	PCC	20AM6T02	Machine Learning	3	-	-	3
2	PCC	20DS6T02	Big Data Analytics	3	-	-	3
3	PCC	20IT6T10	Cryptography and Network Security	3	-	-	3
4	PE	20IT6T11 20IT6T12 20IT6T13 20IT6T14	**Professional Elective - II** 1. Wireless Sensor Networks 2. MEAN Stack Development 3. Design Patterns 4. Scripting Languages	3	-	-	3
5	OE	20CE6T35 20EE6T19 20ME6T25 20EC6T26	**Open Elective - II** 1. Disaster Management 2. Fundamentals of Electric Vehicles 3. Introduction to Automobile Engineering 4. Sensors and Transducers	3	-	-	3
6	PCC	20DS6L02	Big Data Analytics Laboratory	-	-	3	1.5
7	PCC	20AM6L02	Machine Learning using Python Laboratory	-	-	3	1.5
8	PCC	20IT6L07	Cryptography and Network Security Laboratory	-	-	3	1.5
9	SO	20HE6S01	**Skill Oriented Course - IV** Soft Skills and Interpersonal Communication	1	-	2	2
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	20CS7T12 20AI7T10 20EC7T38 20CS7T15	**Professional Elective - III** 1.Cloud Computing 2. Artificial Neural Networks 3. Internet of Things (IoT) 4.Computer Forensics	3	-	-	3
2	PE	20AM7T03 20IT7T15 20CS7T11 20IT7O01	**Professional Elective - IV** 1. Deep Learning 2. Social Networks Analysis 3. Human Computer Interaction 4. MOOCS-NPTEL/SWAYAM	3	-	-	3
3	PE	20IT7T16 20IT7T17 20AM7T04 20IT7O02	**Professional Elective - V** 1. Block-Chain Technologies 2. M-Commerce 3. Reinforcement Learning 4. MOOCS-NPTEL/SWAYAM	3	-	-	3
4	OE	20CE7T11 20EE7T29 20ME7T28 20EC7T40 20HM7T09	**Open Elective - III** 1. Highway Engineering 2. Battery Management Systems and Charging Stations 3. Additive Manufacturing 4. Industrial Electronics 5. Organizational Behavior	2	-	2	3
5	OE	20CE7T13 20EE7T30 20ME7T23 20EC5T41 20HM7T04	**Open Elective - IV** 1. Water Resource Engineering 2. Smart Grid Technologies 3. Industrial Robotics 4. Biomedical Instrumentation 5. Marketing Management	2	-	2	3
6	HS	20HM7T11	Universal Human Values - II : Understanding Harmony	3	-	-	3
7	SO	20IT7S06 20IT7S07	1. Deep Learning using Python / APSSDC offered Courses 2. Secure Coding Techniques	-	-	4	2
8	PR	20IT7I02	**Industrial / Research Internship 2 months (Mandatory) after third year to be evaluated during VII semester**	-	-	3	3
			Total Credits				23

IV YEAR – II SEMESTER

S.No.	Category	Course Code	Course	L	T	P	C
1	PR	20IT8P02	Major Project Work, Seminar, Internship	-	-	-	8
			Total Credits				8

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

Professional Communicative English
(Common to All)

Course Category	Basic Sciences		Course Code	20HE1T01
Course Type	Theory		**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites	LSRW + Vocabulary Synonyms, antonyms, Grammar.	**Internal Assessment** **Semester End Examination** **Total Marks**		30 70 100

COURSE OBJECTIVES	
1	Schumacher describes the education system by saying that it was mere training, something more than mere knowledge of facts. To develop extensive reading skill and comprehension for pleasure and profit.
2	The lesson centres on the pros and cons of the development of science and technology. To develop extensive reading skill and comprehension for pleasure and profit.
3	Depicts the symptoms of Cultural Shock and the aftermath consequences. To develop extensive reading skill and comprehension for pleasure and profit.
4	Learns the importance and secrets of work which enhances the ways of living life in its real sense. To develop extensive reading skill and comprehension for pleasure and profit.
5	Inspires the learners to turn their dreams into reality. To develop extensive reading skill and comprehension for pleasure and profit.

COURSE OUTCOMES	
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.
CO2	Enables the learners to promote peaceful co-existence and universal harmony in society and empowers them to initiate innovation.
CO3	Imparts the students to manage different cultural shocks due to globalization and develop multiculturalism to appreciate diverse cultures and motivate them to contribute to their nation.
CO4	Arouse the thought of the life to lead in a clear path by recognizing the importance of work.
CO5	Inspires the learners at the advancement of software by the eminent personality and motivates the readers to think and tap their innate talents.

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	-	-	-	2	-	-			
													-	-	
CO2	-	-	-	-	-	-	-	2	-	3	-	-			
													-	-	
CO3	-	-	-	-	-	2	-	-	-	2	-	-			
													-	-	

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CO4	-	-	-	-	-	-	-	-	-	2	-	2		-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	2		-	-

COURSE CONTENT	
UNIT I	1. 'The Greatest Resource- Education' from *Professional Communicative English*. 2. 'War' from 'Panorama: A Course on Reading'
UNIT II	1. ' A Dilemma' from *Professional Communicative English*. 2. 'The Verger' from 'Panorama: A Course on Reading'
UNIT III	1. 'Cultural Shock': Adjustments to new Cultural Environments from *Professional Communicative English*. 2. ' The Scarecrow' from *Panorama: A Course on Reading*
UNIT-IV	1. 'The Secret of Work' from *Professional Communicative English*. 2. 'A Village Lost to the Nation' from *Panorama: A Course on Reading*
UNIT V	1. ' The Chief Software Architect' from *Professional Communicative English*. 2. 'Martin Luther King and Africa' from *Panorama: A Course on Reading*

TEXTBOOKS	
1.	*PROFESSIONAL COMMUNICATIVE ENGLISH. Published by Maruthi Publishers.*
2.	*PANORAMA: A COURSE ON READING, Published by Oxford University Press India*
REFERENCE BOOKS	
1.	*ENGLISH GRAMMAR AND COMPOSITION – WREN & MARTIN*
2.	*LEARNER'S ENGLISH GRAMMAR AND COMPOSITION – NDV Prasada Rao*
WEB RESOURCES	
1.	**Online Dictionaries:** https://dictionary.cambridge.org/ https://www.oxfordlearnersdictionaries.com/
2.	**Grammar:** https://www.oxfordlearnersdictionaries.com/grammar/ https://dictionary.cambridge.org/grammar/british-grammar/
3.	**Synonyms and Antonyms:** https://www.thesaurus.com/browse/search https://www.englishclub.com/vocabulary/synonyms-antonyms.htm

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

I B. Tech I Semester

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		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
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

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	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	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**

APPLIED PHYSICS

Course Category	BASIC SCIENCES		Course Code	20BP1T02
Course Type	Theory		**L-T-P-C**	3 -0-0-3
Prerequisites	Intermediate Physics		**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	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		Cognitive Level
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the optical applications using the concepts of Interference and diffraction.	Analyze (K4)
CO2	Apply the basics of Laser Mechanism and fiber optics for the communications systems.	Applying (K3)
CO3	Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response.	Applying(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.	Understanding(K2)
CO5	Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	Understanding(K2)

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	-	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-

CO5	2	2	2	-	-	-	-	-	-	-	-	2	-	-	-

COURSE CONTENT

UNIT I	**WAVE OPTICS** (10 hrs) **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** (8 hrs) 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** (12 hrs) 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** (9hrs) 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 ofconductivity based on quantum free electron theory-Fermi Dirac Distribution-Density of States-Fermi Energy
UNIT V	**BAND THEORY OF SOLIDS** (9hrs) Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron-Classificationof 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)
DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING USING C
(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML),CSE(DS), IT)

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

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

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/

Computer Engineering Workshop

Course Category	Professional Core Course		Course Code	20IT1L01
Course Type	Laboratory		**L-T-P-C**	1-0-4-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES70
Skills and knowledge provided by this subject are the following:

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		Cognitive level
Upon successful completion of the course, the student will be able to:		
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: 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	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
Task3	Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual boating with Windows and Linux
Task4	Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders.
Task5	Demonstration of Hardware and Software Troubleshooting
Task6	Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC, Bluetooth Technology, Wireless Technology, Modem, DSL, and Dialup Connection.
Task7	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:	
Task8	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.,
Task9	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.,
Task10	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.,
Task11	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

Subject Code: **20HE1L01**	L	T	P	C
	0	0	3	1.5

Professional Communicative English Lab

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

UNIT 1:
Introduction Consonant
Sounds Vowel Sounds

UNIT 2:
Rhythm and Pronunciation Weak/strong and
contrasted forms Practice of Rhythm

UNIT 3:
Dialogues

UNIT 4:
Group Discussions

UNIT 5:
Presentations & Public Speaking

UNIT-6:
Interviews

Course Outcomes

CO	Description	COGNITIVE LEVEL
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

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

CO	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	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

APPLIED PHYSICS LABORATORY

Course Category	BASIC SCIENCES		Course Code	20BP1L02
Course Type	Laboratory		**L-T-P-C**	0 -0-3-1.5
Prerequisites	Intermediate Physics		**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

	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	Cognitive Level
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.	Understanding(K2)
CO2 Determine the Magnetic and Dielectric constants of materials.	Application(K3)
CO3 Apply the basics of Current Electricity and Semiconductors in engineering Application	Application(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	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	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)
DEPARTMENT OF INFORMATION TECHNOLOGY

Programming for Problem solving using C Lab
(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML),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	30
		Semester End Examination	70
		Total Marks	100

	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
CO4	Design and develop modular programming 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	0	0	0	0	0	0	0	2	2	0
CO2	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0
CO3	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0

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.

I Year II Semester
Linear Algebra and Partial Differential Equations
(Common to CE, ME, ECE, CSE, IT, CSE-DS, CSE-AI&ML)

I B. Tech II Semester

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	30
			Semester End Examination	70
			Total Marks	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		
Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	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 V: 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

Applied Chemistry

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

Course Category	Basic Sciences	Course Code	20BC2T02
Course Type	Theory	L-T-P-C	3 – 0 – 3 – 4.5
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		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To compare different types of batteries and explain the merits of fuel cell.	Understanding (K2)
CO2	List out different renewable sources of energy.	Applying (K3)
CO3	To explain the Green methods of Synthesis and applications of Green technologies and also Band theory applications.	Applying (K3)
CO4	Analyze the importance of Polymers in engineering applications.	Understanding (K2)
CO5	To Distinguish between Rotaxane and Catenane molecular machines	Analyzing (K4)

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	2	2	2		2				2		1		1
CO2	2	2	1		1	1					1				
CO3	1	1		1	2							1		1	
CO4	2	2		1			1					1			
CO5	1	1	1				1				2	1	1		

UNIT I	**ELECTROCHEMICAL ENERGY SYSTEMS** **9hrs** 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. **Learning Outcomes:** At the end of this unit, the students will be able to Apply Nernst Equation for Calculating Electrode Potentials (L3) Compare different batteries and their applications (L2)
UNIT II	**ENERGY SOURCES AND APPLICATIONS** **8hrs** 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). **Learning outcomes** :After the completion of the Unit ,the student will able to List different renewable sources of energy. (L-1) Explain how photovoltaic cells convert light into energy. (L-2) Illustrate the construction and working of PV cell. (L-2)
UNIT III	**MATERIAL SCIENCE AND ENGINEERING** **7+5 hrs** **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**.** **Learning Outcomes:** At the end of this unit, the students will be able to Classify Nano materials. (L-2) Explain the Synthesis and applications of Nano Materials. (L-2) Explain the band theory of solids for conductors, semiconductors and insulators (L2)
UNIT IV	**POLYMER CHEMISTRY** **10hrs** **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. **Learning Outcomes:** At the end of this unit, the students will be able to Explain different types of polymers and their applications (L2) Demonstrate the mechanism of conduction in conducting polymers (L2)

UNIT V	**Instrumental Methods & Molecular Machines and Switches** **9 hrs** 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. **Learning Outcomes:** At the end of this unit, the students will be able to Explain the concepts of artificial molecular machines and molecular switches. (L-3) Distinguish between rotaxane and catenane molecular machines . (L-2) Explain the different types of spectral series in electromagnetic spectrum (L2) Understand the principles of different analytical instruments (L2) Explain the different applications of analytical instruments (L2)

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

Subject Code: 20EC2T02

COMPUTER ORGANIZATION
(CSE & IT)

Course Objectives:

Students will learn:

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- The depth in understanding of basic organization, design, programming of a simple digital computer.
- The concepts of computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems.

Course Outcomes: The student will be able to

CO1	Understanding the design of the functional units of a digital computer system. Relate Postulates of Boolean algebra and minimize combinational functions.
CO2	Design and analyze sequential circuits and Identify, compare and assess issues related to ISA, memory, control and I/O functions.
CO3	Understand the basic concepts of computer arithmetic, organization and design
CO4	Understand the programming concepts of control unit, CPU and 8086 microprocessors.
CO5	Recall the internal organization of computers, memory unit and Input/Outputs and the relations between its main components

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

UNIT I:

Digital Components and Data Representation: Introduction, Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self-Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCII Code

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Combinational Circuits: Boolean expressions and their minimization using algebraic identities; Karnaugh map representation and minimization of Boolean functions using Kmap; Two-level realizations using gates -- AND-OR, OR-AND, NAND-NAND and NOR-NOR structures

UNIT II:

Digital logic circuits: Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Integrated NAND-NOR Gates, Multifunction gates, Multi-bit adder, Multiplexers, De-multiplexers, Decoders

Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using T flipflops; Synchronous counters; Shift Registers; Ring counters

UNIT III:

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT IV:

Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

8086 microprocessor: pin diagram, instruction set, Introduction to assembly language programming, Assembler, linker, Locator, debugger, emulator concepts. Assembler directives, 8086 programming examples to implement while - do, Repeat - Until, if-thenelse constructs etc, String operations, Array, far and near procedures, macros. Timing and delay loops

UNIT V:

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Text Books:
1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer System Architecture, 3rded., M.MorrisMano, PHI
3. Microprocessor and Interfacing –Douglas V. Hall, 3 rd edition,TMH

Reference Books:
1. Digital Logic and Computer Organization, Rajaraman, Radhakrishnan, PHI, 2006.
2. Computer Organization, 5thed., Hamacher, Vranesic and Zaky, TMH, 2002.
3. Computer Organization & Architecture: Designing for Performance, 7thed., William Stallings, PHI, 2006.

PYTHON PROGRAMMING
(Common to CSE and IT)

Course Category	Engineering Science	Course Code	20CS2T03
Course Type	Theory	L-T-P-C	2-0-2-3
Prerequisites	Exposure to Programming for Problem Solving using C	**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 datatypes, containers.
3	To be familiarized with general computer programming concepts likeconditional 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

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	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

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

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

Data Structures

Course Category	Engineering Science		Course Code	20IT2T01
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

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		Cognitive level
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

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	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, 2nd ed, 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

APPLIED CHEMISTRY LAB

Course Category	Basic sciences	**Course Code:**	20BC2L02
Course Type	Laboratory	**L-T-P-C:**	0 -0 -3-1.5
Prerequisites	Basic Chemistry	**Continuous Evaluation:**	25
		Semester end Evaluation:	50
		Total Marks:	75

COURSE OUTCOMES		
Upon successful completion of this course, the student will be able to:		**Cognitive Level**
CO1	estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of polymers and nano particles	Applying(K3)
CO2	determine the concentration of different metal ions present in water by complexometric titrations.	Understanding(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.	Evaluating (K5)

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
CO1	2	1	2											
CO2	2	1		1										
CO3	2	1												

COURSE CONTENT

(Any 10 of the following listed 13 experiments)

LIST OF 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)

TEXTBOOKS

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).

REFERENCEBOOKS

Vogel's Textbook of Quantitative chemical analysis, J. Mendham et.al.

[1] College designed manual

WEB-RESOURCES

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

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

PYTHON PROGRAMMING LAB

Course Category	Professional Core		Course Code	20CS2L03
Course Type	Laboratory		**L-T-P-C**	0-0-3-1.5
Prerequisites			**Internal Assessment**	15
			Semester End Examination	35
			Total Marks	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	Analyzing
CO2	Use functions and represent Compound data using Lists, Tuples and Dictionaries	Applying
CO3	Use various applications using python	Applying

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	1	1	1	0	0	0	0	0	0	2	3	3	2
CO2	3	2	1	1	1	0	0	0	0	0	0	2	3	3	2
CO3	3	2	1	1	1	0	0	0	0	0	0	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 andreturns x1/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 firstn 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_pricethat 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_purchasethat 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.

Data Structures Laboratory

Course Category	Engineering Science		Course Code	20IT2L02
Course Type	Laboratory		L-T-P-C	0-0-3-1.5
Prerequisites			Internal Assessment	15
			Semester End Examination	35
			Total Marks	50

COURSE OBJECTIVES	
1	The objective of this lab is to demonstrate the different data structures implementation.

COURSE OUTCOMES		Cognitive level
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

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	2	1	-	-	-	-	-	-	-	1	1	1
CO3	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1

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	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

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.

Environmental Sciences
(Common to CE, ME, ECE, CSE, CSEDS&AI, IT)

Course Category	Basic Sciences	Course Code	20BE2T01
Course Type	Theory	L-T-P-C	3 – 0 – 0 – 0
Prerequisites	Basic Knowledge in Environment and protection.	Internal Assessment Semester End Examination Total Marks	0 0 0

COURSE OBJECTIVE:	
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	
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.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems
CO5	Influence their society in proper utilization of goods and services.
CO6	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices

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	1	0	1	0	0	1	2	0	0	0	1	0	0	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0	0	0

Course contents:
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.

LEARNING OUTCOMES:

Students will be able to
Articulate the basic structure, functions, and processes of key social systems affecting the environment
Explain why renewable and non-renewable energy resources are important. Explain how water resources should be used.

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*.

LEARNING OUTCOMES:

Students will be able to
Get a clear picture of structure and functions of ecosystems.
Demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematic in the broad sense.
Explain 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*

LEARNING OUTCOMES

Students will be able to
Understand Cause, effects and control measures of air pollution. Understand solid 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*

LEARNING OUTCOMES:

Students will be able to
Explain the enforcement of Environmental legislations

Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities.
Explain the reasons for global warming

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)

LEARNING OUTCOMES

Students will have

Explain various types of information technologies Explain the theories of population explosion Acquire knowledge on various environmental challenges induced due to nplanned anthropogenic activities

DEPARTMENT OF ENVIRONMENTAL SCIENCES

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 NVIRONMENThttp://www.ecoindia.com/education/water-conservation.html https://thewaterproject.org/water_conservation\ https://legalcareerpath.com/what-is-environmental-law/**

II Year – I Semester

TRANSFORMS AND VECTOR CALCULUS
(Common to CE, ME, ECE, CSE, IT, CSE-DS & CSE-AI&ML and CSE-AI branches)

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

Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

	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.	

TEXTBOOKS

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)
DEPARTMENT OF INFORMATION TECHNOLOGY

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	30
		Semester End Examination	70
		Total Marks	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

Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	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 Red-Black Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a Red-Black 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 Trie-Space Required.

TEXTBOOKS

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

SOFTWARE ENGINEERING
Common to CSE, IT

Course Category	Professional Core		Course Code	20CS3T05
Course Type	Theory		L-T-P-C	3 – 0 – 0 – 3
Prerequisites			**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 OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1 Ability to transform an Object-Oriented Design into 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: 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	-	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 WebApps, 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 Groundwork, 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 Modelling, Requirements Modeling for WebApps.
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 WebApps, Designing Traditional Components, Component-Based Development.
UNIT V	The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp 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 WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing.

TEXTBOOKS

1.	Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2.	Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

REFERENCE BOOKS

1.	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 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

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	30
		Semester End Examination	70
		Total Marks	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 Relational Algebra
3	To introduce the concepts of basic SQL as a universal Database language
4	To demonstrate the principles behind systematic database design approaches by covering conceptual 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/

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**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
1	To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
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 ties between 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/

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**	15
		Semester End Examination	35
		Total Marks	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

Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	3	3	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-

	LIST OF EXPERIMENTS
1	Implement functions of Dictionary using Hashing (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.

TEXTBOOKS	
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, Second Edition, Mark Allen Weiss, Pearson Education, 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

UNIFIED MODELING LANGUAGE LABORATORY

Course Category	Professional Core		Course Code	20IT3L03
Course Type	Laboratory		L-T-P-C	0 – 0 – 3 – 1.5
Prerequisites			Internal Assessment	15
			Semester End Examination	35
			Total Marks	50

COURSE OBJECTIVES

1	To know the practical issues of the different object oriented analysis and design concepts
2	Inculcate the art of object oriented software analysis and design
3	Apply forward and reverse engineering of a software system
4	Carry out the analysis and design of a system in an object oriented way

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1 Design the UML models for the given applications.	K2
CO2 Represent solutions to the problems using UML.	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	1	2	2	2	2	-	-	-	-	-	3	-	3	3	-
CO2	3	3	2	2	2	-	-	-	-	-	3	-	3	3	-

LIST OF EXPERIMENTS

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

1	Familiarization with Rational Rose or Umbrella environment
2	a. Identify and analyze events b. Identify Use cases c. Develop event table
3	a. Identify & analyze domain classes b. Represent use cases and a domain class diagram using Rational Rose c. Develop CRUD matrix to represent relationships between use cases and problem domain classes
4	a. Develop Use case diagrams b. Develop elaborate Use case descriptions & scenarios c. Develop prototypes (without functionality)
5	a. Develop system sequence diagrams and high-level sequence diagrams for each use case b. Identify MVC classes / objects for each use case c. Develop Detailed Sequence Diagrams / Communication diagrams for each use case showinginteractions among all the three-layer objects
6	a. Develop detailed design class model (use GRASP patterns for responsibility assignment) b. Develop three-layer package diagrams for each case study
7	a. Develop Use case Packages b. Develop component diagrams c. Identify relationships between use cases and represent them d. Refine domain class model by showing all the associations among classes
8	Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams anddeployment diagrams

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**	15
			Semester End Examination	35
			Total Marks	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 constraints while 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

ANIMATION - 2D ANIMATION

Course Category	Skill Oriented		Course Code	20IT3S01
Course Type			L-T-P-C	0 – 0 – 4 – 2
Prerequisites			Total Marks	50

COURSE OBJECTIVES

1	This Course will enable students to learn various aspects of animation using a variety of 2-D software and to implement advance principles of traditional animation in Adobe animate to create high quality animation for production

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1	Learn various tools of digital 2-D animation.	K2
CO2	Understand production pipeline to create 2-D animation.	K2
CO3	Analyze special effects in animation to bring interest and awe in the scenes and backgrounds.	K2
CO4	Apply the tools to create 2D animation for films and videos.	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	3	-	3	-	-	-	-	-	-	3	-	2	-
CO2	3	3	3	-	3	-	-	-	-	-	-	3	-	2	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	-	2	-
CO4	3	3	3	-	3	-	-	-	-	-	-	3	-	2	-

	LIST OF EXPERIMENTS
	2D GRAPHIC DESIGN
1	**Adobe Photoshop:** 1. Create your visiting card 2. Create Title for any forthcoming film 3. Digital Matte Paint 4. Convert Black and White to Color 5. Convert Day mode to Night mode 6. Design Image manipulation 7. Smooth skin and remove blemishes & scars

	8. Create a 3D pop-out effect
	9. Create Textures
	10. Timeline Animation
2	**Adobe Illustrator:**
	1. Advertisement
	2. Digital Illustrations
	3. Brochure
	4. Packet Design(Toothpaste packet, Soap cover, any Food product)
	5. Danglers for display
	6. Menu cards
	7. Calendar Design
	8. Tracing image
	9. Vehicle Design
	10. Festival
3	**Adobe Indesign**:
	1. Magazine A4 Size
	2. Newspaper layout design & advertisements – Fine arts
	3. Special Supplement
	4. Different categories of Books
	5. Info-graphics
	6. Caricatures
4	**Corel DRAW:**
	1. Create a paper ad for advertising of any commercial agency
	2. Package Design
	3. Corporate ID
	4. Exhibition Layout
	5. Oblers

	2D ANIMATION
5	Creating Web Banners in Adobe Flash
6	Creating a Logo Animation in Adobe Flash
7	Creating Frame by Frame animation
8	Draw Cartoon Animation using reference.
9	Create Lip Sink to Characters
10	Using filters & Special effects
11	Create a scene by using Mask layers animation

	E-Learning Lab:
12	Student Application form
13	Video Controlling
14	Audio Controlling
15	Start Drag and Stop Drag Actions
16	Interactive Keyboard Controls using Flash Action Script.
17	Interactive Flash Game.
18	Creating Character Animation in After Effects

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NOSQL DATABASES

Course Category	Skill Oriented		Course Code	20IT3S02
Course Type			**L-T-P-C**	0 – 0 – 4 – 2
Prerequisites			**Total Marks**	50

COURSE OBJECTIVES

1	Master the leading document-oriented NoSQL database, MongoDB Architecture, CRUD, Schema.
2	Design, Data Modelling and Indexing using real-life case studies.
3	Learn how to design Schema using Advanced Queries.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Learn about SQLite which is a relational database and perform various operations.	K2
CO2	Install, configure and setup the drivers to use MongoDB with your programming language of choice	K3
CO3	Gain an in-depth understanding of main features of MongoDB and their use cases	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	3	-	2	-	-	-	-	-	-	2	2	2	1
CO2	3	3	3	-	2	-	-	-	-	-	-	2	1	2	1
CO3	3	3	3	-	2	-	-	-	-	-	-	2	1	2	1

	LIST OF EXPERIMENTS
	SQLite
1	SQLite Installation
2	DOT(.) Commands
3	Attach, Detach Databases
4	Data types

5	Constraint
6	Create, Alter, Drop Index
7	SELECT statement
8	Operators
9	Aggregate functions
10	Core Functions
11	JOINS
12	Triggers
MongoDB	
1	MongoDB on Windows
2	MongoShell
3	Databases, Documents
4	Collections
5	MongoDB Connections
6	Query and Projection
7	Operators
8	Aggregation Pipeline Operators
9	Database Commands
10	Shell Methods

CONSTITUTION OF INDIA

Course Category	Humanities including Management		Course Code	20HM3T05
Course Type	Theory		L-T-P-C	2 – 0 – 0 – 0
Prerequisites			Total Marks (Internal Assessment)	100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
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

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	-	1	-	2	-	-	-
CO2	-	-	-	-	-	1	-	2	1	1	-	1	-	-	-
CO3	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO5	-	-	-	-	-	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-ofthe-union-and-the-states.html
3.	https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

II Year – II Semester

STATISTICS WITH R PROGRAMMING
(Only for IT)

Course Category	Basic Sciences		Course Code	20BM4T06
Course Type	Theory		L-T-P-C	3 – 0 – 0 – 3
Prerequisites	NIL		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

1	Use R for statistical programming, computation, graphics, and modelling.
2	Write functions and use R in an efficient way.
3	Fit some basic types of statistical models.
4	Use R in their own research.
5	Be able to expand their knowledge of R on their own.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	List motivation for learning a programming language.	K2
CO2	Access online resources for R and import new function packages into the R workspace.	K3
CO3	Import, review, manipulate and summarize data-sets in R.	K3
CO4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.	K4
CO5	Perform appropriate statistical tests using R , Create and edit visualizations with R.	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	1	2	-	3	-	-	-	-	-	-	1	-	-	-
CO2	3	1	2	2	3	-	-	-	-	-	-	1	-	-	-
CO3	3	2	2	2	3	-	-	-	-	-	-	1	-	-	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	1	-	-	-

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COURSE CONTENT		
UNIT I	**Basic R- operations and concepts:** Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.	
UNIT II	**Control statements and operators in R:** R Programming Structures, Control Statements, Loops, - Looping Over Non vector Sets,- If- Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.	
UNIT III	**Doing Math and Simulation in R :** Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions For Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.	
UNIT IV	**Graphics and probability Distributions in R:** Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files. Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA	
UNIT V	**Linear and Non-linear model in R:** Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests	

TEXTBOOKS

1.	The Art of R Programming, Norman Matloff, Cengage Learning
2.	R for Everyone, Lander, Pearson

REFERENCE BOOKS

1.	R Cookbook, PaulTeetor, Oreilly.
2.	R in Action,Rob Kabacoff, Manning

WEB RESOURCES

1.	**UNIT I:** https://cran.r-project.org/doc/manuals/r-release/R-intro.html https://www.tutorialspoint.com/r/r_data_frames.htm
2.	**UNIT II:** https://www.kdnuggets.com/2018/02/control-structures-r-using-if-else-statements-loops.html https://adv-r.hadley.nz/control-flow.html https://stackoverflow.com/questions/66355937/how-to-create-a-binary-tree-using-only-base-r
3.	**UNIT III:** https://rpubs.com/liamroel13/stat312_mod3_les11 https://www.stat.berkeley.edu/~mgoldman/Section0220.pdf
4.	**UNIT IV:** https://www.coursehero.com/file/61779709/Runit4docx/#:~:text=Creating%20Graphs%20%3AThe%20Workhorse%20of,many%20differentkinds%20of%20graphs. https://www.stat.umn.edu/geyer/old/5101/rlook.html https://www.guru99.com/r-anova-tutorial.html
5.	**UNIT V:** https://medium.com/analytics-vidhya/linear-regression-in-r-make-a-prediction-in-15-lines-ofcode-204752b6bfff https://www.geeksforgeeks.org/survival-analysis-inr/#:~:text=Survival%20analysis%20deals%20with%20the,censored%20observations%20i.e%20incomplete%20observations.

OPERATING SYSTEMS
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT

Course Category	Professional Core		Course Code	20IT4T04
Course Type	Theory		L-T-P-C	3 – 0 – 0 – 3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	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 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	-	-	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 Overview: 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: Multithreading 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, Firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

TEXTBOOKS	
1.	Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2.	Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.)

REFERENCE BOOKS	
1.	Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
2.	Stallings W, Operating Systems - Internals and Design Principles, 6th edition, Pearson Education, 2009
3.	Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105214/

AUTOMATA THEORY AND COMPILER DESIGN
Common to CSE (AI&ML), CSE (AI), CSE (DS), IT

Course Category	Professional Core		Course Code	20IT4T05
Course Type	Theory		**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	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 performanceof 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 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	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, lex 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, LALR 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.

TEXTBOOKS	
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 J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010.
3.	Theory of Computation, V. Kulkarni, Oxford University Press, 2013

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/104/106104028/
2.	https://nptel.ac.in/courses/106/104/106104123/

JAVA PROGRAMMING
Common to CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

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

Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	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

TEXTBOOKS	
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

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

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

COURSE OUTCOMES

	Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1	Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services.	K3
CO2	Assess the functional relation among production, cost of production, cost concepts and Break-Even Analysis.	K5
CO3	Classify market structures for price and output decisions and Appraise the forms of business organizations and trade cycles in economic growth.	K2
CO4	Make use of the final accounting statements in financial decision making	K3
CO5	Apply capital budgeting techniques in financial decision making	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	-	-	-	-	-	-	-	-	-	-	-	-	-
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 BreakEven 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)

TEXTBOOKS

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
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

R PROGRAMMING LABORATORY
Common to CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core		Course Code	20CS4L06
Course Type	Laboratory		**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites			**Internal Assessment**	15
			Semester End Examination	35
			Total Marks	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

Upon successful completion of the course, the student will be able to:		Cognitive Level
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

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	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

	LIST OF EXPERIMENTS
1	Installing R and RStudio Basic functionality of R, variable, data types in R
2	a) Implement R script to show the usage of various operators available in R language. b) Implement R script to read person's age from keyboard and display whether he is eligible for voting or not. c) Implement R script to find biggest number between two numbers. d) Implement R script to check the given year is leap year or not.
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
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.
5	a) Implement R Script to perform various operations on matrices

	b) Implement R Script to extract the data from data frames. c) Write R script to display file contents. d) Write R script to copy file contents from one file to another
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
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
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.
9	a) Implement R Script to perform Normal, Binomial distributions. b) Implement R Script to perform correlation, Linear and multiple regression.
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
11	Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates, outliers, spelling
12	Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Google Spreadsheets, API and web scraping examples.

TEXTBOOKS	
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/

OPERATING SYSTEMS LABORATORY
Common to CSE, IT

Course Category	Professional Core		Course Code	20IT4L05
Course Type	Laboratory		L-T-P-C	0 – 0 – 3 – 1.5
Prerequisites			Internal Assessment	15
			Semester End Examination	35
			Total Marks	50

COURSE OBJECTIVES

1	To understand the design aspects of operating system
2	To study the process management concepts & Techniques
3	To study the storage management concepts
4	To familiarize students with the Linux environment
5	To learn the fundamentals of shell scripting/programming

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Execute UNIX commands	K2
CO2	Stimulate CPU scheduling algorithms in OS	K2
CO3	Implement page replacement algorithms in OS	K3
CO4	Implement file allocation strategies in OS	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	-	-	-	-	-	-	-	2	2	1
CO2	1	3	1	2	2	-	-	-	-	-	-	-	2	-	1
CO3	2	2	2	2	3	-	-	-	-	-	-	-	2	1	2
CO4	1	2	3	2	2	-	-	-	-	-	-	-	2	2	1

	LIST OF EXPERIMENTS
1	a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown. b) Study of vi editor

	c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system d) Study of Unix/Linux file system (tree structure) e) Study of .bashrc, /etc/bashrc and Environment variables.
2	Write a C program that makes a copy of a file using standard I/O, and system calls.
3	Write a C program to emulate the UNIX ls –l command.
4	Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort
5	Simulate the following CPU scheduling algorithms: (a) Round Robin (b) SJF (c) FCFS (d) Priority
6	Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit(), System calls
7	Simulate the following: a) Multiprogramming with a fixed number of tasks (MFT) b) Multiprogramming with a variable number of tasks (MVT)
8	Simulate Bankers Algorithm for Dead Lock Avoidance
9	Simulate Bankers Algorithm for Dead Lock Avoidance
10	Simulate the following page replacement algorithms: a) FIFO b) LRU c) LFU
11	Simulate the following File allocation strategies (a) Sequenced (b) Indexed (c) Linked
12	Write a C program that illustrates two processes communicating using shared memory.
13	Write a C program to simulate producer and consumer problem using semaphores
14	Write C program to create a thread using pthreads library and let it run its function
15	Write a C program to illustrate concurrent execution of threads using pthreads library

PRAGATI ENGINEERING COLLEGE
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JAVA PROGRAMMING LABORATORY
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT

Course Category	Professional Core		Course Code	20CS4L07
Course Type	Laboratory		**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites			**Internal Assessment**	15
			Semester End Examination	35
			Total Marks	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

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Evaluate default value of all primitive data type, Operations, Expressions, Control flow, 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

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	3	2	-	-	-	-	-	-	-	-	3	2	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	2	3

LIST OF EXPERIMENTS

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 ax2+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) 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 to 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

	TEXTBOOKS

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

ANIMATION –3D ANIMATION

Course Category	Skill Oriented		Course Code	20IT4S03
Course Type			L-T-P-C	0 – 0 – 4 – 2
Prerequisites			Total Marks	50

COURSE OBJECTIVES

1	To know about 3D software interface
2	To know about different type of 3D modeling like polygon, nerves modeling, curve based, modeling, Patch modeling
3	To understand the basic blocking of 3D Inorganic and organic modeling, high poly modeling, unwrapping texturing

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	To understand different styles and treatment of content in 3D model creation	K2
CO2	To apply the cognitive 3D designing	K3
CO3	To apply tools to create effective 3D modelling texturing and lighting	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	3	3	3	-	-	-	-	-	-	2	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3	2

	LIST OF EXPERIMENTS
1	Create any Model some objects such as chairs, tables, fruits, utensils.
2	Create any Model instruments, tools.
3	Create any Model of Cars or Bike.
4	Create any model of the male or female character.

5	Create any Model of any animal.
6	Create any Model of any birds, fishes, and worms.
7	Apply basic material and shader types & Procedurals textures.
8	Unwrap the models of objects and characters using various projection maps.
9	Apply texture on various objects and characters.
10	Create a natural outdoor or indoor scene.
11	Create Opacity, Smoothness, Secularity, and color maps, Transparency, Reflection.
12	Bump & Displacement Maps.
13	Render a frame and video of indoor and outdoor scenes.
14	Render a video of indoor scenes.
15	Render a photorealistic output of an interior scene.
16	Advance lighting using mental ray render.
17	Animate day and night scene of a street with the help of lighting.

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WEB APPLICATION DEVELOPMENT USING FULL STACK –

FRONTEND DEVELOPMENT

Course Category	Skill Oriented		Course Code	20IT4S04
Course Type			**L-T-P-C**	0 – 0 – 4 – 2
Prerequisites			**Total Marks**	50

COURSE OBJECTIVES	
1	To provide understanding about the core concepts of frontend programming for responsive web frontend development.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Create web pages using HTML and Cascading Style Sheets.	K3
CO2	Develop applications using JavaScript	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	-	-	-	-	-	-	2	3	2	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	3	2	2

	LIST OF EXPERIMENTS
1	A) HTML 1) Introduction to HTML 2) Browsers and HTML 3) Editor's Offline and Online 4) Tags, Attribute and Elements 5) Doctype Element 6) Comments 7) Headings, Paragraphs, and Formatting Text 8) Lists and Links 9) Images and Tables
2	B) CSS 1) Introduction CSS 2) Applying CSS to HTML 3) Selectors, Properties and Values 4) CSS Colors and Backgrounds 5) CSS Box Model 6) CSS Margins, Padding, and Borders 7) CSS Text and Font Properties 8) CSS General Topics
3	Introduction to JavaScript

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4	Applying JavaScript (internal and external)
5	Understanding JS Syntax
6	Introduction to Document and Window Object
7	Variables and Operators
8	Data Types and Num Type Conversion
9	Math and String Manipulation
10	Objects and Arrays
11	Date and Time
12	Conditional Statements
13	Switch Case
14	Looping in JS
15	Functions

III YEAR I SEMESTER
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	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

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		Cognitive level
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

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	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

PRAGATI ENGINEERING COLLEGE
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DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE, IT, CSE(AI), CSE(AI&ML), CSE(DS))

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

COURSE OBJECTIVES
The objective of the course is to

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

	Upon successful completion of the course, the student will be able to:	Cognitive level
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- Completeness theory ,lower bound theory and String Matching	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	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-

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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, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2.	Introduction to Algorithms Thomas H. Cormen, PHI Learning, Fourth Edition 2020.
3.	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press 2015.

REFERENCE BOOKS

1.	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press
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/

DATA MINING TECHNIQUES

Course Category	Professional Core		Course Code	20IT5T06
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	**30**
			Semester End Examination	**70**
			Total Marks	**100**

COURSE OBJECTIVES
The objectives of the course is to

1	Introduce basic concepts and techniques of data warehousing and data mining
2	Examine the types of the data to be mined and apply pre-processing methods on raw data
3	Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

COURSE OUTCOMES

	Upon successful completion of the course, the student will be able to:	Cognitive level
CO1	Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.	K2
CO2	Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms.	K2
CO3	Choose appropriate classification technique to perform classification, model building and evaluation.	K2
CO4	Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.	K3
CO5	Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.	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	3	2	-	-	-	-	-	-	-	2	1	2
CO2	3	3	2	3	3	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	1	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	1	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2	2

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COURSE CONTENT	
UNIT I	**Introduction:** Data Warehouse: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage. Why and What is data mining, What kinds of data need to be mined and patterns can be mined, Which technologies are used, Which kinds of applications are targeted.
UNIT II	**Attributes, Measures and Data Pre-processing:** Data Objects, Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.
UNIT III	**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction.
UNIT IV	**Association Analysis:** Problem Definition, Frequent Item set Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm.
UNIT V	**Cluster Analysis:** Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K Means

TEXT BOOKS	
1.	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier, 2011.
2.	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

REFERENCE BOOKS	
1.	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2.	Data Mining: Vikrampudi and P. Radha Krishna, Oxford Publisher.
3.	Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4.	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.

WEB REFERENCES	
1.	NPTEL course by Prof. Pabitra Mitra - http://onlinecourses.nptel.ac.in/noc18_cs14/preview
2.	NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran – http://onlinecourses.nptel.ac.in/noc17_mg24/preview
3.	http://www.saedsayad.com/data_mining_map.htm

OPEN ELECTIVE - I
SURVEYING

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

COURSE OBJECTIVES

The objective of the course is to

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 topographical map.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Illustrate the fundamentals in chain and plane table 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 Theodolite 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 Classificationsof Surveying – Errors in survey measurements. **DISTANCEMEASUREMENTCONVENTIONS AND METHODS:** Use of chain and tape, Errors and corrections to linear measurements, overview of plane table surveying.
UNIT II	**COMPASS SURVEY:** Definition- Principles of Compass survey - Meridians, Azimuths and Bearings, declination. Computation of angle - Purpose and types of Traversing - traverse adjustments – Local attraction.
UNIT III	**LEVELING:** Concept and Terminology, Levelling Instruments and their Temporary andpermanent adjustments- method of levelling. **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, Total station advantages and Applications. Introduction to Global Positioning 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 sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

TEXT BOOKS	
1.	Surveying (Vol No.1, 2 &3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd, New Delhi.
2.	Text book of Surveying by C. Venkataramaiah, University press, India (P) limited.

REFERENCE BOOKS	
1.	Text book of Surveying by S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2.	Text book of Surveying by Arora (Vol No. 1&2), Standard Book House, Delhi.

WEB RESOURCES	
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

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

COURSE OBJECTIVES

The objective of the course is to

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		Cognitive level
Upon successful completion of the course, the student will be able to:		
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.

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	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 I	**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 II	**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 III	**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 IV	**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 V	**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

1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

OPERATIONS RESEARCH

Course Category	Open Elective	**Course Code**	20ME5T21
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	Applications of operations research through LPP.
2	Formulation of objective function through transportation and assignment problems.
3	How to sequence the jobs and machines while processing and Replacement of machine/equipment.
4	The applications of waiting line problems and operations research through DPP.
5	Deterministic and stochastic models.

COURSE OUTCOMES

	Upon successful completion of the course, the student will be able to:	Cognitive level
CO1	Formulate the objective function by linear programming problem and solution through various models.	K3
CO2	Evaluate optimal solutions to the objective function with the knowledge of transportation and assignment problems.	K3
CO3	Apply the sequencing of the jobs on a machine and items replacements	K4
CO4	Apply the principle of dynamic programming and service rate.	K3
CO5	Apply the inventory models in balancing the stock and demand ratio for profits	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	3	2	3	-	-	-	-	-	3	-	3	1	3
CO2	3	3	3	1	3	-	-	-	-	-	3	-	3	1	3
CO3	3	3	3	1	3	-	-	-	-	-	3	-	3	1	3
CO4	3	3	3	2	3	-	-	-	-	-	3	-	3	2	3
CO5	3	3	3	1	3	-	-	-	-	-	3	-	3	2	3

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Development – definition– characteristics and phases – types of operation research models – applications. **ALLOCATION:** Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle
UNIT II	**TRANSPORTATION PROBLEM:** Formulation – optimal solution, unbalanced transportation problem – degeneracy, **ASSIGNMENT PROBLEM** – formulation – optimal solution - variants of assignment problem- travelling salesman problem.
UNIT III	**SEQUENCING** – Introduction – flow –shop sequencing –n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through 'm' machines. **REPLACEMENT:** Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.
UNIT IV	**WAITING LINES:** Introduction – single channel – poison arrivals –exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals. **DYNAMIC PROGRAMMING:** Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.
UNIT V	**INVENTORY:** Introduction – single item – deterministic models –purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

TEXT BOOKS	
1.	Operations Research / S.D.Sharma-Kedarnath
2.	Operations Research/S Kalavathy / Vikas Publishers

REFERENCE BOOKS	
1.	Operations Research / A.M.Natarajan, P. Balasubramani, A.Tamilarasi / Pearson Education.
2.	Operations Research / R.Pannerselvam,PHI Publications.
3.	Operations Research / Wagner/ PHI Publications.
4.	Operations Research / DS Cheema/University Science Press
5.	Operations Research / Ravindran, Philips, Solberg / Wiley publishers.

WEB RESOURCES	
1	http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html
2	https://nptel.ac.in/courses/110106062

PRINCIPLES OF COMMUNICATION ENGINEERING

Course Category	Open Elective		Course Code	20EC5T15
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	The Fundamentals of Analog Communication Systems
2	The Generation and Detection of Angle Modulation Techniques
3	The Digital Modulation Techniques
	The knowledge in measurement of information and various codes for communication systems
	Fundamentals of Microwave, Satellite, Optical and Mobile Communications

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of Analog communication system	K2
CO2	Understand the Angle Modulation Techniques	K2
CO3	Understand the basics of Analog communication system	K2
CO4	Apply the knowledge of digital electronics and understand the error control coding techniques.	K3
CO5	Understand different types of communication systems and its requirements.	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	2	2	2	-	-	-	-	-	-	-	-	-			
CO2	2	2	2	-	-	-	-	-	-	-	-	-			
CO3	2	2	2	-	-	-	-	-	-	-	-	-			
CO4	2	2	2	1	-	-	-	-	-	-	-	-			
CO5	2	2	2	-	-	-	-	-	-	-	-	-			

COURSE CONTENT	
UNIT I	**Basic blocks of Communication System**. Analog Modulation-Principles of Amplitude Modulation, DSBSC, SSB-SC and VSB-SC, AM transmitters and receivers
UNIT II	**Angle Modulation-Frequency and Phase Modulation**. Transmission Band width of FM signals, Methods of generation and detection, FM Transmitters and Receivers.
UNIT III	**Sampling theorem, Pulse Modulation Techniques**-PAM, PWM and PPM concept ,PCM System, Delta Modulation, Digital Modulation Techniques-(ASK, FSK, PSK, QPSK).
UNIT IV	**Error control coding techniques**–Basics of Information Theory, Linear block codes-Encoder and decoder, Hamming Code, Cyclic codes–Encoder, Syndrome Calculator, Convolution codes.
UNIT V	**Modern Communication Systems**–Microwave communication systems, Optical communication system, Satellite communication system, Mobile communication system.

TEXT BOOKS	
1.	Communication Systems (Analog And Digital)	Sanjay Sharma, S.K.Kataria& Sons, 2013
2.	CommunicationSystems,SimonHaykins,JohnWiley,3rdEdition,1995

REFERENCE BOOKS	
1.	Shulin Daniel, 'Error Control Coding', Pearson, 2ndEdition,2011.
2.	B.P.Lathi and ZhiDing, 'Modern Digital and Analog Communication Systems', OUPUSA Publications, 4thEdition,2009.

WEB RESOURCES	
1	https://nptel.ac.in/courses/117105143/15
2	http://www.nptelvideos.in/2012/12/digital-communication.html

ENTRPRENEURSHIP

Course Category	Humanities including Management		Course Code	20HM5T03
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand different Entrepreneurial traits.	Understanding
CO2	Identify and compare the financial institutions supporting entrepreneurship.	Analyze
CO3	Understand the functioning and problems faced by MSMEs (Micro Small Medium Enterprises)	Understanding
CO4	Identify Entrepreneurial opportunities for women.	Applying
CO5	Analyze different market, technical factors and prepare a project report based on guidelines.	Analyzing

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	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.

TEXT BOOKS	
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.

REFERENCE BOOKS	
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.	Aruna Kaulgud - Entrepreneurship Management - Vikas publishing house - 2009.

WEB RESOURCES	
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/

JOB ORIENTED ELECTIVE
DEVOPS
(Common to IT, CSE, CSE(DS))

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

PROFESSIONAL ELECTIVE - I
ARTIFICIAL INTELLIGENCE

Course Category	Professional Elective		Course Code	20AI5T09
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	Know the methodology of Problem solving.
2	Implement basic AI algorithms.
3	Design and carry out an empirical evolution of different algorithms on a problem formalization.

COURSE OUTCOMES	Cognitive level
Upon successful completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts in Artificial Intelligence.	K1
CO2	Analyze the applications of search strategies and problem reductions.	K4
CO3	Apply the mathematical logic concepts.	K3
CO4	Develop the Knowledge representations in Artificial Intelligence.	K2
CO5	Explain the Expert systems.	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	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	**Introduction to artificial intelligence:** Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.
UNIT II	**Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem **Search Strategies:** exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction
UNIT III	**Logic concepts:** Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, predicate logic
UNIT IV	**Knowledge representation:** Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR **Advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure.
UNIT V	**Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems black board systems truth maintenance systems, application of expert systems, list of shells and tools.

TEXT BOOKS	
1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2010
2.	Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 2010

REFERENCE BOOKS	
1.	Artificial intelligence, structures and Strategies for Complex problem solving, George F Lugar, 5th ed, PEA
2.	Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3.	Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

WEB RESOURCES	
1	[Artificial Intelligence Tutorial for Beginners	Easy AI Tutorial (mygreatlearning.com)](#)

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

AGILE SOFTWARE PROCESS
(IT)

Course Category	Professional Elective		Course Code	20IT5T08
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objectives of the course is to

1	Know about software and its development
2	Gain knowledge in agile development
3	Study the agile methods
4	Student will know about lifecycle of agile methods
5	Student will have an appreciation of the necessity and difficulty in case study.
6	Student will know about Agile Practice and Testing

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Identify software motivation techniques.	K2
CO2	List out various software development techniques.	K2
CO3	Outline about Agile method and its tools and Design and test project using agile methodology.	K3
CO4	Understand Scrum model.	K2
CO5	Examining the Scrum Team, analyze the roles and responsibilities of sprint.	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	2	2	2	1	1	-	-	-	1	-	1	1	2	-	1
CO2	2	2	2	1	1	-	-	-	1	-	1	1	2	-	1
CO3	2	2	2	1	1	-	-	-	1	-	1	1	2	-	1
CO4	2	2	2	1	1	-	-	-	1	-	1	1	2	-	1
CO5	2	2	3	1	1	-	-	-	1	-	1	1	2	-	1

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CONTENT	
UNIT I	**Introduction:** Software Is New Product Development, Web Resources. Motivation: The Facts of Change on Software Projects, Key Motivations for Iterative Development, Meeting the Requirements Challenge Iteratively, Problems with the Waterfall.
UNIT II	**Iterative Evolutionary:** Iterative Development, Risk-Driven and Client-Driven Iterative Planning, Time boxed Iterative Development, Evolutionary and Adaptive Development, Evolutionary Requirements Analysis, Evolutionary and Adaptive Planning, Incremental Delivery, Evolutionary Delivery, The Most Common Mistake, Specific Iterative Evolutionary Methods.
UNIT III	**Agile:** Agile Development, Classification of Methods, the Agile Manifesto and Principles, Agile Project Management, Embrace Communication and Feedback, Empirical vs. Defined & Prescriptive Process, Principle-Based versus Rule-Based, Sustainable Discipline: The Human Touch, Team as a Complex Adaptive System, Agile Hype. **Agile Practicing and Testing:** Project management – Environment – Requirements – Test – The agile alliances –The manifesto – Supporting the values – Agile testing – Nine principles and six concrete practices for testing on agile teams.
UNIT IV	**Scrum: Method Overview:** Lifecycle, Work products, Roles, and Practices, Values, Common Mistakes and Misunderstandings, Sample Projects, Process Mixtures, Adoption Strategies, Fact versus Fantasy, Strengths versus Other.
UNIT V	**The Team**: Dedicated cross functional teams, conditions for self organization, T-shaped people, product backlog characteristics. **Sprint planning**: Team Capacity, facilitating the sprint planning meeting, the sprint backlog. **Scrum Roles and Responsibilities**: Scrum Master Responsibilities, product owner Responsibilities, The scrum project community.

TEXT BOOKS	
1.	Agile and Iterative Development – A Manager's Guide, Craig Larman, Pearson Education – 2004.
2.	Agile Testing, Elisabeth Hendrickson, Quality Tree Software Inc, 2008.

REFERENCE BOOKS	
1.	Agile Software Development Series, Cockburn, Alistair, 2001.

WEB RESOURCES	
1	www.agileintro.wordpress.com/2008
2	http://nptel.ac.in/courses/106101061/26
3	https://www.versionone.com/agile-101/agile-methodologies/
4	https://www.codeproject.com/Articles/604417/Agile-software-development-methodologies-and-how-t
5	https://www.coursera.org/learn/agile-software-development
6	https://www.smartsheet.com/understanding-agile-software-development-lifecycle-and-processworkflow

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

DISTRIBUTED SYSTEMS
(Common to CSE, IT, CSE(AI), CSE(AI&ML), CSE(DS))

Course Category	Professional Elective		Course Code	20CS5T13
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objectives of the course is to

1	To understand the foundations of distributed systems.
2	To learn issues related to clock Synchronization and the need for global state in distributed systems.
3	To learn distributed mutual exclusion and deadlock detection algorithms.
4	To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
5	To learn the characteristics of peer-to-peer and distributed shared memory systems.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive level
CO1	Understand the foundations and issues of distributed systems	K2
CO2	Illustrate the various synchronization issues and global state for distributed systems	K2
CO3	Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems	K2
CO4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems	K2
CO5	Describe the features of peer-to-peer and distributed shared memory systems	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	2	2	-	-	-	-	-	-	-	-	3	2	-
CO2	2	3	1	2	-	-	-	-	-	-	-	-	3	2	-
CO3	2	3	1	2	-	-	-	-	-	-	-	-	3	2	-
CO4	3	1	3	2	-	-	-	-	-	-	-	-	3	2	-
CO5	2	1	2	2	-	-	-	-	-	-	-	-	3	2	-

COURSE CONTENT

UNIT I	**Distributed Systems**: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions,

	Design issues andchallenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Modelsof process communications. Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.
UNIT II	**Message Ordering & Snapshots**: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.
UNIT III	**Distributed Mutex & Deadlock**: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart - Agrawala algorithm, Maekawa's algorithm, Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp's classification, Algorithms forthe single resource model, the AND model and the OR model.
UNIT IV	**Recovery & Consensus: Check pointing and rollback recovery**: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.
UNIT V	**Peer-to-peer computing and overlay graphs**: Introduction, Data indexing and overlays, Chord – Content addressable networks, Tapestry. **Distributed shared memory**: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion.

TEXT BOOKS	
1.	Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
2.	Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

REFERENCE BOOKS	
1.	Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
2.	Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri, McGraw-Hill, 2017.
3.	Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007.

WEB REFERENCES	
1.	https://nptel.ac.in/courses/106/106/106106168/

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

ADVANCED UNIX PROGRAMMING
(Common to IT, CSE)

Course Category	Professional Elective		Course Code	20IT5T09
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	Understating the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Gain good knowledge on Unix commands and awareness of shell programming	K1
CO2	Know about different system calls for files and directories	K2
CO3	Ability to know the working of processes and signals	K2
CO4	Application of client server program for IPC	K3
CO5	Knowledge about socket programming	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	2	2	-	-	2	-	-	-	-	-	-	-	2	2	-
CO2	2	2	2	2	2	-	-	-	-	-	-	-	-	3	-
CO3	2	3	-	3	3	-	-	-	-	-	-	-	-	3	-
CO4	2	3	-	3	3	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	3	3	-	-	-	-	-	-	-	-	3	-

COURSE CONTENT	
UNIT I	Introduction, Architecture of Unix, Responsibilities of shell, Unix file system, vi editor. **Unix commands**: Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities, Security by file permissions.

UNIT II	**Shell Programming**: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The $? Variable, Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs. **Files** - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking - fcntl function, file permissions - chmod, fchmod, file ownership - chown, lchown, links-soft and hard links - symlink, link, unlink.
UNIT III	**Directories** - Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory - getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions. **Process Control**: process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals**: signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.
UNIT IV	**IPC**: introduction, pipes, FIFO's, client –server examples for pipes and FIFO's **message queues:** message queue structure in kernel, system calls of message queue, client-server example for message queue. **Semaphores:** definition, system calls of semaphores, semaphores structure in kernel, file locking using semaphores
UNIT V	**Shared memory**-system calls of shared memory, semaphore structure in kernel, client server example. **Sockets:** Introduction, overview, elementary socket system calls, TCP Echo program, UDP Echo program

TEXT BOOKS	
1.	Unix the ultimate guide, 3rd edition, Sumitabha Das, TMH.
2.	Advanced programming in the Unix environment, W. Richard Stevens.
3.	Unix network programming, W. Richard Stevens.

REFERENCE BOOKS	
1.	Introduction to Unix and shell programming, Venkatesh murthy
2.	Unix and shell programming, B.M. Harwani, OXFORD university press.

DATA MINING TECHNIQUES LABORATORY

Course Category	Professional Core		Course Code	20IT5L06
Course Type	Laboratory		L-T-P-C	0-0-3-1.5
Prerequisites	Python Programming		Internal Assessment	15
			Semester End Examination	35
			Total Marks	50

COURSE OBJECTIVES
The objectives of the course is to

1	To get practical exposure on implementation of well-known data mining algorithms
2	To evaluate performance of data mining algorithms in a supervised and an unsupervised setting.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Apply preprocessing techniques on real world datasets	K3
CO2	Apply Apriori, FP-growth algorithms to generate frequent itemsets.	K3
CO3	Apply Classification and clustering algorithms on different datasets	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	1	1	0	0	0	0	0	0	0	1	1	0
CO2	3	3	3	1	1	0	0	0	0	0	0	0	1	2	0
CO3	3	3	3	1	1	0	0	0	0	0	0	0	1	2	0

List of Experiments	
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 Pearson's Correlation a) Cosine Similarity b) Jaccard Similarity c) Euclidean Distance

4.	Build a classification model using Decision Tree algorithm on iris dataset
5.	Apply Naïve Bayes Classification algorithm on any dataset
6.	Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data.
7.	Apply FP - Growth algorithm on any market basket data.
8.	Apply K - Means clustering algorithm on any dataset.
9.	Apply Hierarchical Clustering algorithm on any dataset.
10.	Apply DBSCAN clustering algorithm on any dataset.

WEB RESOURCES	
1.	https://analyticsindiamag.com/data-pre-processing-in-python/
2.	https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3.	https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4.	https://www.springboard.com/blog/data-mining-python-tutorial/
5	https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6	https://medium.com/@pcm1312/implementing-fp-growth-in-python-170f3dc64d78
7	https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
8	https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
9	https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learn-d690cbae4c5d

COMPUTER NETWORKS LABORATORY
(Common to CSE, IT)

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

COURSE OBJECTIVES

The objective of the course is to

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		Cognitive level
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

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	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

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.	How to run 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.

CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY USING DEVOPS
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT

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 Netbeans or eclipse.

4	To Create a Pipeline project in Jenkins to test, and deploy Java or Web Applications using Netbeans 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 StarEdu 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.

EMPLOYABILITY SKILLS – I
(Common to CSE, CSE AI&ML, CSE DS, CSE AI, and IT)

Course Category	Humanities		Course Code	20HE5T02
Course Type	Theory		**L-T-P-C**	1-0-2-2
Prerequisites	Basic Language Knowledge.		**Total Marks**	50

COURSE OBJECTIVES
The objectives of the course is to

1	To present language ability in the interview for employment.

COURSE OUTCOMES		Cognitive 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.	K1
CO2	Grooms the learner in their mental flexibility to be fit in team for an organization.	K2
CO3	Strengthens in syntactic construction of the language.	K2
CO4	Empowers the learner in the language comprehension skills.	K2
CO5	Assists the learner to present academic and professional abilities through writing skills.	K1

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	0	0	0	0	0	0	0	0	0	2	0	0	-	-	-
CO2	0	0	0	0	0	0	0	0	2	0	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	1	-	-	-
CO5	0	0	0	0	0	0	0	0	0	1	0	0	-	-	-

COURSE CONTENT	
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

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

III   Year – II Semester
MACHINE LEARNING
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT

Course Category	Professional Core		Course Code	20AM6T02
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objectives of the course is to

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		Cognitive level
Upon successful completion of the course, the student will be able to:		
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.	K3
CO5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning	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	3	2	2	1	-	-	-	-	-	-	-	2	1	2
CO2	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO3	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO4	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO5	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2

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 Neighbours, 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 and Deep Learning:** Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.
TEXT BOOKS	
1.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2.	Data Science and Machine Learning Mathematical and Statistical Methods, Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman, 25th November 2020
REFERENCE BOOKS	
1.	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

BIG DATA ANALYTICS
(Common to CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS))

Course Category	Professional Core		Course Code	20DS6T02
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

The objective of the course is to

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.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
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)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	**Types of Digital Data:** Classification of Digital Data. Introduction to Big Data: Characteristic of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data? **Big Data Analytics:** Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments. The Big Data Technology Landscape: NoSQL. **(Text Book 1)**

UNIT II	**Introduction to Cassandra:** Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live, Alter Commands, Import and Export. **(Text Book 1)**
UNIT III	**Hadoop**: Hadoop Overview, HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator). **MAPREDUCE:** Introduction to MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. **(Text Book 1)**
UNIT IV	**Introduction to Data Analysis with Spark**: What is Apache Spark, A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. **Programming with RDDs:** RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. **(Text Book 2)**
UNIT V	**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)**

TEXT BOOKS

1.	Big Data and Analytics by Seema Acharya, Subhashini Chellappan, Second Edition, Wiley India Pvt. Ltd., 2019
2.	Learning Spark: Lightning-Fast Big Data Analysis by Andy Konwinski, Holden Karau, Matei Zaharia, Patrick Wendell, First Edition, O'Reilly, 2015

REFERENCE BOOKS

1.	Big Data Analytics, by Radha Shankarmani, M Vijayalakshmi, 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 Guide by 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.

Web References:

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

CRYPTOGRAPHY AND NETWORK SECURITY
(Common to IT, CSE)

Course Category	Professional Core		Course Code	20IT6T10
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Explain different security threats and countermeasures and foundation course of cryptography mathematics.	K1
CO2	Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography	K2
CO3	Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA,ECC and some more	K2
CO4	Design applications of hash algorithms, digital signatures and key management techniques	K3
CO5	Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL, TSL, and IPsec	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	2	3	1	2	-	-	-	-	-	-	-	-	2	2
CO2	3	2	3	1	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	2	2
CO4	3	2	3	3	3	-	-	-	-	-	-	-	1	1	2
CO5	3	2	3	3	3	-	-	-	-	-	-	-	1	1	2

COURSE CONTENT		
UNIT I		**Basic Principles:** Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography.
UNIT II		**Symmetric Encryption:** Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.
UNIT III		**Asymmetric Encryption:** Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography
UNIT IV		**Data Integrity, Digital Signature Schemes & Key Management:** Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.
UNIT V		**Network Security - I:** Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security - II :** Security at the Network Layer: IPSec, System Security

TEXT BOOKS	
1.	Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill, 2015
2.	Cryptography and Network Security, 4th Edition, William Stallings, (6e) Pearson,2006
3.	Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

REFERENCE BOOKS	
1.	Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning, 2018.

PROFESSIONAL ELECTIVE - II
WIRELESS SENSOR NETWORKS

Course Category	Professional Elective	Course Code	20IT6T11
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Computer Networks	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To acquire the knowledge about various architectures and applications of Sensor Networks.
2	To understand issues, challenges and emerging technologies for wireless sensor networks.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive level
CO1	Understand wireless sensor node and different applications of wireless sensor networks.	K2
CO2	Be familiar with architectural framework.	K2
CO3	Discuss different network layer functions.	K3
CO4	Understand the synchronization problems and Synchronization Protocols	K2
CO5	Identify and understand security issues in ad hoc and sensor 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)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	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	**Introduction:** Components of a wireless sensor node, Motivation for a Network of Wireless Sensor Nodes, Classification of sensor networks, Characteristics of wireless sensor networks, Challenges of wireless sensor networks, Comparison between wireless sensor networks and wireless mesh networks, Limitations in wireless sensor networks, Design challenges, Hardware architecture, Applications : Structural Health Monitoring, Traffic Control, Health Care, Pipeline Monitoring, Precision Agriculture, Active Volcano, Underground Mining Node Architecture: The Sensing Subsystem, the Processor Subsystem, Communication Interfaces, Prototypes. Operating Systems: Functional Aspects, Nonfunctional Aspects, Prototypes, Evaluation
UNIT II	**Basic Architectural Framework:** Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation Medium Access Control: Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols
UNIT III	**Network Layer:** Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols Node and Network Management: Power Management, Local Power Management aspects, Dynamic Power Management, Conceptual Architecture
UNIT IV	**Time Synchronization:** Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event Driven Localization
UNIT V	**Security:** Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks , Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and Zig Bee Security

TEXT BOOKS	
1.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks - Theory and Practice", John Wiley & Sons Publications, 2011.
2.	Mohammad S. Obaidat, Sudip Misra, "Principles of Wireless Sensor Networks", Cambridge, 2014
3.	Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

REFERENCE BOOKS	
1.	Ian F. Akyildiz, Mehmet Can Vuran , "Wireless Sensor Networks", Wiley 2010
2.	C S Raghavendra, K M Sivalingam, Taieb Znati, "Wireless Sensor Networks", Springer, 2010
3.	C. Sivarm murthy & B.S. Manoj, "Adhoc Wireless Networks", PHI-2004
4.	FEI HU., XIAOJUN CAO, "Wireless Sensor Networks", CRC Press, 2013
5.	Feng ZHAO, Leonidas GUIBAS, " Wireless Sensor Networks", ELSEVIER , 2004

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105160/
2.	https://onlinecourses.swayam2.ac.in/arp19_ap52/preview
3.	https://cse.iitkgp.ac.in/~smisra/course/wasn.html

PRAGATI ENGINEERING COLLEGE
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DEPARTMENT OF INFORMATION TECHNOLOGY

MEAN STACK DEVELOPMENT
(Common to IT,CSE)

Course Category	Professional Elective		Course Code	20IT6T12
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objectives of the course is to

1	To design static web pages using HTML elements.
2	To make use of JavaScript for writing programs in web page and to validate HTML form.
3	To apply Node.js and Express.js to develop Javascript applications.
4	To utilize typescript with Javascript applications and work with MongoDB queries.
5	To choose Angular JS concepts for developing dynamic web pages.

COURSE OUTCOMES	Cognitive level
Upon successful completion of the course, the student will be able to:	
CO1 Build static web pages using HTML 5 elements.	K2
CO2 Apply JavaScript to embed programming interface for web pages and also to perform Client side validations.	K3
CO3 Build a basic web server using Node.js, work with Node Package Manager (NPM) and recognize the need for Express.js.	K2
CO4 Develop Javascript applications using typescript and work with document database using MongoDB.	K3
CO5 Utilize Angular JS to design dynamic and responsive web pages.	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	2	3	2	3	-	-	-	2	-	-	2	2	-	-
CO2	1	2	3	2	3	-	-	-	2	-	-	2	2	-	-
CO3	1	2	3	3	3	-	-	-	2	-	-	2	3	2	-
CO4	1	2	3	3	3	-	-	-	2	-	-	2	3	3	-
CO5	1	2	3	3	3	-	-	-	2	-	-	2		2	3

COURSE CONTENT	
UNIT I	**HTML 5:**Introduction to Web, Overview of Web Technologies, HTML - Introduction, HTML - Need, Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element, Sectioning Elements, Paragraph Element, Division and Span Elements, List Element, Link Element, Character Entities, HTML5 Global Attributes, Creating Table Elements, Table Elements : Colspan / Rowspan Attributes, border, cell spacing and cell padding attributes, Creating Form Elements, Input Elements - Attributes, Color and Date Pickers, Select and Datalist Elements, Editing Elements, Media, Iframe, Why HTML Security, HTML Injection, Clickjacking, HTML5 Attributes & Events Vulnerabilities, Local Storage Vulnerabilities, HTML5 - Cross-browser support, Best Practices For HTML Web Pages.
UNIT II	**Javascript:** Why we need JavaScript, What is JavaScript, Environment Setup, Working with Identifiers, Type of Identifiers, Primitive and Non Primitive Data Types, Operators and Types of Operators, Types of Statements, Non - Conditional Statements, Types of Conditional Statements, If and Switch Statements, Types of Loops, Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions, Working With Classes, Creating and Inheriting Classes, In-built Events and Handlers, Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser and Document Object Model, Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods, Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API, Creating and consuming Modules.
UNIT III	Node.js: Why and What Node.js, How to use Node.js, Create a web server in Node.js, Node Package Manager, Modular programming in Node.js, Restarting Node Application, File Operations. Express.js: Express Development Environment, Defining a route, Handling Routes, Route and Query Parameters, How Middleware works, Chaining of Middlewares, Types of Middlewares, Connecting to MongoDB with Mongoose, Validation Types and Defaults, Models, CRUD Operations, API Development, Why Session management, Cookies, Sessions, Why and What Security, Helmet Middleware, Using a Template Engine Middleware, Stylus CSS Preprocessor.
UNIT IV	Typescript: Installing Type Script, Basics of Type Script, Function, Parameter Types and Return Types, Arrow Function, Function Types, Optional and Default Parameters, Rest Parameter, Creating an Interface, Duck Typing, Function Types, Extending Interfaces, Classes, Constructor, Access Modifiers, Properties and Methods, Creating and using Namespaces, Creating and using Modules, Module Formats and Loaders, Module Vs Namespace, What is Generics, What are Type Parameters, Generic Functions, Generic Constraints. MongoDB: Introduction Module Overview, Document Database Overview, Understanding JSON, MongoDB Structure and Architecture, MongoDB Remote Management, Installing MongoDB on the local computer (Mac or Windows), Introduction to MongoDB Cloud, Create MongoDB Atlas Cluster, GUI tools Overview, Install and Configure MongoDB Compass, Introduction to the MongoDB Shell, MongoDB Shell JavaScript Engine, MongoDB Shell JavaScript Syntax, Introduction to the MongoDB Data Types, Introduction to the CRUD Operations on documents, Create and Delete Databases and Collections, Introduction to MongoDB Queries.
UNIT V	What is Angular, Features of Angular, Angular Application Setup, Components and Modules, Executing Angular Application, Elements of Template, Change Detection, Structural Directives - ngIf, ngFor, ngSwitch, Custom Structural Directive, Attribute Directives - ngStyle, ngClass,

	Custom Attribute Directive, Property Binding, Attribute Binding, Style and Event Binding, Built in Pipes, Passing Parameters to Pipes, Nested Components Basics, Passing data from Container Component to Child Component, Passing data from Child Component to Container Component, Shadow DOM, Component Life Cycle, Template Driven Forms, Model Driven Forms or Reactive Forms, Custom Validators in Reactive Forms, Custom Validators in Template Driven forms, Dependency Injection, Services Basics, RxJS Observables, Server Communication using HttpClient, Communicating with different backend services using Angular HttpClient, Routing Basics, Router Links, Route Guards, Asynchronous Routing, Nested Routes.

TEXT BOOKS	
1.	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson.
2.	Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3.	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4.	MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly.

REFERENCE BOOKS	
1.	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech.
2.	An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda SKatila, Cengage Learning.

WEB REFERENCES	
1.	https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
2.	https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript)
3.	https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview (Node.js & Express.js)
4.	https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview (Typescript)

DESIGN PATTERNS

Course Category	Professional Elective		Course Code	20IT6T13
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objectives of the course is to

1	Demonstration of patterns related to object oriented design.
2	Describe the design patterns that are common in software applications.
3	Analyze a software development problem and express it.
4	Design a module structure to solve a problem, and evaluate alternatives.
5	Implement a module so that it executes efficiently and correctly.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Construct a design consisting of a collection of modules	K2
CO2	Examine well-known design patterns (such as Iterator, Observer, Factory and Visitor)	K2
CO3	Distinguish between different categories of design patterns	K2
CO4	Ability to understand and apply common design patterns to incremental/iterative development	K3
CO5	Identify appropriate patterns for design of given problem and Design the software using Pattern Oriented Architectures	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	2	2	2	-	-	-	-	-	-	-	2	2	-
CO2	2	1	1	-	2	-	-	-	-	-	1	-	2	2	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-

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COURSE CONTENT	
UNIT I	Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern. A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.
UNIT II	Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.
UNIT III	Structural Pattern: Adapter, Bridge, Composite, Decorator, açade, Flyweight, Proxy.
UNIT IV	Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.
UNIT V	Behavioral Patterns: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, a Brief History, the Pattern Community an Invitation, a Parting Thought.

TEXT BOOKS	
1.	"Design Patterns", Erich Gamma, Pearson Education.

REFERENCE BOOKS	
1.	"Head First Design patterns", Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
2.	"Design Patterns in Java", Steven John Metsker & William C. Wake, Pearson education, 2006
3.	"J2EE Patterns", Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
4.	"Design Patterns in C#", Steven John metsker, Pearson education, 2004.
5.	"Pattern Oriented Software Architecture", F.Buschmann & others, John Wiley & Sons.

WEB RESOURCES	
1.	https://www.javatpoint.com/design-patterns-in-java
2.	https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm

SCRIPTING LANGUAGES

Course Category	Professional Elective	**Course Code**	20IT6T14
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
The objectives of the course is to

1	Understand the concepts of scripting languages for developing web based projects
2	Illustrates object oriented concepts like PHP, PYTHON, PERL
3	Create database connections using PHP and build the website for the world
4	Demonstrate IP address for connecting the web servers
5	Analyze the internet ware application, security issues and frame works for application

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Ability to understand the differences between scripting languages	K2
CO2	Create PHP authentication Methodology for security issues and Identify PHP encryption functions and Mcrypt Package	K4
CO3	Explain syntax and variables in TCL	K2
CO4	Able to gain some fluency programming in Ruby, JavaScript, Perl, Python, and related languages	K2
CO5	Master an understanding of python especially the object oriented concepts	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	1	3	2	-	3	-	-	-	2	-	-	1	-	2	2
CO2	1	2	3	-	2	-	-	-	2	-	-	2	-	2	3
CO3	1	2	2	-	3	-	-	-	3	-	-	1	1	3	3
CO4	2	2	3	2	3	-	-	-	3	-	-	1	1	3	3
CO5	2	2	3	2	3	-	-	-	3	-	-	1	1	3	3

COURSE CONTENT	
UNIT I	**Introduction to PERL and Scripting:** Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.
UNIT II	**Advanced PERL:** Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues. **PHP Basics:** PHP Basics - Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.
UNIT III	**Advanced PHP Programming:** PHP and Web Forms, Files, PHP Authentication and Methodologies- Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.
UNIT IV	**TCL:** TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl- Tk.
UNIT V	**Python:** Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

TEXT BOOKS	
1.	The World of Scripting Languages, David Barron, Wiley Publications.
2.	Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3.	Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dream tech).

REFERENCE BOOKS	
1.	Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.LeeandB. Ware (Addison Wesley) Pearson Education. Programming Python, M.Lutz, SPD.
2.	PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
3.	Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
4.	PHP and MySQL by Example, E.Quigley, Prentice Hall (Pearson). Perl Power, J.P.Flynt, Cengage Learning.

OPEN ELECTIVE - II
DISASTER MANAGEMENT

Course Category	Open Elective		Course Code	20CE6T35
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To provide basic conceptual understanding of disasters.
2	To understand approaches of Disaster Management.
3	To build skills to respond to disaster.
4	To understand to reduce the intensity of future disasters.
5	To understand the Restoration of human life in the region.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive level
CO1	Knowledge on characteristics of natural disasters	
CO2	Planning on approaches of Disaster Management	
CO3	Ability to plan and design the new skills in disaster response	
CO4	Role of remote sensing system in disaster area response	
CO5	Knowledge on the Restoration of human life in the region.	

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	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

COURSE CONTENT

UNIT I	**Natural Hazards and Disaster Management**: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.
UNIT II	**Man Made Disaster and Their Management Along With Case Study Methods Of The Following:** Fire hazards – transport hazard dynamics – solid waste management – postdisaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.
UNIT III	**Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses
UNIT IV	**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 information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS
UNIT V	**Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action

TEXT BOOKS

1.	"Disaster Management guide lines", GOI-UND Disaster Risk program (2009-2012)
2.	Modh S. (2010) "Managing Natural Disasters", Mac Millan publishers India LTD.

REFERENCE BOOKS

1.	Murty D.B.N. (2012) "Disaster Management", Deep and Deep Publication PVT.Ltd. New Delhi

WEB RESOURCES

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

FUNDAMENTALS OF ELECTRIC VEHICLES

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

COURSE OBJECTIVES

The objective of the course is to

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.
	To be familiar all the different types of motors suitable for electric vehicles.
	To have knowledge on latest developments in strategies and other storage systems.

COURSE OUTCOMES	**Cognitive level**
Upon successful completion of the course, the student will be able to:	
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)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 I	**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 II	**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 III	**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 IV	**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 V	**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.
	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	
1.	https://nptel.ac.in/courses/108106170
	https://inverted.in/blog/fundamentals-of-electric-vehicles

INTRODUCTION TO AUTOMOBLE ENGINEERING

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

COURSE OBJECTIVES

The objective of the course is to

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		Cognitive level
Upon successful completion of the course, the student will be able to:		
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	PSO3
CO1	3	-	-	-	-	2	2	-	-	-	-	-	2	-	3
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	-	2
CO4	3	2	1	1	-	2	2	-	-	-	-	-	2	1	3
CO5	2	2	1	-	-	-	2	-	-	-	-	1	3	-	2

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

Course Category	Open Elective		Course Code	20EC6T26
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites	control systems		**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

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	Cognitive level
Upon successful completion of the course, the student will be able to:	
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	PSO1	PSO2	PSO3
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										

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

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.
	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
	https://www.youtube.com/watch?v=qSa3GNjIyy0

BIG DATA ANALYTICS LABORATORY
(Common to CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS))

Course Category	Professional Core	Course Code	20DS6L02
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites	Data Mining	Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES

The objective of the course is to

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

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
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)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	1	1	2	2	-	-	-	-	-	-	-	2	1	1
CO3	3	2	3	2	2	-	-	-	-	-	-	-	2	2	1

List of Experiments	
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: 1. Adding files and directories 2. Retrieving files 3. 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 for analysis 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 Page Rankvalues.
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.	/hadoop.apache.org/release/2.7.6.html
2.	/www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3	/www.eclipse.org/downloads/
4	/spark.apache.org/docs/latest/rdd-programming-guide.html

MACHINE LEARNING USING PYTHON LABORATORY

Course Category	Professional Core		Course Code	20AM6L02
Course Type	Laboratory		**L-T-P-C**	0-0-3-1.5
Prerequisites			**Internal Assessment**	**15**
			Semester End Examination	**35**
			Total Marks	**50**

COURSE OBJECTIVES
The objective of the course is to

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

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
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, 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	1	-	-	-	-	-	-	-	-	2	2	2	3
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1	1	3
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	1	3

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

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 Matplotlib.
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

CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY
(Common to IT, CSE)

Course Category	Professional Core		Course Code	20IT6L07
Course Type	Laboratory		**L-T-P-C**	0-0-3-1.5
Prerequisites			**Internal Assessment**	**15**
			Semester End Examination	**35**
			Total Marks	**50**

COURSE OBJECTIVES
The objectives of the course is to

1	To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
2	To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Apply the knowledge of symmetric cryptography to implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher	K2
CO2	Demonstrate the different algorithms like DES, BlowFish, and Rijndael, encrypt the text "Hello world" using Blowfish Algorithm.	K3
CO3	Analyze and implement public key algorithms like RSA, Diffie-Hellman Key Exchange mechanism, the message digest of a text using the SHA-1 algorithm	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	3	3	-	-	-	-	-	-	-	-	3	-	3
CO2	2	2	3	3	-	-	-	-	-	-	-	-	3	-	3
CO3	2	2	3	3	-	-	-	-	-	-	-	-	3	-	3

List of Experiments	
1.	Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.

2.	Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result

3.	Write a Java program to perform encryption and decryption using the following algorithms:
	  a) Ceaser Cipher
	  b) Substitution Cipher
	  c) Hill Cipher

4.	Write a Java program to implement the DES algorithm logic
5.	Write a C/JAVA program to implement the BlowFish algorithm logic
6.	Write a C/JAVA program to implement the Rijndael algorithm logic.
7.	Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8.	Write a Java program to implement RSA Algorithm
9.	Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10.	Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

SOFT SKILLS AND INTERPERSONAL COMMUNICATION

Course Category	Humanities		Course Code	20HE6S01
Course Type	Skill Oriented Course		L-T-P-C	3-0-0-3
Prerequisites	Life skills for better life		Internal Assessment	0
			Semester End Examination	0
			Total Marks	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.	K2
CO2	Enhances the required methods and strategies to develop public speaking skills among the learners.	K1
CO3	Builds the confidence in verbal and non-verbal communication besides life skills.	K2
CO4	Strengthens various inter and intra personal abilities to lead better personal and professional career.	K2
CO5	Improves the innate abilities which help for decision-making and problem-solving with emotional intelligence.	K1

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			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	1	-	1	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	1			

COURSE CONTENT	
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 relationships through 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, Overcoming Nervousness. 2.Group Discussion: Importance, Planning, Elements, Skills assessed; effectively disagreeing, Initiating, Summarizing and 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 of Leaders; Leadership Behavior; 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 and Impact 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.
	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
(Common to CSE, CSE AI&ML, CSE DS, CSE AI, and IT)

Course Category	Humanities		**Course Code**	20HE6T03
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites	Basic Language Knowledge.		**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To present language ability in the interview for employment.

COURSE OUTCOMES		Cognitive 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.	K2
CO2	Develops logical inter-relation of words in usage.	K2
CO3	Helps to develop compendious usage in communication.	K2
CO4	Determines to concentrate on Non-Verbal interpretation.	K1
CO5	Enriches the ability in vocabulary usage.	K1

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	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 CONTENT	
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

TEXT BOOKS	
1.	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier,2014.

REFERENCE BOOKS	
1.	Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier, First Edition,2013
2.	Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press,2014.
3.	Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH, 2009
4.	Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

WEB RESOURCES	
1.	https://onlinecourses.nptel.ac.in/noc22_cs20/preview

IV   Year – I Semester
PROFESSIONAL ELECTIVE – III
CLOUD COMPUTING
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT, EEE

Course Category	Professional Elective		Course Code	20CS7T12
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To explain the evolving computer model caned cloud computing.
2	To introduce the various levels of services that can be achieved by cloud.
3	To describe the security aspects in cloud.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Illustrate the key dimensions of the challenge of Cloud Computing.	K2
CO2	Classify the Levels of Virtualization and mechanism of tools.	K3
CO3	Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.	K4
CO4	Design Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud.	K3
CO5	Analyze control storage systems and cloud security, the risks involved its impact and develop cloud application.	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
CO1	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3

CO2	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
CO3	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	2	1	3	3	3	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT	
UNIT I	**Systems Modeling, Clustering and Virtualization:** Scalable Computing over the Internet- The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency
UNIT II	**Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.
UNIT III	**Cloud Platform Architecture:** Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure
UNIT IV	**Cloud Resource Management and Scheduling:** Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.
UNIT V	**Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

TEXT BOOKS	
1.	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier,2014.

REFERENCE BOOKS	
1.	Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier, First Edition,2013
2.	Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press,2014.
3.	Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH, 2009
4.	Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

WEB RESOURCES	
1.	https://onlinecourses.nptel.ac.in/noc22_cs20/preview

ARTIFICIAL NEURAL NETWORKS

Course Category	Professional Core		Course Code	20AI7T10
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To acquire the knowledge on Soft Computing Concepts.
2	To learn various types of Genetic algorithms and its applications.
3	To gain knowledge to apply optimization strategies.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the concepts of Artificial intelligence and soft computing techniques.	K2
CO2	Analyze the concepts of Neural Networks and select the Learning Networks in modeling real world systems.	K4
CO3	Implement the concepts of Fuzzy reasoning and concepts of Genetic algorithm and its applications to soft computing.	K2
CO4	Classify Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization.	K2
CO5	Design hybrid system incorporating neural network, genetic algorithms, fuzzy systems.	K6

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	1	2	-	-	-	-	-	-	-	-	-	2	2
CO2	1	2	3	3	3	-	-	-	-	-	-	-	1	2	3
CO3	2	1	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	1	2	3	3	3	-	-	-	-	-	-	-	2	3	-
CO5	1	2	3	3	3	-	-	-	-	-	-	-	2	2	3

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CONTENT	
UNIT I	**Soft Computing and Artificial Intelligence:** Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Interference, Semantic Networks, Frames, Objects, Hybrid Models.
UNIT II	**Artificial Neural Networks and Paradigms:** Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptrons, Multilayer Perceptrons, Back propagation Networks, Kohnen's self organizing networks, Hopfield network, Applications of NN.
UNIT III	**Fuzzy Logic:** Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.
UNIT IV	**Genetic Algorithms and Swarm Optimizations:** Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.
UNIT V	**Hybrid Systems:** Neuro fuzzy hybrid systems, Adaptive neuro fuzzy inference systems, Fuzzy back propagation network, Genetic neuro hybrid system, Genetic algorithm based back propagation network, Genetic-fuzzy hybrid systems.

TEXT BOOKS	
1.	Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
2.	S. Rajasekaran & G. A. Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI,2003.

REFERENCE BOOKS	
1.	S. N. Sivanandam& S. N. Deepa "Principles of Soft Computing" Wiley – India, 2nd Edition, 2007.
2.	Jang J.S.R., SunC.T. and MizutaniE, "Neuro-Fuzzy and Soft computing", Prentice Hall, 1998.
3.	Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House,1994

WEB RESOURCES	
1.	Neural Networks (w3schools.com)
2.	https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

INTERNET OF THINGS (IoT)

Course Category	Professional Elective		Course Code	20EC7T38
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites	Wireless Sensor Networks		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objectives of the course is to

1	To introduce the terminology, technology and its applications
2	To Implement Data and Knowledge Management and use of Devices in IoT Technology
3	To introduce the concept of M2M (machine to machine) with necessary protocols
4	To classify Real World IoT Design Constraints, Industrial Automation in IoT.
5	To introduce the Raspberry PI platform, that is widely used in IoT applications
6	To introduce the Python Scripting Language which is used in many IoT devices

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive level
CO1	Understand the building blocks of Internet of Things and characteristics	K1
CO2	Appraise the role of IoT protocols for efficient network communication. Elaborate the need for Data Analytics and Security in IoT	K2
CO3	Realize the difference between M2M and IOT. Explain IOT physical devices.	K3
CO4	Analyze the domain specific applications of IoT	K4
CO5	Develop Internet of Things & Logical Design using Python. Develop real life IoT based projects	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	2	2	2	1							1		2	2	-
CO2	2	2	2	2							1		2	2	1
CO3	2	2	2	1							1		2	2	1
CO4	2	2	1	2							1		2	2	1
CO5	2	2	2	2							1		2	1	1

COURSE CONTENT	
UNIT I	Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II	Machine to Machine, Difference between IoT and M2M, SDN and NFV for IOT, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER
UNIT III	What is an IOT Device, Exemplary Device: Arduino IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP
UNIT IV	Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle Industry applications, Surveillance applications,
UNIT V	Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date / Time Operations, Classes, Python Packages of interest for IOT **Introduction to Industrial IoT (IIoT) Systems**: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories

TEXT BOOKS	
1.	Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2.	Internet of Things, Srinivasa K.G., Siddesh, G.M., Hanumantha Raju R. Cengage Publications, 1st Edition 2018
REFERENCE BOOKS	
1.	Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2.	Internet of Things, Srinivasa K.G., Siddesh, G.M., Hanumantha Raju R. Cengage Publications, 1st Edition 2018
3.	Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
4.	Internet of Things, Srinivasa K.G., Siddesh, G.M., Hanumantha Raju R. Cengage Publications, 1st Edition 2018
WEB RESOURCES	
1.	https://www.coursera.org/specializations/internet-of-things
2.	https://www.class-central.com/tag/internet%20of%20things
3.	https://www.businessinsider.com/internet-of-things-devices-applications-examples-2016-8?IR=T

COMPUTER FORENSICS
(Common to CSE, IT, CE, ME, EEE, ECE)

Course Category	Professional Elective		Course Code	20CS7T15
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objectives of the course is to

1	Identify Security Risks And Take Preventive Steps.
2	Understand the Forensics Fundamentals.
3	Understand the Evidence Capturing Process.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the Cybercrime Fundamentals	K2
CO2	List the types of attacks on networks	K4
CO3	Analyze various tools available for Cybercrime Investigation	K4
CO4	Summarize the Computer Forensics and Investigation Fundamentals and tools	K2
CO5	Analyze the legal perspectives of Cybercrime	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
CO1	3	2	2	2	2	1	0	2	0	0	0	0	2	2	2
CO2	3	2	2	2	2	1	0	2	0	0	0	0	2	2	2
CO3	3	2	2	2	2	1	0	2	0	0	0	0	2	2	2
CO4	3	2	2	2	2	1	0	2	0	0	0	0	2	2	2
CO5	3	2	2	2	2	1	0	2	0	0	0	0	2	2	2

COURSE CONTENT	
UNIT I	**Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.
UNIT II	**Tools and Methods:** Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot

	Printing and Social Engineering, Port Scanning, Enumeration.
UNIT III	**Cyber Crime Investigation:** Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.
UNIT IV	**Computer Forensics and Investigations:** Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.
UNIT V	**Cyber Crime Legal Perspectives:** Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act-ITA2000, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.

TEXT BOOKS	
1.	Sunit Belapure, Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, First Edition 2011.
2.	Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

REFERENCE BOOKS	
1.	Michael T. Simpson, Kent Backman and James E. Corley, "Hands on Ethical Hacking and Network Defence", Cengage, 2019.
2.	Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi, First Edition,2015
3.	Alfred Basta, Nadine Basta,Mary Brown and Ravinder Kumar "Cyber Security and Cyber Laws", Cengage, 2018.

WEB RESOURCES	
1.	CERT-In Guidelines- http://www.cert-in.org.in/
2.	https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3.	https://computersecurity.stanford.edu/free-online-videos
4.	Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.eduLicense: Creative Commons BY-NC-SA.

PROFESSIONAL ELECTIVE – IV
DEEP LEARNING

Course Category	Professional Elective	Course Code	20AM7T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The objective of the course is to	
1	Learn deep learning methods for working with sequential data,
2	Learn deep recurrent and memory networks,
3	Learn deep Turing machines,
4	Apply such deep learning mechanisms to various learning problems.
5	Know the open issues in deep learning, and have a grasp of the current research directions.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.	K1
CO2	Discuss the Neural Network training, various random models.	K2
CO3	Explain the Techniques of Keras, TensorFlow, Theano and CNTK	K3
CO4	Classify the Concepts of CNN and RNN	K4
CO5	Implement Interactive Applications of Deep Learning.	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
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	**Fundamentals of Deep Learning:** Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, **Fundamentals of Machine Learning:** Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting. **[Text Book 2]**
UNIT II	**Introducing Deep Learning:** Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. **[Text Book3]**
UNIT III	**Neural Networks:** Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification.**[Text Book 2]**
UNIT IV	**Convolutional Neural Networks:** Neural Network and Representation Learning, Convolutional Layers, Multichannel Convolution Operation, Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch.**[Text Book 3]**
UNIT V	**Interactive Applications of Deep Learning:** Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. **[Text Book 1]** **Deep Learning Research:** Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks.**[Text Book 1]**

TEXT BOOKS

1.	Deep Learning- Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016
2.	Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3.	Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4.	Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

REFERENCE BOOKS

1.	Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2.	Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3.	Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw- Hill Education, 2004.

WEB RESOURCES

1.	Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

SOCIAL NETWORK ANALYSIS
Common to IT, CSE(DS)

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

COURSE OBJECTIVES
The objectives of the course is to

1	Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
2	Plan and execute network analytical computations
3	Use advanced network analysis software to generate visualizations and perform empirical investigations 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 legal standards and ethics standards

COURSE OUTCOMES

	Upon successful completion of the course, the student will be able to:	Cognitive level
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
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		**Social Network Analysis:** Preliminaries and definitions, Erdos Number Project, 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", Cambridge University Press.
2.	D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected 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

HUMAN COMPUTER INTERACTION
Common to CSE,IT

Course Category	Professional Elective		**Course Code**	20CS7T11
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
The objectives of the course is to	
1	This Subject deals with dealing data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
2	This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
3	The concepts of data clustering includes a different methods of clustering such as k-means, k-mediods, db scan algorithm, role of data mining in web mining.

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze on normalization techniques.	K4
CO2	Elaborate on concurrency control techniques and query optimization.	K2
CO3	Summarize the concepts of data mining, data warehousing and data preprocessing strategies.	K2
CO4	Apply data mining algorithms.	K3
CO5	Assess various classification & cluster techniques.	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**: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. **Normalization Techniques:** Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.
UNIT II	**Transaction Processing:** Consistency, Atomicity, Isolation and Durability, Serializable Schedule, Recoverable Schedule, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing, **Database performance Tuning and Query optimization:** Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Optimization Database Security: Access Control, MAC, RBAC, Authorization, SQL Injection Attacks.
UNIT III	**Data Mining:** stages and techniques, knowledge representation methods, data mining approaches (OLAP, DBMS, Statistics and ML). **Data warehousing:** data warehouse and DBMS, multidimensional data model, OLAP operations. **Data processing:** cleaning, transformation, reduction, filters and discretization with weka.
UNIT IV	**Knowledge representation:** background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. **Data mining algorithms:** association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.
UNIT V	**Classification & Clustering:** 1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance based methods, linear models, Cluster/2, Cobweb, k-means, Hierarchical methods. **Mining real data:** Preprocessing Data from a Real Medical Domain, Data Mining Techniques To Create A Comprehensive And Accurate Model of Data. **Advanced topics:** Text Mining, Text Classification, Web Mining, Data Mining Software.

TEXT BOOKS	
1.	Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Addison-Wesley,6th edition
2.	Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition

REFERENCE BOOKS	
1.	Principles of Distributed Database Systems, Prentice Hall, P. Valduriez, M. TamerOzsu 3rd edition-2000
2.	Database systems: Design, implementation and Management, C.M. Coronel,S. Morris, P. Rob, Boston: Cengage Learning,9th edition-2011

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

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

PROFESSIONAL ELECTIVE – V
BLOCK-CHAIN TECHNOLOGIES
(Common to IT, CSE, CSE(DS))

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

COURSE OBJECTIVES
The objective of the course is to

1	To understand block chain technology and Crypto currency 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:** Bitcoin Block 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

M-COMMERCE

Course Category	Professional Elective		Course Code	20IT7T17
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	**30**
			Semester End Examination	**70**
			Total Marks	**100**

COURSE OBJECTIVES
The objective of the course is to

1	The objective of the course is to provide the students with the Mobile Commerce concepts, environment and customer value and Business applications of Mobile Commerce.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Define mobile commerce and its framework, growth benefits and limitations	K1
CO2	Determine the information distribution for mobile networks in multimedia content	K2
CO3	Describe the method how to publish mobile networks and mobile payment models in multimedia	K1
CO4	Get acquaintance with wireless communications technology with reference to WWAN, Cellular systems 2G, 2.5G, 3G, 4G, 5G and WLAN, and WMAN technology	K2
CO5	Learn M-COMMERCE applications in various areas like advertising, payment, ticketing, product location, entertainment and shopping	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		**Electronic Commerce:** Traditional commerce and E-commerce, Internet and WWW, Role of WWW, Value Chains, Strategic Business and Industry Value Chains, Role of E- commerce. Packet Switched Networks, TCP/IP Protocol Script, Internet Utility Programmes – SGML, HTML and XML, Web Client and Servers, Web Client/Server Architecture, Intranet and Extranets, Web Based Tools for E- commerce, Security.
UNIT II		**Mobile Commerce:** Introduction, Infrastructure of M–Commerce, Types Of Mobile Commerce Services, Technologies of Wireless Business, Benefits and Limitations, Support, Mobile Marketing & Advertisement, Non– Internet Applications in M– Commerce, Wireless/Wired Commerce Comparisons.
UNIT III		**Mobile Commerce Technology:** A Framework For The Study Of Mobile Commerce, NTT Docomo's I-Mode, Wireless Devices For Mobile Commerce, Towards a Classification Framework for Mobile Location Based Services, Wireless Personal and Local Area Networks, The Impact of Technology Advances on Strategy Formulation in Mobile Communications Networks.
UNIT IV		**Mobile Commerce Theory and Applications:** The Ecology of Mobile Commerce, The Wireless Application Protocol, Mobile Business Services, Mobile Portal, Factors Influencing the Adoption of Mobile Gaming Services, Mobile Data Technologies and Small Business Adoption and Diffusion, E–commerce in The Automotive Industry, Location– Based Services: Criteria For Adoption and Solution Deployment, The Role of Mobile Advertising in Building a Brand, M–commerce Business Models
UNIT V		**Mobile E– Commerce:** Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse Automation, Security.

TEXT BOOKS	
1.	E.Brian Mennecke, J.Troy Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2.	Ravi Kalakota, B.Andrew Whinston, "Frontiers of Electronic Commerce", Pearson Education, 2003.

REFERENCE BOOKS	
1.	P.J.Louis, "M-Commerce Crash Course", McGraw-Hill Companies February 2001.
2.	Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies Of Wireless Business" Cambridge University Press March 2001.

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

REINFORCEMENT LEARNING
Common to CSE (AI&ML), CSE (AI), CSE (DS), IT

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

Course Category	Professional Elective		Course Code	20AM7T04
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	Learn various approaches to solve decision problems with functional models and algorithmsfor task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.
2	Learn Various policies regarding Dynamic Programming.
3	Learn the various methods of MonteCarlo Methods.
4	Learn about various methods in Off – policy with approximation.
5	Learn the various Policy Gradient Methods and its applications.

COURSE OUTCOMES

	Upon successful completion of the course, the student will be able to:	Cognitive level
CO1	Remember the basic concepts of Reinforcement learning.	K1
CO2	Understand basic concepts of Dynamic Programming.	K2
CO3	Understand various methods and applications of reinforcement learning.	K2
CO4	Analyze various off-policy methods with approximations.	K4
CO5	Understand about Policy Gradient Methods.	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

COURSE CONTENT

UNIT I	**Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe** Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm
UNIT II	Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of DynamicProgramming
UNIT III	**Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling** n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step $Q(\sigma)$
UNIT IV	**Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance** Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)
UNIT V	**Policy Gradient Methods**: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE - Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization fr Continuous Actions Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double Wagering, Optimizing Memory Control, Personalized Web Services

TEXT BOOKS	
1.	R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.
2.	Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.

REFERENCE BOOKS	
1.	Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.

WEB RESOURCES	
1.	Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2.	https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

OPEN ELECTIVE – III

HIGHWAY ENGINEERING

Course Category	Professional course		Course Code	20CE7T11
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To introduce the students with the principles and practice of transportation engineering which focuses on Highway Engineering.
2	Ability to mathematically develop and interpret design standards for horizontal and vertical geometry and super elevation
3	To provide basic knowledge on materials used in pavement construction.
4	To enable the students to have a strong analytical and practical knowledge of Planning, Designing of Pavements.
5	To provide basic knowledge in traffic engineering, and transportation planning.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Plan highway network for a given area.	
CO2	Design the Highway geometrics based on highway alignment.	
CO3	Characterize the pavement materials like aggregates, Bituminous materials &construction.	
CO4	Judge suitability of pavement materials and design flexible and rigid pavements.	
CO5	Design Intersections and prepare traffic management plans.	

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	-	-
CO2	1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-

COURSE CONTENT	
UNIT I	**Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT II	**Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment- Gradients- Vertical curves.
UNIT III	**Highway Materials:** Sub-grade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties– Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties -Tests on Bitumen .
UNIT IV	**Design of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors **Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements. **Rigid Pavements:** Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.
UNIT V	**Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; 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; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC method.

TEXT BOOKS

1.	Highway Engineering' by Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P)Ltd., New Delhi.
2.	Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A, Nem Chand Bros, Roorkee.

REFERENCE BOOKS

1.	Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall ofIndia Pvt. Ltd; New Delhi.
2.	'Highway Engineering' by Srinivasa Kumar R, Universities Press, Hyderabad

WEB RESOURCES

1.	https://nptel.ac.in/downloads/105101087/

BATTERY MANAGEMENT SYSTEMS AND CHARGING STATIONS

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

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

COURSE OBJECTIVES
The objective of the course is to

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)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 I	**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 II	**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 III	**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 IV	**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 V	**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

1.	https://nptel.ac.in/courses/108106170
2	https://www.youtube.com/watch?v=omnQN5Z5vsA

ADDITIVE MANUFACTURING

Course Category	Open Elective		Course Code	20ME7T28
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	**30**
			Semester End Examination	**70**
			Total Marks	**100**

COURSE OBJECTIVES

The objective of the course is to

1	Fundamentals of rapid prototyping and concepts of liquid-based rapid prototyping systems
2	Concepts of solid-based rapid prototyping systems
3	Concepts of powder-based rapid prototyping systems
4	Different rapid tooling processes
5	Rapid prototyping data formats and applications of additive manufacturing in various industries

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive level
CO1	Explain the rapid prototyping fundamentals & choose different liquid based rapid prototyping processes for manufacturing	K2
CO2	Choose different solid based rapid prototyping processes for manufacturing	K2
CO3	Choose different powder based rapid prototyping processes for manufacturing	K2
CO4	Choose different rapid tooling processes for prototyping manufacturing	K2
CO5	Elaborate the uses of additive manufacturing processes in various industries.	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	2	2	1	-	-	-	-	-	-	-	1	2	-	1
CO2	1	2	2	1	-	-	-	-	-	-	-	1	2	-	1
CO3	1	2	2	1	-	-	-	-	-	-	-	1	2	-	1
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	1	-	-	-	1	-	-	-	-	-	-	-	1	-	1

COURSE CONTENT

UNIT I	INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process. LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Photopolymers, photo polymerization, layering technology, laser and laser scanning. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT II	SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modelling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.
UNIT III	POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Three-dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies
UNIT IV	RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.
UNIT V	ENHANCING ADDITIVE MANUFACTURING WITH REVERSE ENGINEERING: Reverse engineering, uses of reverse engineering, Steps for reverse engineering in additive manufacturing, 3D scanning techniques. RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis.

TEXT BOOKS

1.	Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2.	Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003

REFERENCE BOOKS

1.	Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
2.	Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
3.	Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.

WEB RESOURCES

1.	nptel.ac.in/courses/112104204/47
2.	nptel.ac.in/courses/112107078/37
3.	https://www.youtube.com/watch?v=kNzTM4zPkE&list=PLbTLRuAivTCR0YVCNxSTPI9lgccanmZLG
4.	https://lecturenotes.in/m/46059-note-of-additive-manufacturing-by-madhura-diwakar?reading=true
5.	https://www.slideshare.net/badebhau/additive-manufacturing-processes-pdf-by-badebhau4gmailcom

INDUSTRIAL ELECTRONICS

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	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

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
	The operation and applications of important switching devices such as DIAC and TRIAC much used in power electronics
	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		Cognitive level
Upon successful completion of the course, the student will be able to:		
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	PSO1	PSO2	PSO3
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.
	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

Course Category	Humanities including Management	Course Code	20HM7T09
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the meaning and importance of Organizational Behaviour to start and survive in corporate environment.	Understanding
CO2	Demonstrate how the perception can integrate in human behaviour , attitudes and values.	Understanding
CO3	Understand the importance of Groups and Teams in organizations for better Decision making.	Understanding
CO4	Understand the need for change and its importance in organizations.	Understanding
CO5	Understand the culture of organizations and to apply techniques in dealing with stress in organizations.	Applying

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	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.

REFERENCE BOOKS

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, Organisational Behaviour--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%20 perspectives%20in,%2C%20behavioral%2C%20 cognitive%20and%20humanistic
4.	https://theintactone.com/2019/06/18/mpob-u3-topic-6-perception-process-and-errors

OPEN ELECTIVE - IV
WATER RESOURCE ENGINEERING

Course Category	Professional Core		Course Code	20CE7T13
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites	Hydraulics and Hydraulic Machinery		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	To introduce hydrologic cycle and its relevance to Civil engineering.
2	Make the students understand physical processes in hydrology and, components of the hydrologic cycle.
3	Appreciate concepts and theory of physical processes and interactions.
4	Learn measurement and estimation of the components hydrologic cycle.
5	Provide an overview and understanding of Unit Hydrograph theory and its analysis.
6	Understand flood frequency analysis, design flood, flood routing.
7	Appreciate the concepts of groundwater movement and well hydraulics
8	Learn overview of flood routing and its effects.
9	Has to be understood and identify the flood occurring areas nearby.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Explain the theories and principles governing the hydrologic processes and list out the forms of precipitation in real conditions.	
CO2	Apply key concepts to several practical areas of engineering hydrology and related design aspects.	
CO3	Design major hydrologic components for need-based structures.	
CO4	Estimate flood magnitude and carry out flood routing.	
CO5	Demonstrate the recuperation test process in open wells.	

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	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

COURSE CONTENT	
UNIT I	INTRODUCTION: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement,

	rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF) curves, Depth-Area Duration (DAD)curves, Probable Maximum Precipitation (PMP), design storm, problems on average rainfall on towns
UNIT II	ABSTRACTIONS FROM PRECIPITATION: Introduction, Initial abstractions. EVAPORATION: Factors affecting, measurement, reduction, Analytical methods ofEvaporation estimation. EVAPOTRANSPIRATION:Factorsaffecting,measurement,control,Potential Evapotranspiration over India. INFILTRATION: Factors affecting, Infiltration capacity curve, measurement, Infiltration Indices. Problems on ϕ-Index and W-Index.
UNIT III	RUNOFF: Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. HYDROGRAPH ANALYSIS: Components of hydrograph, separation of base flow, effectiverainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation ofunit hydrograph, unit hydrographs of different durations, principle of superposition and S- hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. Problems on unit hydrograph.
UNIT IV	FLOODS: Causes and effects, frequency analysis - Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Design flood, Design storm. FLOOD ROUTING: Hydrologic storage routing, channel and reservoir routing-Muskingum and Puls methods of routing, flood control in India. ADVANCED TOPICS IN HYDROLOGY: Rainfall-Runoff Modelling, Instantaneous Unit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model.
UNIT V	GROUNDWATER: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, specific capacity, permeability, transitivity and storage coefficient, types of wells, wellloss, Darcy's law,Dupuit's equation- steady radial flow to wells in confined and unconfinedaquifers, yield of a open well-recuperation test.

TEXT BOOKS	
1.	„Engineering Hydrology" by Subramanya, K, Tata McGraw-Hill Education Pvt. Ltd, (2013), NewDelhi.
2.	„Engineering Hydrology" by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi.
3.	"Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jainand A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi.

REFERENCE BOOKS	
1.	'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2.	'Hydrology' by Raghunath. H.M., New Age International Publishers,(2010).
3.	'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International,(1994).
4.	'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications,(2011).
5.	'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt.Ltd., Transportation Engineering-Id., (2011), NewDelhi.
6.	'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press,(2010).
WEB REFERENCES	
1.	https://www.digimat.in/nptel/courses/video/105104103/L01.html

SMART GRID TECHNOLOGIES

Course Category	Professional Core Courses		Course Code	20EE7T30
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	To understand the basic concepts of smart grid.
2	To understand various smart grid technologies and its usage in smart applications.
3	To realize substation automation with intelligent sensors and have an idea on battery energy storage systems.
	To have basic knowledge on micro grids and DG's.
	To have an idea on communication technologies used in smart grid.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Know the concepts of smart grids and analyze the smart grid policies and developments in smart grids.	K2
CO2	Analyze the concepts of smart grid technologies in hybrid electrical vehicles etc.	K4
CO3	Know the concepts of smart substations - feeder automation - Battery Energy storage systems etc.	K2
CO4	Analyze micro grids and distributed generation systems.	K4
CO5	Analyze the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.	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
CO1	3	1	1	1	1	1	1	-	-	-	-	1	2	2	
CO2	3	2	1	1	1	1	1	-	-	-	-	1	2	2	
CO3	3	2	1	1	1	1	1	-	-	-	-	1	2	2	
CO4	3	2	1	1	1	1	1	-	-	-	-	1	2	2	
CO5	3	2	1	1	1	1	1	-	-	-	-	1	2	2	

COURSE CONTENT	
UNIT I	**Introduction to Smart Grid** Evolution of Electric Grid - Concept of Smart Grid - Definitions - Need of Smart Grid - Functions of Smart Grid - Opportunities & Barriers of Smart Grid - Difference between conventional & smart grid - Concept of Resilient & Self-Healing Grid - Present development & International policies on Smart Grid.
UNIT II	**Smart Grid Technologies-1** Introduction to Smart Meters - Real Time Pricing - Smart Appliances - Automatic Meter Reading(AMR) - Outage Management System(OMS) - Plug in Hybrid Electric Vehicles(PHEV) - Vehicle to Grid - Smart Sensors - Home & Building Automation - Phase Shifting Transformers - Net Metering.
UNIT III	**Smart Grid Technologies- 2** Smart Substations - Substation Automation - Feeder Automation. Geographic Information System(GIS) - Intelligent Electronic Devices (IED) & their application for monitoring & protection. Smart storage like Battery Energy Storage Systems (BESS) - Super Conducting Magnetic Energy Storage Systems (SMES) - Pumped Hydro - Compressed Air Energy Storage (CAES)
UNIT IV	**Micro grids and Distributed Energy Resources** Concept of micro grid - need & applications of microgrid - formation of microgrid - Issues of interconnection - protection & control of microgrid - Integration of renewable energy sources - Demand Response.
UNIT V	**Information and Communication Technology for Smart Grid** Advanced Metering Infrastructure (AMI) - Home Area Network (HAN) - Neighborhood Area Network (NAN) - Wide Area Network (WAN).

TEXT BOOKS	
1.	Integration of Green and Renewable Energy in Electric Power Systems - by Ali Keyhani - Mohammad N. Marwali - Min Dai Wiley - 2009.
	The Smart Grid: Enabling Energy Efficiency and Demand Response - by Clark W.Gellings - Fairmont Press - 2009.

REFERENCE BOOKS	
1.	The Advanced Smart Grid: Edge Power Driving Sustainability:1 by Andres Carvallo - John Cooper - Artech House Publishers July 2011
2.	Control and Automation of Electric Power Distribution Systems (Power Engineering) by James Northcote - Green - Robert G. Wilson - CRC Press - 2017.
3.	Substation Automation (Power Electronics and Power Systems) by MladenKezunovic - Mark G. Adamiak - Alexander P. Apostolov - Jeffrey George Gilbert - Springer - 2010.
4.	Electrical Power System Quality by R. C. Dugan - Mark F. McGranghan - Surya Santoso -H. Wayne Beaty - McGraw Hill Publication - 2nd Edition.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/108107113
	https://electrical-engineering-portal.com/smart-grid-concept-and-characteristics

INDUSTRIAL ROBOTICS

Course Category	Open Elective		Course Code	20ME7T23
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	To impart knowledge about industrial robots and their configurations.
2	To acquire knowledge about components of industrial robots.
3	To learn programming and kinematics of robotics
4	To familiarize with trajectory planning and control architecture
5	To impart knowledge industrial applications.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive level
CO1	Explain various robots and their configuration related to industries.	K2
CO2	Demonstrate working of various components of industrial robots.	K2
CO3	Illustrate programming and kinematics of robotics	K2
CO4	Make use of trajectory planning and control architecture	K3
CO5	Develop industrial applications in various conditions.	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	2	2	-	-	-	-	2	-	-	-	3	-	
CO2	3	3	2	2	-	-	-	-	2	-	-	-	3	-	
CO3	3	3	2	2	-	-	-	-	2	-	-	-	3	-	
CO4	3	3	2	2	-	-	-	-	2	-	-	-	3	-	
CO5	3	3	2	2	-	-	-	-	2	-	-	-	3	-	

COURSE CONTENT

UNIT I	**Introduction:** Definition of a robot – Automations & Robotics - Basic concepts, types of industrial robots – Robot configurations, SCARA, workspace and work volume – Types of robot drives – Basic robot motions – point to point control, continuous path control - Specifications of robots.
UNIT II	**Components of the Industrial Robotics:** Line diagram representation of robot, common types of arms. Manipulators - Types of Robot end effectors - Grippers - Tools as end effectors. **Actuators and Sensors:** Pneumatic, Hydraulic actuators, electric & stepper motors. Position sensors – potentiometers, resolvers, encoders – Velocity sensors. Range sensing - Proximity sensing - Touch

	sensing - Force and Torque sensing.
UNIT III	**Programming** of Robots and Vision System-Lead through programming methods- Teach pendent overview of various textual programming languages like VAL etc. **Kinematics**-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H Transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for Industrial robots. Differential Kinematics for planar serial robots
UNIT IV	**Trajectory planning**: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, blending scheme. Introduction Cartesian space scheme. Control-Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.
UNIT V	**Industrial Applications:** Present and Future applications of robotics in industry - Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.

TEXT BOOKS

1.	Industrial Robotics by Mikell P Groover, Pearson Education.
2.	Robotics and Control by Mittal R K &Nagrath I J, TMH Publications.

REFERENCE BOOKS

1.	Robotic Engineering – An integrated Approach by Richard D Klafter, Thomas Achmielewski and Mickael Negin, Prentice Hall India, New Delhi, 2001.
2.	Automation, Production Systems, and Computer-Integrated Manufacturing by Mikell P Groover, Pearson Education, 2015.
3.	Robotics Control sensing, Vision and Intelligence by K.S. Fu., R.C. Gonalez, C.S.G. Lee, McGraw Hill International Edition, 1987.

WEB RESOURCES

1.	http://www.nptel.ac.in/courses/112101099/1#
2.	https://www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial#:~:text=Two%20main%20programming%20languages%20are,tests%20or%20proof%20of%20concepts.
3.	https://www.plantautomation-technology.com/articles/different-types-of-robot-programming-languages

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY

BIOMEDICAL INSTRUMENTATION

Course Category	Open Elective		Course Code	20EC5T41
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
The objective of the course is to

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.
	Learn various fundamental blocks in patient care and monitoring
	Study various diagnostic and therapeutic techniques

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Acquainted with the function of human body and measure active and resting potentials of cell bodies.	K2
CO2	Measure the Bioelectric potential using appropriate electrodes and Transducers.	K2
CO3	Know the mechanism and measurement of ECG for the Cardiac cycle and respiratory system	K2
CO4	Monitor the Patient care monitoring system and applications of therapeutic equipment	K2
CO5	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	PSO3
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
	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

PRAGATI ENGINEERING COLLEGE
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DEPARTMENT OF INFORMATION TECHNOLOGY

MARKETING MANAGEMENT

Course Category	Humanities including Management		Course Code	20HM7T04
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the concepts of Marketing and Marketing Environment.	Understanding
CO2	Analyze the consumer behavior and market segmentation in order to maintain better consumer relations and product positioning respectively.	Analyzing
CO3	Make use of strategies and make decisions based on product life cycle and product mix concepts.	Application
CO4	Understand the pricing effects and select a better distribution channel to reach the consumer.	Understanding
CO5	Understand the promotional methods and importance.	Understanding

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	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 IV	**Pricing 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 V	**Promotion :** 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	

TEXT BOOKS	
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 - II : UNDERSTANDING HARMONY

Course Category	Humanities including Management	Course Code	20HM7T11
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	**30**
		Semester End Examination	**70**
		Total Marks	**100**

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K2
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K1
CO3	Understand the role of a human being in ensuring harmony in society and nature.	K2
CO4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	K1
CO5	Understand the current scenario in Technology with respect to the Professional Ethics	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	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.

TEXT BOOKS

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

DEEP LEARNING USING PYTHON
Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), IT

Course Category	Skill Oriented	Course Code	20IT7S06
Course Type	Laboratory	**L-T-P-C**	0-0-4-2
Prerequisites		**Total Marks**	**50**

COURSE OBJECTIVES
The objective of the course is to

1	Understand the context of neural networks and deep learning

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Implement deep neural networks to solve real world problems	K3
CO2	Choose appropriate pre-trained model to solve real time problem	K3
CO3	Interpret the results of two different deep learning models	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	3	3	-	-	-	-	-	-	-	-	3	-	3
CO2	2	2	3	3	-	-	-	-	-	-	-	-	3	-	3
CO3	2	2	3	3	-	-	-	-	-	-	-	-	3	-	3

List of Experiments	
1	Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
2	Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3	Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4	Design a neural network for predicting house prices using Boston Housing Price dataset.
5	Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6	Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7	Use a pre-trained convolution neural network (VGG16) for image classification.

8	Implement one hot encoding of words or characters.
9	Implement word embeddings for IMDB dataset.
10	Implement a Recurrent Neural Network for IMDB movie review classification problem.
Software Packages required	
1.	Keras
2.	Tensorflow
3.	PyTorch
WEB RESOURCES	
1.	https://github.com/fchollet/deep-learning-with-python-notebooks

SECURE CODING TECHNIQUES

Course Category	Skill Oriented		Course Code	20IT7S07
Course Type	Laboratory		**L-T-P-C**	0-0-4-2
Prerequisites			**Total Marks**	**50**

COURSE OBJECTIVES
The objective of the course is to

1	Understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
2	Knowledge of outline of the techniques for developing a secure application.
3	Recognize opportunities to apply secure coding principles

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	List of secure systems and various security attacks	K1
CO2	**Demonstrate the development of process of software leads to secure coding practices**	K2
CO3	Apply Secure programs and various risk in the software's	K3
CO4	Classify various errors that lead to vulnerabilities	K3
CO5	**Design Real time software and vulnerabilities**	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
CO1	1	2	2	2	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

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Course Content	
1	Data Validation : Database and Web Specific Input Issues - Quoting the Input
2	Secure Coding in C-Character strings- String manipulation errors, String Vulnerabilities
3	Buffer Overflow
4	Mitigation strategies for strings, Pointers
5	Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities
6	Secure Coding in C++ and Java - Dynamic memory management, Common errors in dynamic memory management, Memory managers
7	Double – free vulnerabilities, Integer security, Mitigation strategies
8	SQL Injection : use of stored procedures, Building SQL statements securely
9	Cross-Site Scripting (XSS) related attacks and remedies
10	Software Security Engineering - Requirements engineering for secure software: Misuse and abuse cases
11	SQUARE process model
12	Software security practices and knowledge for architecture and design

TEXT BOOKS:	
1	Michael Howard, David LeBlanc, "Writing Secure Code", Microsoft Press, 2nd Edition, 2003
2	J. Viega, M. Messier, Secure Programming Cookbook, O'Reilly.
3	J. Viega, G. McGraw, Building Secure Software, Addison Wesley

REFERENCE BOOKS	
1.	Robert C. Seacord, "Secure Coding in C and C++", Pearson Education, 2nd edition, 2013.
2.	Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, "Software Security Engineering: A guide for Project Managers", Addison-Wesley Professional, 2008.

WEB REFERENCES	
1.	https://owasp.org/www-pdf-archive/OWASP_Code_Review_Guide_v2.pdf
2.	https://security.berkeley.edu/secure-coding-practice-guidelines
3.	https://www.whitehatsec.com/glossary/content/secure-coding