w.e.f. 2020-21 **VR20**

SCHEME OF INSTRUCTIONS AND SYLLABUS

B.Tech.

in

INFORMATION TECHNOLOGY

w.e.f

2020-2021 (VR20)

Department of Information Technology

(B. Tech. IT Programme Accredited by NBA)

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous, ISO 9001:2015Certified Institution)
(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada
Andhra Pradesh - 520007, INDIA.
www.vrsiddhartha.ac.in

INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and proactive nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

To provide excellent information technology and computer science education by building strong teaching and research environment.

DEPARTMENT MISSION

To offer high quality graduate and post graduate programs in information technology and computer science education and to prepare students for professional career or higher studies. The department promotes excellence in teaching, research, collaborative activities and positive contributions to society.

PROGRAM EDUCATIONAL OBJECTIVES (B.TECH IN IT)

PEO 1: Excel in Professional Career and / or higher education by acquiring knowledge in mathematical, computing and engineering principles.

PEO 2: Analyse real life problems, design computing systems appropriate to its solutions that are technically sound, economically feasible and socially acceptable.

PEO 3: Exhibit professionalism, ethical attitude, communication skills, team work in their profession and adopt to current trends by engaging in life learning.

PROGRAM OUTCOMES

PO1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - 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.

PO3 - 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.

PO4 - 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.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 - 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.

PO7 - 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.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - 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.

PO11 - 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.

PO12 - Lifelong 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.

PROGRAM SPECIFIC OUTCOMES

PSO1	**Apply the concepts of Data Science, Software Modeling and Networking for IT applications**
PSO2	**Discover mechanisms that would perform tasks related to Research, Education, Training and/or E-governance**

SCHEME OF INSTRUCTIONS

VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR20]

GROUP A (CSE, ECE, EIE, IT)

SEMESTER I

CONTACT HOURS: 26

S. No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	20BS1101	Basic Science	Matrices and Differential Calculus(ECE/EIE) Mathematics - I (CSE/IT)	3	0	0	**3**
2.	20BS1102A 20BS1102B	Basic Science	Engineering Physics (ECE/EIE) Applied Physics (CSE/IT)	3	0	0	**3**
3.	20ES1103	Engineering Science	Programming for Problem Solving	3	0	0	**3**
4.	20ES1104	Engineering Science	Basics of Electrical Engineering	3	0	0	**3**
5.	20HS1105	Humanities and Social Science	Technical English and Communication Skills	2	0	0	**2**
6.	20BS1151	Basic Science	Engineering Physics Laboratory	0	0	3	**1.5**
7.	20ES1152	Engineering Science	Programming for Problem Solving Laboratory	0	0	3	**1.5**
8.	20HS1153	Humanities and Social Science	Technical English and Communication Skills Laboratory	0	0	3	**1.5**
9.	20ES1154	Engineering Science	Computing and Peripherals Laboratory	0	0	2	**1**
10.	20MC1106	Mandatory Course	Technology and Society	1	0	0	**-**
			Total	**15**	**0**	**11**	**19.5**
11.	20MC1107	Mandatory Course	Induction Program				**-**

Category	**Credits**
Basic Science Course	3+3+1.5 = 7.5
Engineering Science Course	3+3+1.5+1 = 8.5
Humanities and Social Science	2+1.5=3.5
Mandatory Course	0
TOTAL CREDITS	**19.5**

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SEMESTER II

CONTACT HOURS: 27

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS2101	Basic Science	Laplace Transforms and Integral Calculus(ECE/EIE) Mathematics - II (CSE/IT)	3	0	0	**3**
2.	20BS2102	Basic Science	Engineering Chemistry	3	0	0	**3**
3.	20ES2103A 20ES2103B	Engineering Science	Object Oriented Programming using Python(CSE/ECE/IT) Python Programming(EIE)	3	0	0	**3**
4.	20ES2104A 20ES2104B 20ES2104C	Engineering Science	Basic Electronics Engineering (CSE/IT) Electronic Devices (ECE) Network Theory (EIE)	3	0	0	**3**
5.	20ES2105	Engineering Science	Engineering Graphics	1	0	4	**3**
6.	20BS2151	Basic Science	Engineering Chemistry Laboratory	0	0	3	**1.5**
7.	20ES2152A 20ES2152B	Engineering Science	Object Oriented Programming using Python Laboratory(CSE/ECE/IT) Python Programming Laboratory(EIE)	0	0	3	**1.5**
8.	20ES2153	Engineering Science	Engineering Workshop	0	0	3	**1.5**
9.	20MC2106	Mandatory Course	Professional Ethics and Practice	1	0	0	**-**
Total				**14**	**0**	**13**	**19.5**

Category	Credits
Basic Science Course	3+3+1.5 = 7.5
Engineering Science Course	3+3+3+1.5+1.5 = 12
Humanities and Social Science	0
Mandatory Course	0
TOTAL CREDITS	**19.5**

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SEMESTER III

CONTACT HOURS: 28

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1	20BS3101	Basic Science	Complex Analysis and Numerical Methods	3	0	0	**3**
2	20ES3102	Engineering Science	Discrete Mathematical Structures	3	0	0	**3**
3	20IT3303	Program Core	Data Structures	3	0	0	**3**
4	20IT3304	Program Core	Computer Organization	3	0	0	**3**
5	20IT3305	Program Core	Operating Systems	2	0	2	**3**
6	20IT3308	Program Core	Object Oriented Programming using C++	2	0	0	**2**
7	20ES3151	Engineering Science Lab	Web Programming Lab	0	0	2	**1**
8	20IT3352	Program Core Lab 1	Data Structures Lab	0	0	2	**1**
9	20IT3353	Program Core Lab 2	Object Oriented Programming using C++ Lab	0	0	2	**1**
10	20TP3106	Soft Skills – 1	Logic and Reasoning	0	0	2	**1**
11	20MC3107A	Mandatory Course (AICTE suggested)	Environmental Studies(CSE/ECE/IT)	2	0	0	**-**
			Total	**18**	**0**	**10**	**21**

Category	Credits
Basic Science Course	3
Engineering Science Courses	4
Program Core Courses	13
Skill oriented Courses/Soft Skills	1
Mandatory Courses	0
TOTAL CREDITS	**21**

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SEMESTER IV

CONTACT HOURS: 31

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1.	20BS4101	Basic Science	Statistics with R	2	0	2	**3**
2.	20IT4302	Program Core	Java Programming	3	0	0	**3**
3.	20IT4303	Program Core	Advanced Data Structures and Algorithms	2	1	0	**3**
4.	20IT4304	Program Core	Database Management Systems	3	0	0	**3**
5.	20HS4105	Humanities and Social Sciences	Universal Human Values 2: Understanding Harmony	3	0	0	**3**
6.	20IT4351	Program Core Lab1	Java Programming Lab	0	0	3	**1.5**
7.	20IT4352	Program Core Lab 2	Database Management Systems Lab	0	0	3	**1.5**
8.	20IT4353	Program Core Lab 3	Advanced programming Lab -I	0	0	2	**1**
9.	20TP4106	Soft Skills – 2	English for Professionals	**0**	**0**	**2**	**1**
10	20IT4607	Skill Oriented Course -1	Ethical Hacking	**1**	**0**	**2**	**2**
11	20MC4108B	MC (AICTE suggested)	Indian Constitution (CSE/ECE/EIE/IT)	**2**	**0**	**0**	**-**
Total				**16**	**1**	**14**	**22**
	Summer Internship six weeks (Mandatory) during summer vacation (EPICS)						
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Basic Science Courses	3
Program Core Courses	13
Engineering Science Courses	0
Skill Oriented Courses and Soft Skills	3
Humanities and Social Science courses	3
Mandatory Courses	0
TOTAL CREDITS	**22**

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SEMESTER V

CONTACT HOURS: 31

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1	20IT5301	Program Core	Computer Networks	2	0	2	**3**
2	20IT5302	Program Core	Software Engineering	2	1	0	**3**
3	20HS5103	Humanities and Social Sciences (Group A)	Engineering Economics and Management	2	0	0	**2**
4	20IT5404	Program Elective 1	A: Data Mining B: Dot Net Technologies C: Blockchain Technologies	3	0	0	**3**
5	20IT5205	Open Elective/Job oriented Elective -1	A: AI Tools,Techniques and Applications B: Mobile Application Development C: Introduction to DBMS **(For other Branch students)**	3	0	0	**3**
6	20IT5451	Program Core Lab 1	Program Elective I - Lab	0	0	2	**1**
7	20IT5352	Program Core Lab 2	Advanced programming Lab-II	0	0	2	**1**
8	20HS5153	Humanities and Social Sciences (Group A)	English Communication Skills Laboratory	0	0	2	**1**
9	20IT5554	Internship / Project (6 weeks)	EPICS / Internship	0	0	3	**1.5**
10	20TP5106	Soft Skills – 3	Personality Development	0	0	2	**1**
11	20IT5607	Skill Oriented Course - 2	A.Google GO B. React Programming	1	0	2	**2**
12	20MC5108A	Mandatory Course (AICTE suggested)	B. Humanities Elective (Group A)	2	0	0	**-**
Total				**15**	**1**	**15**	**21.5**
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Program Core Courses (Group A)	7
Humanities and Social Sciences(Group A)	3
Program Elective Courses	4
Open Elective Courses	3
Skill Oriented Courses& Soft Skills	3
Internship / Project	1.5
Mandatory Course	0
TOTAL CREDITS	**21.5**

List of Humanities Elective Courses			
20MC5108A1	Foreign Languages (German/French)	20MC5108A5	Law for Engineers
20MC5108A2	Biology for Engineers	20MC5108A6	Sanskrit Bhasa
20MC5108A3	Human Rights&Legislative Procedures	20MC5108A7	Yoga & Meditation
20MC5108A4	Philosophy	20MC5108A8	Psychology

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SEMESTER VI

CONTACT HOURS: 32

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1	20IT6301	Program Core	Cloud Computing	2	0	2	**3**
2	20IT6302	Program Core	Machine Learning	2	0	2	**3**
3	20IT6303	Program Core	Web Programming and Development	3	0	0	**3**
4	20IT6404	Program Elective 2	A; Data Visualization	3	0	0	**3**
			B: Big Data				
			C: Internet of Things				
			D: Information Retrieval Systems				
5	20IT6205	Open Elective /Job oriented elective - 2	A: Agile Software Development	3	0	0	**3**
			B: Automata and Compiler Design				
			C: Introduction to Data Structures (For other Branch students)				
6	20IT6351	Program Core Lab 1	Web Programming and Development Lab	0	0	3	**1.5**
7	20IT6452	Program Core Lab 2	Program Elective 2 Lab	0	0	3	**1.5**
8	20IT6353	Program Core Lab 3	Advanced Programming Lab-III	0	0	3	**1.5**
9	20IT6554	Internship / Project	Mini Project - I	0	0	2	**1**
10	20TP6106	Soft Skills –4	Quantitative Aptitude	0	0	2	**1**
11	20MC6107 A	Mandatory Course (AICTE suggested)	Innovation, IPR & Entrepreneurship (Group A)	2	0	0	**0**
Total				**15**	**0**	**17**	**21.5**
Industrial/Research Internship six weeks (Mandatory) during summer vacation							
Honors/Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Program Core Courses(Group A)	13.5
Humanities and Social Sciences(Group A)	0
Program Elective Courses	3
Open Elective Courses	3
Skill Oriented Courses/Soft Skills	1
Mandatory Course	0
Internship / Project	1
TOTAL CREDITS	**21.5**

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SEMESTER VII

CONTACT HOURS: 23

S. No	Course Code	Course Category	Subject	L	T	P	Credits
1	20IT7301	Program Core	Deep Learning	2	0	2	**3**
2	20IT7402	Program Elective 3	A: Software Testing &Automation	2	0	2	**3**
			B: Devops Essentials				
			C: Cyber Security				
3	20IT7403	Program Elective 4	A Business Intelligence	3	0	0	**3**
			B: Computer Vision				
			C: Remote Sensing and GIS				
4	20IT7404	Program Elective 5	A: Natural Language Processing	3	0	0	**3**
			B: Wireless Networks				
			C: Software Project Management				
5	20IT7205	Open Elective 3	Courses from NPTEL / Coursera	0	0	0	**3**
6	20IT7206	Open Elective 4	Courses from NPTEL / Coursera	0	0	0	**3**
7	20IT7607	Advanced Skill Course	A: User Interface Design and Implementation B: Full Stack Development C: Augmented Reality and Virtual Reality	1	0	2	**2**
8	20IT7551	Internship / Project	Mini Project - II	0	0	3	**1.5**
9	20IT7552	Internship / Project	Industrial / Research Internship	0	0	3	**1.5**
Total				**11**	**0**	**12**	**23**
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Note: Open Elective Courses 3 and 4 are self-learning. Students may opt from any MOOCs platform. They have to submit the certificate before the last instruction day of VII semester.

Category	Credits
Program Core	3
Program Electives	9
Open Electives	6
Skill Oriented Courses	2
Internship / Project	3
TOTAL CREDITS	**23**

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SEMESTER VIII

CONTACT HOURS: 24

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1	20IT8551	Internship / Project	Major Project and Internship (6 Months)	0	0	24	**12**
Total				**0**	**0**	**24**	**12**

** The student should undergo internship and simultaneously he/she should work on a project with well-defined objectives. At the end of the semester the student should submit an internship completion certificate and a project report.

20BS1101-MATRICES AND DIFFERENTIAL CALCULUS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Determine Eigen values, Eigen vectors of a matrix.
	CO2	Estimate Maxima and Minima of Multivariable functions.
	CO3	Solve the Linear differential equations with constant coefficients.
	CO4	Solve the Linear differential equations with variable coefficients.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	2			1										3	
CO2	3	2			1										3	
CO3	3	2			1										3	
CO4	3	2			1										3	

Course Content

UNIT I:

Matrices: Consistency of Linear System of Equations, Linear Transformations, Vectors, Eigen values and Eigen vectors, Properties of Eigen values, Finding Inverse and Powers of a Matrix by Cayley-Hamilton Theorem. Reduction to Diagonal form, Reduction of Quadratic form to Canonical form, Nature of a Quadratic form, Complex matrices.

UNIT II:

Differential Calculus: Fundamental Theorems-Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem and Taylor's Theorem, Expansions of functions-Maclaurin's Series and Taylor's Series.

Application: Curvature, Radius of Curvature**.**

Functions of two or more Variables: Taylor's Theorem for Function of two Variables, Maxima and Minima of Functions of two Variables, Lagrange's Method of Undetermined Multipliers.

UNIT III:

Differential Equations of First Order: Exact Differential Equations, Equations Reducible to Exact Equations.

Applications: Orthogonal Trajectories, Newton's Law of Cooling.

Linear Differential Equations of Higher Order: Definitions, Operator D, Rules for Finding the Complementary Function, Inverse Operator, Rules for finding Particular Integral, Working Procedure to Solve the Equation.

	UNIT IV: Method of Variation of Parameters, Method of Undetermined Coefficients, Equations Reducible to Linear Equations with Constant Coefficients: Cauchy's Homogeneous Linear Equation, Legendre's Linear Equation, Linear Dependence of Solutions, Simultaneous Linear Equations with Constant Coefficients. **Application:** L-C-R Circuits.
Text books and Reference books	**Text Book(s):** [1]. B.S.Grewal , Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2019. **Reference Books**: [1].Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015. [2].B.V.Ramana, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007. [3].N.P.Bali, Dr.Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 9th Edition, 2014.
E-resources and other digital material	[1]. www.nptel videos.com/mathematics/(Math Lectures from MIT,Stanford,IIT'S) [2]. nptel.ac.in/courses/122104017 [3]. nptel.ac.in/courses/111105035 [4].EngineeringMathematics Open Learning Project. www.3.ul.ie/~mlc/support/Loughborough%20website/

20BS1102B-APPLIED PHYSICS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	10 + 2 level Physics	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the importance of quantum mechanics.
	CO2	Analyse and understand various types of lasers and their applications.
	CO3	Elaborate different types of optical fibres and understand the concept of Superconductivity.
	CO4	Understand the fabrication of Nano materials and carbon Nanotubes.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2		
CO1	3														2	
CO2	3														4	
CO3	3		2												2	
CO4	3		1		2										2	

Course Content

UNIT I:

Quantum Mechanics: Dual nature of light, Matter waves and Debroglie's hypothesis, Davisson-Germer's experiment, G. P. Thomson experiment, Heisenberg's uncertainty principle and its applications (Nonexistence of electron in nucleus, Finite width of spectral lines), One dimensional time independent and time dependent Schrödinger's wave equations, physical significance of wave function, Particle in a box (One dimension).

UNIT II:

Lasers: Introduction, Characteristics of laser, Basic Principles of lasers (absorption, spontaneous emission, stimulated emission), Requirements of lasers (pumping, population inversion, cavity resonance), Einstein's coefficients, different types of lasers: solid-state lasers (Ruby, Neodymium), gas lasers (He-Ne, CO_2), Semiconductor laser, applications of lasers in science, engineering and medicine.

UNIT III:

Fibre Optics and Superconductivity

Fibre Optics: Introduction, Fundamentals of optic fibre, Propagation of light through optical fiber, Types of optical fibers, Numerical aperture, Fractional Refractive Index change, Fiber optics in communication and its advantages.

	Superconductivity: Introduction, Critical parameters, Flux quantization, Meissner effect, Types of Superconductors, BCS theory, Cooper pairs, London's equation- penetration depth, high temperature super conductors, Applications of superconductors.
	UNIT IV: **Nanotechnology**: basic concepts of Nanotechnology, Nano scale, Introduction to nano materials, Significance of nano scale (surface to volume ratio, uantum confinement effect), Fabrication of nano materials: Plasma arcing, chemical vapour deposition, Characterization of nano materials: AFM, SEM, TEM, STM, Carbon nanotubes: SWNT, MWNT, Formation of carbon nanotubes: Arc discharge, laser ablation, Properties of carbon nanotubes, Applications of CNT and Nanotechnology.
Text books and Reference books	**Text Book(s):** [1]. M.N. Avadhanulu & P.G. Kshirsagar, Engineering Physics, S. Chand publications, Revised Edition, 2014 [2]. P.K. Palanisamy, "Applied Physics", Scitech Publications(INDIA) Pvt. Ltd., Fifth Print, 2008. **Reference Books**: [1]. B. K. Pandey and S. Chaturvedi, 'Engineering Physics' Cengage Learning', Delhi, 2012. [2]. O. Svelto, Principles of Lasers, 5th Edition, Springer, London, 2010 [3]. M.R. Srinivasan, "Engineering Physics", New age international publishers, First Edition, 2011. [4]. Gaur and Gupta, Engineering Physics, Dhanpatrai publishers, 8thedition 2008.
E-resources and other digital material	[1]. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/lecture-videos/ [2]. https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-i/ [3]. http://nptel.ac.in/courses/112106198/19 [4]. https://www.peterindia.net/NanoTechnologyResources.html

20ES1103 -PROGRAMMING FOR PROBLEM SOLVING

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the different types of problem solving approaches
	CO2	Apply the selections, loops, arrays, and string concepts in C to solve problems.
	CO3	Apply functions and PInter concepts in C to solve problems.
	CO4	Solve problems using enum, structures, unions, and file handling functions.

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

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

Course Content

UNIT I:Introduction to computer-based problem solving: Requirement of problem soling by computers, problem definition, Use of examples for problem solving, similarities between problems, Problem solving strategies, steps involved in problem solving.

Program design and implementation issues: programs and algorithms, top-down design and step-wise refinement, construction of loops-basic programming constructs, Implementation, programming environment.

Algorithms for problem solving: Exchanging values of two variables, Summation of a set of numbers, decimal to binary base conversion, reversing the digit of an integer, to find greatest common divisor (GCD) of two numbers, to verify whether an integer is prime or not, organize a given set of numbers in ascending order, find the square root of an integer, factorial of a given number, generate the Fibonacci sequence for n terms, evaluate sin(x) as sum of series, to find the value of the power of a number raised by another integer, reverse order elements of an array, find largest number in an array, print elements of upper triangular matrix, multiplication of two matrices, to compute to roots of a quadratic equation $ax^2+bx+c=0$.

UNIT II:

Introduction to the C Language: Background of C program, Identifiers, Types, Variables, Constants, Memory Layout, Input/Output, Programming Examples.

Structure of a C Program: Logical Data and Operators, Expressions, Precedence and Associatively, Evaluating Expressions, Type Conversion, Statements, Storage Class.

Selection: Two-way Selection, Multiway Selection, More Standard Functions.

Repetition: Concept of a Loop Loops In C, Loop Examples, Recursion, The Calculator Program.

	Arrays: Array Concepts in C, Inter-Function Communication, Array Applications, Two Dimensional Arrays, Multidimensional Arrays.
	UNIT III: **Strings:** String Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions, String- Data Conversion. **Functions:** Functions in C, User Defined Functions, Call by Value, Call Value Reference, Inter-Function Communication, Standard Functions, Scope. **Pointers*:*** Introduction to Pointer, Pointers for Inter-Function Communications, Pointers to Pointers, Compatibility, Lvalue and Rvlaue. **Pointers Applications:** Arrays and Pointers , Pointers Arithmetic and Arrays, Passing an Array to a Function, Memory Allocations Functions, Array of Pointers .
	UNIT IV: **Enumerations:** The Type Definition(Typedef), Enumerated Types: Declaring an Enumerated Type , Operations on Enumerated Types, Enumeration Type Conversion, Initializing Enumerated Constants, Anonymous Enumeration: Constants, Input/Output Operators. **Structures:** Structure Type Declaration, Initialization, Accessing Structures, Operations on Structures, Complex Structures, Structures and Functions, Sending the Whole Structure, Passing Structures through Pointers **Unions:** Referencing Unions, Initializers, Unions and Structures, Internet Address, Programming Applications. **File Handling:** Files, Streams, Standard Library Input/Output Functions, Formatting Input/output Functions and Character Input/Output Functions, Command-Line Arguments.
Text books and Reference book	**Text Book(s):** [1]. Programming and Problem Solving Through "C" Language By HarshaPriya, R. Ranjeet · Firewall media 2006. [2]. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", CENGAGE Learning, Third Edition. **Reference Books**: [1]. Anil B. Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. [2]. R.G. Dromey, "How to Solve it By Computer", Prentice-Hall International Series in Computer Science,1982. [3]. YashwantKanetkar , "Let us C" , BPB Publications, 16th Edition 2017. [4]. Kernighan and Ritchie,"The C programming language", The (Ansi C Version), PHI, second edition. [5]. Paul J. Dietel and Harvey M. Deitel, "C: How to Program", Prentice Hall, 8th edition (Jan 19 ,2021). [6]. K.R.Venugopal, Sundeep R. Prasad, "Mastering C", McGraw Hill, 2nd Edition, 2015.
E-resources and other digital material	[1]. Computer Science and Engineering - Noc:problem Solving Through Programming in C. [online] https://nptel.ac.in/courses/106/105/106105171/ [2] Computer Science and Engineering - Noc: Introduction To Programming in C. [online] https://-nptel.ac.in/courses/106/104/106104128/ [3] C For Everyone: Structured Programming. [online] https://www.coursera.org/learn/c-structured -programming [4] Advanced C Programming CourseTim Academy-Jason Fedin. [online] https://www.udemy.com/- course/advanced-c-programming-course/

20ES1104-BASICS OF ELECTRICAL ENGINEERING

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze Electric Circuit fundamentals.
	CO2	Understand the basic concepts of Alternating Quantities and Magnetic Circuits.
	CO3	Analyze the basic concepts of Electric Machines.
	CO4	Understand Measuring Instruments & Solar Photo Voltaic System concepts.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	3			2								1		4	
CO2	3	3											1		2	
CO3	2	1			2								1		4	
CO4	2	1											1		2	

Course Content

UNIT I:

Introduction to Electrical Engineering: Electric Current, Electromotive force,Electric power and energy, Basic circuit components- Resistors-Inductors-Capacitors. Electromagnetic Phenomenon and Related Laws, Kirchhoff's laws.

Network Analysis: Network sources-Ideal independent voltage source, Ideal independent current source, Dependent sources, Practical voltage and currentsources, Source conversion, Voltage and Current division rule, series and parallelconnection of R, L and C, Star-Delta or, Delta- Star transformation. Mesh andNodal Analysis (with independent sources only).

UNIT II:

Alternating Quantities: Introduction, Generation of AC voltages, Waveformsand Basic Definitions, Relationship between frequency, speed and number ofpoles, Root Mean Square and Average values of alternating current and voltages,Form Factor and Peak Factor, Phase representation of alternating quantities.

Magnetic Circuits: Introduction, Magnetic Circuits, Magnetic Field Strength (H),Magneto motive Force, Permeability, Reluctance, Analogy between Electric andMagnetic Circuits, Magnetic potential drop, Magnetic circuit computations, Selfand Mutual Inductance, Energy in Linear Magnetic Systems
(Derivation for pure inductor).

UNIT III:

DC Machines: Introduction, Construction of dc machines, Armature Windings, Generation of dc voltage and torque production in a dc machine, Operation of a dc machine as a generator, Operation of DC machine as a motor.

	Induction Motors: Introduction, Constructional features of three-phase induction motors, Principle of operation of three-phase induction motor- Slip and rotor frequency, Voltage and current equations and equivalent circuit of an induction motor.
	UNIT IV: **Measuring Instruments:** Introduction, Classification of instruments, Operating Principles, Essential features of measuring instruments, Ammeters and Voltmeters, Measurement of power. **Solar photovoltaic Systems:** Solar cell fundamentals, characteristics, classification, module, panel and array construction, Maximizing the solar PV output and load matching, Maximum Power Point Tracker Basic Algorithm and Flowchart, PV system components, solar PV systems and solar PV applications.
Text books and Reference books	**Text Book(s):** [3]. T.K. Nagasarkar and M.S. Sukhja, "Basic Electric Engineering", 2nd ed.,Oxford University press 2011. **Reference Books**: [1]. B.H.Khan, "Non Conventional Energy Resources", 2nd ed., Mc.Graw HillEducation PvtLtd.,NewDelhi,2013. [2] AshfaqHussain, HaroonAshfaq, " Fundamentals of Electric Engineering" 4th ed., DhanpatRai& Co,2014. [3] I.J.Nagarath and Kothari, "Theoy and Problems of Basic Electric Engineering", 2nd ed., PHI Pvt. Ltd.2016.
E-resources and other digital material	[1]. http://nptel.ac.in/courses/108108076/

20HS1105-TECHNICAL ENGLISH AND COMMUNICATION SKILLS

Course Category:	Institutional Core	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2 - 0 - 0
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop administrative and professional compilations with felicity of expression
	CO2	Demonstrate Proficiency in advanced reading and context oriented writing
	CO3	Apply the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment
	CO4	Execute tasks in Technical communication with competence

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

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

Course Content

UNIT I:

Professional Writing Skills:-

Professional Letters:

Business, Complaint and Transmittal – Purpose, Style and format with special reference to I Format and Modified Block Format

Paragraph and Essay Writing:

Linkers , Descriptive and Analytical with illustrations

Effective writing Practice: Appropriateness. Brevity, clarity, cogency and coherence wit guided and semi-controlled compilations including the use of Idiomatic expressions

UNIT II:

Reading comprehension and Discourse development Skills

Analytical and critical reading - critical, creative and lateral thinking- language and thinking – thinking process and language development.

Effective reading Strategies - Skimming, Scanning, Eye span, fixation, taming Regression, and Issues and Challenges of Vocalization and sub-vocalization.

Context-oriented Dialogue/ Argument writing - Extending Invitation, Reciprocation, Acceptance, Concurrence, Disagreeing without being disagreeable- Discourse/dialogue Development and identification of inconsistencies in pre-prepared dialogues.

	UNIT III: **Vocabulary for Competitive examinations**(A list of 500 High frequency words) Synony Antonyms, Matching Homonyms, Homophones and nearer words along with Root words. **Verbal analogies**(Single Unit) – Synonym Relation, Antonym relation, Object- Operator relation, Object-Obstacle/obstruction relation, Sequence Relation, Place-Monument Relation, Science-area of activity relation, Profession- Tool relation, Gender relation, Diminutive relation, etc., . **Functional Grammar** with special reference to Tense, Concord, Articles, pronoun-referen Prepositions, use of Gerund ,Parallelism, etc., (A Representative collection of 100 sentences).
	UNIT IV: **Measuring Instruments:** Introduction, Classification of instruments, Operating Principles, Essential features of measuring instruments, Ammeters and Voltmeters, Measurement of power. **Solar photovoltaic Systems:** Solar cell fundamentals, characteristics, classification, module, panel and array construction, Maximizing the solar PV output and load matching, Maximum Power Point Tracker Basic Algorithm and Flowchart, PV system components, solar PV systems and solar PV applications.
Text books and Reference books	**Text Book(s):** [1].T.K. Nagasarkar and M.S. Sukhja, "Basic Electric Engineering", 2nd ed.,Oxford University press 2011. **Reference Books**: [1].B.H.Khan, "Non Conventional Energy Resources", 2nd ed., Mc.Graw HillEducation PvtLtd.,NewDelhi,2013. [2] AshfaqHussain, HaroonAshfaq, " Fundamentals of Electric Engineering" 4th ed., DhanpatRai& Co,2014. [3] I.J.Nagarath and Kothari, "Theoy and Problems of Basic Electric Engineering", 2nd ed., PHI Pvt. Ltd.2016.
E-resources and other digital material	[1]. http://nptel.ac.in/courses/108108076/

20MC1106-TECHNOLOGY AND SOCIETY

Course Category:	Institutional Core	**Credits:**	-
Course Type:	Mandatory Learning	**Lecture-Tutorial-Practice:**	1 - 0 - 0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the origins of technology and its role in the history of human progress.
	CO2	Know the Industrial Revolution and its impact on Society
	CO3	Interpret the developments in various fields of technology till Twentieth Century.
	CO4	Distinguish the impacts of Technology on the Environment and achievements of great scientists.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3							1							2	
CO2	3				2		1								2	
CO3	3							1							3	
CO4	3				2		1								2	

Course Content

UNIT I:
Introduction: Origins of technology, The Agriculture revolution, Technological contributions of ancient civilizations- Mesopotamians, Egyptians, Greeks, Romans, Indians and Chinese.

UNIT II:
Industrial revolution: The social and political background, The technical background, Steam: The power behind the Indistrial Revolution, The revolution in Textile Industry, The Imapact of Industrial Revolution on Society.

UNIT III:
The Flowering of modern technology: Manufacturing Technologies, Prime Movers, Internal Combustion Engines, Production of Metals and Alloys, The Birth of Electrical Technology, Twentieth Century: The Flowering of modern technology like information technology and biotechnology, and its implications on society.

UNIT IV:
Technology, Science and Society: Impact of technology on society, The Impacts of Technology on the environment, Sustainable development.
Achievements of famous scientists:
(**World**): Einestein, Newton, Faraday, Graham Bell, Edison, S.Hawking.
(**India**): CV Raman, S.Chandrasekhar, Aryabhatta, Homi J Bhabha, Vikram Sarabhai, APJ Abdulkalam, S.Ramanujan, M.Visweswarayya.

Text books and Reference books	**Text Book(s):** [1].Dr. R.V.G Menon, "Technology and Society", Pearson Education, 2011 **Reference Books**: [1].Quan-Haase, A., " Technology and Society: Inequality, Power, and Social Networks", Oxford University Press, 2013.
E-resources and other digital material	[1]. http://nptel.ac.in/courses/108108076/

20BS1151A : ENGINEERING PHYSICS LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites :		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Use function generator, spectrometer and travelling microscope in various experiments.
	CO2	Test optical components using principles of interference and diffraction of light.
	CO3	Determine the V-I characteristics of solar cell and photo cell and appreciate the accuracy in measurements.

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

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

Course Content	1. Photo cell-Study of V-I Characteristics, determination of work function 2. Newton's Rings-Radius of curvature of plano convex lens. 3. Compound pendulum-Measurement of 'g' 4. LCR circuit- Study of Resonance 5. AC Sonometer –Verification of vibrating laws 6. Solar cell–Determination of Fill Factor 7. Diffraction grating-Wavelength of laser light 8. Optical fiber-Study of attenuation and propagation characteristics 9. Diffraction grating-Measurement of wavelength of mercury source 10. Hall effect –Hall coefficient measurement 11. Figure of merit of a galvanometer 12. Variation of magnetic field along the axis of current-carrying circular coil.
Text books and Reference books	**Text Book(s):** [1] Madhusudhan Rao, "Engineering Physics Lab Manual", Isted., Scitech Publications, 2015. [2] Ramarao Sri, ChoudaryNityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010.

E-resources and other digital material	[1] http://plato.stanford.edu/entries/physics-experiment [2] http://www.physicsclassroom.com/The-Laboratory [3] http://facstaff.cbu.edu/~jvarrian/physlabs.html [4] http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1 [5] http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1 [6] http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

20ES1152-PROGRAMMING FOR PROBLEM SOLVING LABORATORY

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement the use of programming constructs in a structural programming language.
	CO2	Apply the selections, loops, arrays, and string concepts in C to solve problems.
	CO3	Apply functions, PInter, and Enum concepts in C to solve problems.
	CO4	Solve problems using structures, Unions, and file handling functions.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		3											1	4	
CO2		1	3										1		3	
CO3		1	3										3		3	
CO4		1	3										3		3	

Course Content

WEEK – 1 : Introduction to C Programming

a) The Structure of C Program with a sample program.
b) Use identifiers, data types, format specifiers, constants, and variables declaration and initialization to write simple C programs.
c) Write simple C programs using preprocessor commands and simple I/O statements.

WEEK – 2 : Data Types and Variable Declarations

a) Use void, integral and floating PInt data types in different scenarios to write programs.
b) Use various primitive data types for performing different mathematical operations.
c) Programs to perform mathematical operations using various operators in C

WEEK – 3 : Selection – Making Decisions

a) Write programs using the if...else selection statements.
b) Use nested if...else statement to solve problems that need multi-level selection making decisions.
c) Write programs that use switch...case and else...if multi way statements to select one out of several options.

WEEK – 4 : Looping Constructs and Their Applications

a) To have a clear idea on loop initialization, validation and updation.
b) Write programs using the while, for, or do...while loops.
c) To understand the logic and adopt best looping construct for different kinds of problems.
d) Design and develop programs based on Iterative loops using While, Do While, For, Nested For.

WEEK – 5 : Unconditional Control Transfer Statements

a) Write programs using of (break, and continue) unconditional control transfer statements.
b) Use the goto statement to transfer the control from one part to another part of a program and the use of return statement to end the execution of a called function.

WEEK – 6 : Arrays and Their Applications

a) To utilize one dimensional and multi-dimensional arrays to solve problems that use set(s) of similar type input data.
b) To write programs that perform multiple classical operations like searching, sorting, updation, or deletion on array elements.

WEEK – 7 : Strings, String I/O and Manipulation Functions

a) To write programs that work on read, write and manipulate fixed length and variable-length strings and/or arrays of strings
b) To write programs that use predefined string I/O functions.
c) To write programs that use string manipulation functions from the string library.

WEEK – 8 : Concepts of User Defined Functions

a) Design and develop programs depending on functions both user defined andstandard library functions in C with different approaches.
b) To write a program using more than one function with or without parameters and function return type.

WEEK – 9 : PInters and Their Applications

a) Programs on declaration of PInters and their usage in C.
b) Programs to relate between arrays and PInters and use them efficiently in a program.
c) To pass PInters as an argument to a function, and use it efficiently in a program.
d) To write programs using static and dynamic memory allocation.

WEEK – 10 : Structure, Union, and Enumeration

a) Programs to define, declare and access structure and union variables
b) Design and develop programs to work with PInters to access data within a structure
c) Programs to pass structure as an argument to a function
d) To write C programs using enumeration data types, an easiest way of mapping symbolic names to integer values.

	WEEK – 11 : File Handling Operations a) Programs to open and close text and binary files using file I/O commands. b) Write programs to perform read and write operations using the formatting I/O and character I/O functions. c) Apply file positioning, status and system commands based on a problem requirements. **WEEK – 12 : Command Line Arguments** a) To use command line arguments to pass inputs in a single line while executing a program through the DOS command prompt or Linux terminal. b) To use atoi function to convert a default string value argument to an integer value inside the main function in a program. c) To use atof function to convert a default string value argument to a float value inside the main function in a program.
Text books and Reference books	**Text Book(s):** [1].Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", CENGAGE Learning, Third Edition. **Reference Books:** [1] Anil B. Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. [2] R.G. Dromey, "How to Solve it By Computer", Prentice-Hall International Series in Computer Science,1982. [3] YashwantKanetkar , "Let us C" , BPB Publications, 16th Edition 2017. [4] Kernighan and Ritchie,"The C programming language", The (Ansi C Version), PHI, second edition. [5] Paul J. Dietel and Harvey M. Deitel, "C: How to Program", Prentice Hall, 8th edition (Jan 19, 2021). [6] K.R.Venugopal, Sundeep R. Prasad, "Mastering C", McGraw Hill, 2nd Edition, 2015.
E-resources and other digital material	1] Computer Science and Engineering - Noc:problem Solving Through Programming in C. [online] https://nptel.ac.in/courses/106/105/106105171/ [2] Computer Science and Engineering - Noc:introduction To Programming in C. [online] https://-nptel.ac.in/courses/106/104/106104128/ [3] C For Everyone: Structured Programming. [online]https://www.coursera.org/learn/c-structured -programming [4] Advanced C Programming CourseTim Academy-Jason Fedin. [online] https://www.udemy.com/-course/advanced-c-programming-course/

20HS1153-TECHNICAL ENGLISH AND COMMUNICATION SKILLS LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop active and authentic listening comprehension skills relevant for the professional world.
	CO2	Execute web related(On-line) communication with felicity of expression
	CO3	Apply relevant speech patterns including standard pronunciation.
	CO4	Demonstrate Proficiency in Interpersonal Communication with fluency and accuracy.

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

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

Course Content

UNIT I:

- **Exposure to structured and open talks-** Active listening, Appreciative listening, Biased listening, Critical listening Empathetic listening, Judgmental listening
- **Content-oriented Listening Skills** :

Short Conversations- 5-10 minute duration- components, statistics, nominal and other references .

- **Concept oriented/ purposive Listening skills**:

Long Conversations- 10-30minute duration -

- **Problems in comprehension & retention** – Note-taking practice – Listening tests-
- **Overcoming Barriers to listening**: Physical & psychological – Steps to overcome them with demonstration and practice .

UNIT II:

Professional and On-line drafting skills:

- **Professional drafting skills** : Circular, Notice, Executive summary
- **E-mail etiquette-** Awareness with Illustrations and practice
- **Elements of Chat-room interaction-** courtesy, techniques of argumentation
- **Written Response to web-content-** conciseness with accountability
- **Data interpretation-** compiling analytical, comparative and critical observationsb interpreting graphs, charts, etc.

	UNIT III: **Phonetics and Speech patterns:** ➢ **Speech Mechanism** – Organs of speech and patterns of articulation of speech sounds. ➢ **Vowels, Consonants and Diphthongs**- Transcription using International Phonetic Alphabe ➢ **Word Stress and Rhythm-** practice ➢ **Intonation pattern practice**- Tones , Tone group boundaries and Tonal variations ➢ **Strong forms and weak forms in Connected speech** - Illustrations and Practice .
	UNIT IV: **Interpersonal Spoken communication skills:** ➢ **Fluency & accuracy in speech** –Improving self-expression ➢ **Listener oriented speaking** - Interpersonal Conversation- Manner and Temper ➢ **Developing persuasive speaking skills-** Role play ➢ **Overcoming Barriers to speaking** – Building self-confidence– through Conversation practice ➢ **Improving responding capacity** - Extempore speech practice
Text books and Reference books	**Text Book(s):** [1]. Garner, Bryan A, HBR Guide to Better Business Writing, Harvard Business Review Press, Boston, Massachusetts, 2013. [2]. Exercises in Spoken English, Prepared by Department of Phonetics and Spoken English, CIEFL, (Currently English and Foreign Languages University) OUP, 21st Impression, 2003 **Reference Books:** [1] Randolph Quirk, Use of English, Longman, I Edition (1968) Reprinted 2004. [2] Thomson A.J & A.V, Martinet, Practical English Grammar, III Edition, Oxford University Press,2001 [3] V.Sethi and P.V. Dhamija, A Course in Phonetics and Spoken English, II Edition, PHI, 2006
E-resources and other digital material	[1].ODll Language Learner's Software, Orell Techno Systems [2].Visionet Spears Digital Language Lab software Advance Pro [3].www.natcorp.ox.ac.uk, British National Corpus

20ES1154: COMPUTING AND PERIPHERALS LABORATORY

Course Category:	Engineering Sciences	**Credits:**	1
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0 - 0 - 2
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Assemble a PC and install operating system and other software.
	CO2	Trouble shoot hardware and software issues.
	CO3	Configure network settings to connect to internet.
	CO4	Create documents, presentations and spread sheets using office productivity tools.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	3											3	3	3	
CO2	3	2							3				3	2	3	
CO3	3			1	2								3		3	
CO4	3									2			3		3	

Course Content

PC Hardware/Software

Week 1

- Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.
- Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Week 2

- Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
- Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Week 3

- Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva
- Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Networks, Internet & World Wide Web

Week 4:

- Types of Network cables, connectors, crimping straight and crossover cables, identification of network devices (Hubs, Switches, Routers).

Week 5:

- Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email.

Week 6:

- Wi-fi router configuration, connecting to internet, Static/Dynamic IP address configuration, DNS, Gateway, Security configuration.

Productivity tools

LaTeX and Word

Week 7:

- **Word Orientation**: The mentor needs to give an overview of Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in word – Accessing, overview of components of toolbars, saving files, Using help and resources, rulers, format painter.

Week 8:

- **Latex**: Using LaTeX to create project certificate. Features to be covered: Formatting Fonts, Drop Cap, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in both LaTeX.

Week 9:

- Creating project abstract Features to be covered: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Excel

Week 10 :

- Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
- Calculating GPA -Features to be covered: Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting.

	Power Point or equivalent (FOSS) tool **Week 11**: • Students will be working on basic power PInt utilities and tools which help them create basic power PInt presentation. Topic covered during this week includes: PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power PInt. Students will be given model power PInt presentation which needs to be replicated (exactly how it's asked). **Week 12** • Concentrating on the in and out of Microsoft power PInt. Helps them learn best practices in designing and preparing power PInt presentation. Topics covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide master, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.
Text books and Reference books	**Reference Books:** [1]. LaTeX Companion – Leslie Lamport, PHI/Pearson. [2]. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers. [3]. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education. [4]. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech. [5]. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft).
E-resources and other digital material	[1]. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual- 2016-17- 1.pdf [2]. https://www.protosystech.com/rapid-prototyping.htm [3]. https://www.arduino.cc/en/Tutorial/Foundations [4]. [https://www.tutorialsPInt.com/arduino/

SEMESTER – II

20BS2101 : LAPLACE TRANSFORMS AND INTEGRAL CALCULUS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Vectors, Integration, Curve Tracing.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Solve the Linear differential equations using Laplace Transforms.
	CO2	Evaluate areas and volumes using Double, Triple Integrals.
	CO3	Evaluate Grad, Div & Curl of scalar and vector PInt functions.
	CO4	Convert Line Integrals to Area Integrals and Surface Integrals to Volume Integrals.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	2			1										3	
CO2	3	2			1										4	
CO3	3	2			1										4	
CO4			3	2			1								3	

Course Content

UNIT I

Laplace Transforms: Introduction, Definition, Conditions for the Existence, Transforms of Elementary functions, Properties of Laplace Transforms, Transforms of Periodic functions, Transforms of Derivatives, Transforms of Integrals, Multiplication by t^n, Division by 't', Inverse Transforms-Method of partial fractions, Other methods of finding Inverse Transform, Convolution Theorem, Unit Step and Unit Impulse functions.

Applications: Evaluation of Integrals, Solving Differential Equations by Laplace Transforms.

UNIT II

Integral Calculus: Double Integrals, Change of Order of Integration, Double Integrals in Polar Coordinates, Triple Integrals, Change of Variables.

Applications: Area enclosed by Plane Curves, Volumes of Solids.

UNIT III:

Vector Differential Calculus: Scalar and Vector PInt functions, Del applied to Scalar PInt functions-Gradient, Del applied to Vector PInt functions, Physical interpretation of Divergence and Curl, Del applied twice to PInt functions, Del applied to products of PInt functions.

UNIT IV:

Vector Integral Calculus: Integration of Vectors, Line Integral, Surface Integral, Green's Theorem in the plane, Stokes's Theorem, Volume Integral, Gauss Divergence Theorem, Irrotational Fields.

Text books and Reference books	**Text Book(s):** [1].B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2019 **Reference Books:** [1].Erwin Kreyszig , Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015. [2].B.V.Ramana, Higher Engineering Mathematics,Tata MC Graw Hill, 1st Edition, 2007. [3].N.P.Bali, Dr.Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 9th Edition, 2014.
E-resources and other digital material	[1]. www.nptel videos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S) [2]. nptel.ac.in/courses/122104017 [3]. nptel.ac.in/courses/111105035 [4]. Engineering Mathematics Open Learning Project. www.3.ul.ie/~mlc/support/Loughborough%20website/

20BS2102-ENGINEEERING CHEMISTRY

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Chemistry knowledge at Intermediate level	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze various water treatment methods and boiler troubles.
	CO2	Apply the concept of phase equilibrium to different materials and the knowledge of working of electrodes and batteries in various technological fields.
	CO3	Evaluate corrosion processes as well as protection methods.
	CO4	Apply the knowledge of conventional fuels and mechanistic aspects of conducting polymers for their effective and efficient utilisation.

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

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

Course Content

UNIT I

Water technology-I: WHO standards - Water treatment for drinking purpose - sedimentation, coagulation, filtration, disinfection by chlorination, break PInt chlorination and its significance - Desalination of brackish water - principle and process of electro dialysis and reverse osmosis, advantages and disadvantages.

Water technology-II: Boiler troubles - scales-formation, disadvantages and internal conditioning methods - phosphate conditioning, calgon conditioning and sodium aluminate, caustic embrittlement- reasons, mechanism and its control, and boiler corrosion – causes and control.

UNIT II

Phase rule and applications: Definition and explanation of the terms – phase, component and degree of freedom, phase rule equation, phase equilibria of single component system – water system, two component system – silver-lead system, applications of phase rule.

Electrochemistry: Construction and working of Calomel electrode, silver-silver chloride electrode, and principle, construction and working of glass electrode, determination of pH using glass electrode. Chemistry of modern batteries - $Li/SOCl_2$ battery and $Li_xC/LiCoO_2$ battery – construction, working and advantages.

Fuel cells: General working principle of a fuel cell, examples, chemistry of H_2-O_2 fuel cell.

	UNIT III: **Corrosion principles:** Introduction, definition, reason for corrosion, examples – types of electrochemical corrosion - hydrogen evolution and oxygen absorption – corrosion due to dissimilar metals, galvanic series – differential aeration corrosion – pitting corrosion and concept of passivity. **Corrosion control methods:** Cathodic protection- principle and types - impressed current method and sacrificial anode method, anodic protection-principle and method, corrosion inhibitors – types and mechanism of inhibition – principle, process and advantages of electroplating and electroless plating.
	UNIT IV: **Conducting polymers:** Definition, examples, classification-intrinsically conducting polymers and extrinsically conducting polymers- mechanism of conduction of undoped polyacetylene, doping of conducting polymers- mechanism of conduction of p-doped and n-doped polyacetylenes – applications of conducting polymers. **Fuel technology:** Fuel-definition, calorific value- lower and higher calorific values and numericals on calculation of HCV and LCV relation, analysis of coal – proximate analysis and ultimate analysis, flue gas analysis by Orsat's apparatus, numericals based on calculation of air required for combustion.
Text books and Reference books	**Text Book(s):** [1].Shikha Agarwal, "Engineering Chemistry – Fundamentals and Applications", Cambridge University Press, New Delhi, 1st edition (2015). **Reference Books:** [1] Sunita Rattan , "A Textbook of Engineering Chemistry", S.K. Kataria & Sons, New Delhi, First edition 2012. [2] P.C. Jain , "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Limited, New Delhi, 15th edition. [3] B.S. Bahl, G. D. Tuli and Arun Bahl, "Essentials of Physical Chemistry", S. Chand and Company Limited, New Delhi. [4] O. G. Palanna, " Engineering Chemistry", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
E-resources and other digital material	[1] http://www.cip.ukcentre.com/steam.htm [2] http://corrosion-doctors.org/Modi;es/mod-basics.htm [3] http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR%2063%289%29%20715-728.pdf [4] https://chem.libretexts.org/Core/Analytical_Chemistry/Electrochemistry/Basics_of_Electrochemistry [5] http://www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/ [6] NPTEL online course, "Corrosion Part-I" offered by MHRD and instructed by Prof. Kallol Mondal of IIT Kanpur

20ES2103A-OBJECT ORIENTED PROGRAMMING USING PYTHON

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites :	20ES1103Programming for Problem Solving. 20ES1152Programming for Problem Solving Laboratory	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:
CO1	Interpret the python syntax and semantics of control flow statements
CO2	Apply functions, modules and string handling in Python to solve problems
CO3	Determine the methods to create and manipulate programs with Python data structures
CO4	Analyse the concepts of object oriented approach to solve problems

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

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

Course Content

UNIT I

Introduction to Object Oriented Programming: Features of Object Oriented Programming, Merits and demerits of object oriented programming languages, applications of object oriented programming, comparison between commonly used programming languages.

Basics of Python Programming: Features, History, future of python, , writing and executing first python program, Literal constants, variables and identifiers, data types, input operation, comments, reserved words, indentation, operators and expressions, expressions, Type conversion

Decision control statements: Introduction, Selection/conditional branching statements, Basic loop structures/iterative statements, Nested loops, break, continue and pass statements

UNIT II

Functions and Modules: Introduction, function declaration and definition, function definition, function call, variable scope and lifetime, the return statement, recursive functions, modules, packages in python.

Strings: Concatenating, appending and multiplying strings, immutability, String formatting operator, built-in string methods and function, slice operation.

Lists: access and update values in lists, nested and cloning lists, basic list operations, List methods, Using lists as Stack and Queues, list comprehensions, loping in lists.

Tuple: Creating tuple, utility of tuples, accessing values in a tuple, updating tuple, deleting elements in tuple, basic tuple operations.

	UNIT III: **Sets:** Creating a Set and set operations **Dictionaries:** Creating a dictionary, accessing values, add, modify, delete, sort items in a dictionary, looping over a dictionary. **Classes and Objects:** Introduction, classes and objects, class method and self argument, init() method, class and object variables, del() method, other special methods, public and private data members, private methods, calling a class method from another class method, built-in class attributes, garbage collection, class and static methods **Inheritance:** Introduction, inheriting classes in python, types of inheritance, composition/containership/complex objects, abstract classes and interfaces, Meta class.
	UNIT IV: **Operator Overloading:** Introduction, implementing operator overloading, reverse adding, overriding __getitem__() and __setitem__() methods, overriding the in operator, overriding miscellaneous functions, overriding the _call__() method. **Error and Exception Handling:** Introduction to errors and exceptions, handling exceptions, multiple except blocks, multiple exceptions in a single block, except block without exception, the else clause, raising exceptions, built-in and user-defined exceptions, the finally block..
Text books and Reference books	**Text Book(s):** [1]. Reema Thareja,"Python Programming Using Problem Solving Approach", Oxford University Press, 2019. **Reference Books:** [1]. Zed Shah, "Learn PythonThe Hard Way", Third edition, Addison-Wesley, 2013. [2]. Charles Severance, " Python for Informatics- Exploring Information", 1st edition Shroff Publishers, 2017. [3]. John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013 [4]. W.Chun , "Core Python Programming", 2nd Edition, Prentice Hall, 2006.
E-resources and other digital material	[1] Charles Severance: University of Michigan,Python for Everybody [COURSERA]. (05-01-2021), Available: https://www.coursera.org/ [2] Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021), Available:https://nptel.ac.in/courses/106/106/106106182/# [3] Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM],(05-01-2021),Available: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview [4] Corey Schafer,Python OOP Tutorials - Working with Classes, (05-01-2021), Available: Python OOP Tutorials - Working with Classes - YouTube

20ES2104A-BASIC ELECTRONICS ENGINEERING

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Comprehend the fundamentals of electronic components, devices, transducers
	CO2	Understand and apply the principles of digital electronics
	CO3	Learn the principles of various communication systems.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	3			2										2	
CO2	3	3													2	
CO3	2				2										2	

Course Content

UNIT I

Electronic Components: Passive components - resistors, capacitors &inductors (properties, common types, I-V relationship and uses). Semiconductor Devices: Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, Zener diode, BJT, JFET, optoelectronic devices (LDR, photodiode, phototransistor, solar cell, photo couplers).

UNIT II

Transducers: Transducers - Instrumentation - general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers - piezoelectric and thermocouple -DHT, ULTRASONIC , PIR sensors

UNIT III:

Digital Electronics: Number systems - binary codes - logic gates Boolean algebra, laws & theorems - simplification of Boolean expression - Implementation of Boolean expressions using logic gates – standard forms of Boolean expression.

UNIT IV:

Digital Communication: Block diagram of a basic communication system - frequency spectrum - need for modulation, Types of communication-Analog and Digital communication-Advantages and Disadvantages of Digital Communication, Time and frequency domain representation of signals, Sampling theorem, Nyquist rate and Nyquist interval, Pulse code modulation, Line coding-Various formats, Generation of digital modulation techniques-ASK,FSK,PSK

Text books and Reference

Text Book(s):

[1] hyagarajan.T, Sendur Chelvi.K.P, Rangaswamy, "Engineering Basics: Electrical, Electronics and computer Engineering", T.R, New Age International, Third Edition,

books	2007. (UNIT- I&II) [2] Thomas L. Floyd, "Electronic Devices", Pearson Education, 9thEdition, 2011. (UNIT-III) **[3]** Dr. Sanjay Sharma, "Communication Systems(Analog & Digital)", S.K.Kataria& Sons (KATSON Books), 6th edition, 2014 (UNIT- IV) **Reference Books:** [1] M. Morris Mano, Michael D. Ciletti, ―Digital Design‖, 4th edition, Prentice Hall, 2007. [2] S. Salivahanan, N.Suresh Kumar & A. Vallavaraj, "Electronic Devices & Circuits", 2nd Edition, Tata McGraw Hill,2008. [3] Simon Haykin. ―Communication Systems, 4th edition, 2000, John Wiley and Sons.
E-resources and other digital material	[1] https://nptel.ac.in/courses/117/103/117103063/ [2] https://nptel.ac.in/courses/108/105/108105132/ [3] https://nptel.ac.in/courses/108/102/108102096/

20ES2105-ENGINEERING GRAPHICS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory & Practice	**Lecture-Tutorial-Practice:**	1-0-4
Prerequisites:	Nil	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the Scales and conics.
	CO2	Draw Orthographic projections of Points, Lines and Planes.
	CO3	Draw Orthographic projections of Solids and to understand basics of Auto CAD.
	CO4	Understand the sections, Developments of solids and draw isometric views using Auto CAD.

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

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

Course Content

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance

Scales: Construction of plain and diagonal Scales

Conic Sections: Construction of ellipse, parabola and hyperbola (Treatment is limited to Eccentricity or General method only).

UNIT II

Orthographic Projections: Principles of Orthographic Projections –Projections of points, Lines (Treatment is limited to First Angle Projection) and Projections of Plane regular geometric figures (Up to Plane Inclined to both of the Reference planes).

UNIT III

Projections of Solids: Projections of simple solids such as Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to Solid Inclined to one of the Reference planes)

INTRODUCTION TO AUTO CAD: Basic introduction and operational instructions of various commands in AutoCAD. **(**Internal Evaluation only**)**.

UNIT IV

Sections and Development of Surfaces of Right Angular Solids:

Sections and sectional views of right angular solids of Prism, Pyramid and Cone, Development of surfaces of Right Regular Solids of Prism, Pyramid and Cone.

Isometric Projections: Conversion of isometric views into Orthographic Projections of simple

	castings using Auto CAD. (Treatment is limited to simple objects only, Internal Evaluation only).
Text books and Reference books	**Text Book(s):** [1]. BasanthAgrawal& C M Agrawal," Engineering Drawing", McGraw Hill Education Private Limited, New Delhi. [2]. N.D. Bhatt "Engineering Drawing", Charotar Publishing House, Anand. 53rd Edition – 2019. **Reference Books:** [1].K. L. Narayana& P. Kannaiah, "Text Book on Engineering Drawing", Scitech publications (India) Pvt. Ltd.,Chennai, 2nd Edition - fifth reprint 2006. [2].K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New AgeInternational, New Delhi. [3].D M Kulkarni, AP Rastogi, AK Sarkar, "Engineering Graphics with Auto CAD",PHI Learning Private Limited, Delhi Edition – 2013
E-resources and other digital material	[1]. http://www.youtube.com/watch?v=XCWJ XrkWco. **[2].** http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# isodrawing. **[3].** https://onlinecourses.nptel.ac.in/noc20_me79/preview [4]. http://nptel.ac.in/courses/112/103/112103019/

20MC2106- PROFESSIONAL ETHICS & PRACTICE

Course Category:	Mandatory Learning	**Credits:**	-
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Know the moral autonomy and uses of ethical theories.
	CO2	Understand Engineering as Experimentation
	CO3	Understand about safety, risk and professional rights.
	CO4	Know the ethics regarding Global issues related to Environment, Computers and weapon's development. Understand general principles of contracting.

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

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

Course Content

UNIT I

Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issues- types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory -Gilligan's theory - consensus and controversy - Models of Professional Roles -theories about right action - Self-interest - customs and religion- uses of ethical theories.

UNIT II

Engineering as Social Experimentation: Engineering as experimentation – engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT III

Safety, Responsibilities and Rights: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk – the three mile island and chernobyl case studies. Collegiality and loyalty – respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT IV

Global Issues: Multinational corporations- Environmental ethics- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

General principles of contracts management : Indian contract act,1972 and amendments covering general principles of contracting.

Text books and Reference books	**Text Book(s):** [1]. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York (1996). [2]. Govindarajan M, Natarajan S, Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi(2004). **Reference Books:** [1] Baum, R.J. and Flores, A., "Ethical Problems in Engineering, Center for the studyof the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute,Troy, New York, 335 pp. eds. (1978) [2] Beabout, G.R., Wennemann, D.J. , "Applied Professional Ethics: A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175 pp (1994). [3] Dutt (1994) Indian Contract Act, Eastern Law House.
E-resources and other digital material	

20BS2151B-ENGINEERING CHEMISTRY LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Knowledge of chemistry practicals at Intermediate level	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze ores, commercial samples, quality parameters of water samples from different sources
	CO2	Perform quantitative analysis using instrumental methods.
	CO3	Apply the knowledge of preparation of polymers, separation of ions, mechanism of corrosion and photochemical reactions.

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

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

Course Content

List of Experiments:

1. Determination of MnO2 in Pyrolusite / Iron in Haematite ore
2. Determination of total alkalinity of a water sample
3. Determination of purity of a boric acid sample
4. Conductometric analysis of a strong base using a strong acid
5. Determination of total hardness of a water sample
6. Determination of copper in a given sample
7. Chemistry of blueprinting
8. Determination of Mohr's salt - Permanganometry
9. Determination of Mohr's salt - Dichrometry
10. Comparison of corrosion rates of different metals
11. Determination of available chlorine in a bleaching powder sample
12. Determination of chlorides in a water sample
13. pH metric analysis of a strong base using a strong acid
14. Preparation of urea-formaldehyde resin
15. Separation of ions by paper chromatography

Text books and Reference books

Reference Books:

[1].*S.K. Bhasin and Sudha Rani*, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.

[2] Sunitha *Rattan*, "Experiments in Applied Chemistry", S.K. Kataria & Sons, New Delhi, 2nd edition.

20ES2152A-OBJECT ORIENTED PROGRAMMING USING PYTHON LABORATORY

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	20ES1103 Programming for Problem Solving 20ES1152 Programming for Problem Solving Laboratory	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate the usage of Python syntax and semantics in solving the problems
	CO2	Develop python programs using functions and built in modules
	CO3	Implement Python data structures to solve the complex problems
	CO4	Apply object oriented concepts to design solution to real world scenarios

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

CO	PO												POS		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	1		2						1		3		3	
CO2			1		2						1		1	2	4	
CO3		1	1		1						1		2	2	4	
CO4		2	2		2						2		3		3	

Course Content

Week 1: Understanding Object Oriented Programming, Python installation

a. Differentiate procedure oriented and Object Oriented Programming
b. Identify a simple real world scenario using the concept of classes and objects
c. Demonstrate different types of inheritance in the scenario identified
d. Practice Python Installation

Week 2: Declaration of Variables, identifiers and type conversions

a. Write simple programs by defining variables and assigning values of different basic data types
b. Write programs to know data type of a variable using Type statement
c. Write programs to do multiple assignments at a time
d. Write programs for writing multiple statements in a single line
e. Use Input statement, type conversion
f. Use different operators in programs

Week 3: Python programs on Decision Control Statements

a. Write programs using selection statements
b. Implement programs on and conditional branching statements

Week 4: Python programs on looping control structures

a. Design and develop programs using Iterative statements- while, for , nested loops
b. Use Break, continue, pass statements in programs
c. Understand the usage of else statement in loops with a case study

Week 5 & 6: Identify the need and importance in the creation of Python Functions and Modules

a. Write programs for defining and calling functions
b. Understand Scope of a variable and Use global statement
c. Differentiate fruitful and void functions through a case study
d. Apply recursive and Lambda functions
e. Understand different kinds of arguments through a case study
f. Installing and usage of standard library modules
g. Use python packages

Week 7: Solve the problems using Strings and understanding the methods and operations on Lists

a. Apply string formatting operator
b. Use built in string methods, functions and regular expressions
c. Define a list and write programs to access and modify elements of a list
d. Practice basic list operations, methods
e. Write programs to use list as a stack and queue

Week 8:Programs on the implementation of methods and operations of List data structure

a. Define a list and write programs to access and modify elements of a list
b. Practice basic list operations, methods
c. Write programs to use list as a stack and queue

Week 9: Implement programs to solve the problems using Python other data structures: Tuples and Dictionaries

a. Write programs to define a dictionary and write programs to modify values, adding new keys
b. Apply looping over a dictionary
c. Use built in dictionary methods, functions
d. Create a tuple and assign values
e. Use basic tuple operations and comparisons

Week 10& 11: Implement the Python Classes and Objects to address the real world scenarios

a. Define classes and objects using python for the real world scenario
b. Defining constructors and using Self
c. Understand public and private members
d. Practice calling class methods from another class
e. Write built in functions to check, get, set and delete attributes

Week 12&13: Develop the programs to implement parent-child relationship

a. Demonstrate different inheritance types
b. Apply polymorphism and method overriding
c. Create abstract classes.

	Week 14: Write the programs to address the exceptions via exception handling in the development of solutions and implement operator overloading a. Write a simple exception handling program with try- except b. Write a program for catching multiple exceptions c. Demonstrate raising and re raising exceptions d. Apply else and finally clauses e. Demonstrate the usage of polymorphism in overloading of operators
Text books and Reference books	**Text books** **[1].** ReemaThareja,"Python ProgrammingUsing Problem Solving Approach", Oxford University Press, 2019 **Reference Books:** [1].Zed Shah, "Learn PythonThe Hard Way", Third edition, Addison-Wesley, 2013. [2].Charles Severance, " Python for Informatics- Exploring Information", 1st edition Shroff Publishers, 2017. [3].John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013 [4].W.Chun , "Core Python Programming", 2nd Edition, Prentice Hall, 2006.
E-resources and other digital material	[1]. Charles Severance: University of Michigan,Python for Everybody [COURSERA]. (05-01-2021), Available: https://www.coursera.org/ [2]. Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021), Available:https://nptel.ac.in/courses/106/106/106106182/# **[3].** Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM], (05-01-2021), Available: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview [4]. Corey Schafer,Python OOP Tutorials - Working with Classes, (05-01-2021), Available: Python OOP Tutorials - Working with Classes - YouTube

20ES2153-ENGINEERING WORKSHOP

Course Category:	Engineering Sciences	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	20ES1103 Programming for Problem Solving 20ES1152 Programming for Problem Solving Laboratory	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring.
	CO2	Prepare basic models using sheet metal and practice joining of metals using arc
	CO3	Familiarize with various manufacturing processes such as injection moulding and 3D printing
	CO4	Understand the preparation of PCB
	CO5	Understand simple IOT Applications using Arduino

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

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

Course Content

PART-A

Carpentry:

f. Demonstration of Cross half lap and T joints.
g. Demonstration of power tools.

Electrical Wiring:

a. Fundamentals ofElectric wiring and practice of Series wiring.
b. Practice of stair case wiring and connecting a fluorescent Tube.

Sheet metal & soldering:

a. Preparation of complete funnel using sheet metal and practice of soldering.
b. Preparation of a square box using sheet metal and practice of soldering.

Reference books

Antonopoulos and Gavin Wood, Shroff Publisher/O′Reilly Publisher

E-resources and other digital material	[1] Prof. SandeepShuklaCSE**, IIT Kanpur** ,February 2020 ,https://onlinecourses.nptel.ac.in/noc20_cs01/preview [2] Prof. SandipChakraborty, Department of Computer Science and Engineering, **IIT Kharagpur.** April 2018 http://www.infocobuild.com/education/audio-video-courses/computer-science/BlockchainArchitectureDesign-IIT-Kharagpur/lecture-02.html [3] Steven Pu ,Founder& CEO of Taraxa,**Stanford** Seminar - Practical Blockchain Applications May 2020https://www.youtube.com/watch?v=q6WEe4ws-pE

SEMESTER III

20BS3101-COMPLEX ANALYSIS AND NUMERICAL METHODS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20BS1101: Matrices and Differential Calculus. 20BS2101: Complex Analysis and Numerical Methods.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Determine analytic, non-analytic functions and evaluate complex integrals.
	CO2	Analyze Taylor, Laurent series and apply residue theorem for computing real definite integrals.
	CO3	Find solutions for algebraic, transcendental, system of equations and estimate functions using polynomial interpolation.
	CO4	Solve initial value problems numerically.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	2													2	1.5.1, 2.4.1
CO2	3	2													3	1.5.1, 2.4.1
CO3	3	2			2								1	1	3	1.5.1, 2.4.1,5.1.1
CO4	3	2			2								1	1	3	1.5.1, 2.4.1, 5.1.1

Course Content

UNIT I:

Complex Analysis: Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula.

UNIT II:

Taylor's series, Laurent's series, Zeros and Singularities of an analytic function, Residue theorem, Calculation of Residues, Evaluation of real definite integrals:(i) Integration around the unit circle (ii) Integration around a small semi-circle, Bilinear transformation.

UNIT III:

Numerical Methods: Solution of Algebraic and Transcendental Equations with Newton - Raphson method, Solution of Simultaneous linear equations with Gauss - Seidel iterative method.

Interpolation: Introduction, Finite Differences-Forward, Backward and Central differences, Symbolic Relations, Newton's interpolation formulae-forward and backward differences, Central difference interpolation formulae-Gauss's, Stirling's, Bessel's formulae, Interpolation with unequal intervals - Lagrange's and Newton's divided difference formulae.

	UNIT IV: Numerical Differentiation-First and second order derivatives using Newton's forward and backward difference formulae, Numerical integration with Trapezoidal rule and Simpsons 1/3 Rule, Numerical Solutions of Differential Equations-Taylor's series method, Euler's method, Modified Euler's method and Runge - Kutta method of 4th order.
Text books and Reference books	**Text Book(s):** [1].B.S.Grewal, "Higher Engineering Mathematics", 44th Edition,Khanna Publishers, 2019. **Reference Books**: [1].ErwinKreyzig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2015. [2] R.K.Jain,S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishers, 2016. [3] N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9thEdition, Lakshmi Publications (P) Limited, 2016. [4] H. K. Das, Er. RajnishVerma, "Higher Engineering Mathematics", 3rdRevised Edition, S.Chand& Co., 2014. [5] S. S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition PHI Learning, 2012.
E-resources and other digital material	[1].Prof. PranavHaridas,Kerala School of Mathematics, ComplexAnalysis, (26,may,2021) Available:https://onlinecourses.nptel.ac.in/noc21_ma39/preview [2].Prof. Ameeya Kumar Nayak,Sanjeev Kumar, IIT Roorkee, Numerical methods,(26,may,2021) Available:https://onlinecourses.nptel.ac.in/noc21_ma45/preview [3].Jeremy Orloff, Massachusetts Institute of Technology: MIT Open Courseware,Complex Variables with Applications, Available:https://ocw.mit.edu. [4].Henrik Schmidt, Massachusetts Institute of Technology: MITOpenCourseware,Introduction to Numerical Analysis for Engineering, Available:https://ocw.mit.edu.

20ES3102- DISCRETE MATHEMATICS FOR INFORMATION TECHNOLOGY

Course Category:	Engineering Science	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	20BS1101: Matrices and Differential Calculus	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the logical inference and counting techniques
	CO2	Solve problems involving recurrence relations and generating functions
	CO3	Apply abstract algebra and evaluate the algebraic structures
	CO4	Classification of graphs and interpret their applications.

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

CO	PO												PSO		BT L	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	3							3						2	1.2.1, 2.1.3,9.2.1
CO2	3	3							3						3	1.2.1, 2.1.3, 9.2.1
CO3	3	3							1						3	1.2.1,2.1.3,9.2.1
CO4	3	1							1						3	1.2.1, 2.1.3,9.2.1

Course Content

UNIT I:
The Foundations: Logic and Proofs-Propositional Logic, Propositional equivalences, Predicates and Quantifiers, Rules of inference, Introductions to proofs.
Counting: Basics of counting, Pigeonhole principle, Generalized permutations and combinations Generating Functions: definition and examples, useful facts about power series, counting problems and generating functions.

UNIT II:
Advanced Counting Techniques: Recurrence Relations- Solving Linear recurrence relations- Solving homogeneous recurrence relations with constant coefficients-Solving Non homogeneous recurrence relations with constant coefficient.
Relations and Functions: Relations and their Properties, functions- one to one and onto functions, equivalence relation, partial order relations, POSET and Hasse diagrams.

UNIT III: Group Theory: Groups- definition of a group, examples and elementary properties, sub groups, group homomorphism, Cosets and Lagrange's Theorem.

UNIT IV:
Graph Theory: Introduction(graphs, sub graphs, circuits) Sum of degrees theorem, Isomorphism and sub graphs, planar graphs, Euler's formula, Multi graphs and Euler's circuits, Hamiltonian graphs, Grin-berg's theorem, Graph coloring, Chromatic number.

Text books and Reference books	**Text Book(s):** [1]. J.L Mott and A.Kandel, Discrete Mathematics for Computer scientists and Mathematicians, 2nd edition, PHI. [2]. N.ChandraShekharan and M.Umaparvathi , Discrete Mathematics ,PHI 2010 **Reference Books:** [1]. Kenneth H Rosen, Discrete Mathematics and Applications, 6th edition, McGrahill [2]. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, 4th edition(2003), Pearson education
E-resources and other digital material	[1]. Kamala Krithivasan, IIT Madras, Discrete Mathematical Structures [NPTEL], (26,may,2021)Available: http://nptel.ac.in/syllabus/syllabus.php?subjectId=106106094 [2]. DominikScheduer, Assistant Professor, Department of CSE, Shanghai Jiao Tong Univeristy Discrete Mathematics [COURSERA].,(26,may,2021) Available: https://www.coursera.org/learn/discrete-mathematics [3]. Dr. Kamala Krithivasan, IIT Madras, Discrete Mathematical Structures,[NPTEL],(26,may,2021)http://www.infocobuild.com/education/audio-video-courses/computerscience/DiscreteMathematicalStructures-IIT-Madras/lecture-16.html

20IT3303- DATA STRUCTURES

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103- Programming for Problem Solving 20ES2103A- Object Oriented Programming using Python	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Illustrate various techniques for searching, sorting and hashing.
	CO2	Demonstrate the operations on linear data structures like stack, queue and linked list.
	CO3	Analyze various operations on nonlinear data structures – binary tree, binary search tree, AVL and B-trees.
	CO4	Apply data structures to solve real-time problems efficiently.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	3										2	1	2	1.5.1, 2.2.5, 3.3.1
CO2	2	2	2										1	1	2	1.5.1, 2.2.5,3.3.1
CO3		2	2										1	1	4	2.2.5, 3.3.1
CO4		3	3									2	3	2	3	2.3.1, 3.2.2, 12.2.2

Course Content

UNIT I:

Basic Concepts: Overview: System life cycle. Algorithm Specification, Data Abstraction, Performance Analysis, The Abstract Data Type.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Sorting: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Performance and Comparison among all the methods.

Stacks: Stacks, Stacks using dynamic arrays, Evaluation of expressions: Infix to Postfix, Evaluating postfix expressions

UNIT II

Queues: ADT queue, Types of Queue: Simple Queue, Circular Queue using Dynamic Arrays, Applications of queues.

Linked Lists: Single linked list and Chains, Linked Stacks and Queues, Doubly Linked List

Polynomials: Polynomial representation, adding polynomials, Circular List representation of polynomials

UNIT III

Introduction to Binary Trees: Basic Tree Terminologies, Properties of binary trees, binary tree

	representations. Binary Tree Traversals: In order, Preorder, Post order, level order traversal. **Binary Search Trees:** Definition, searching a Binary Search Trees (BST), Insertion into a binary search tree, Deletion from a binary search tree. **Efficient Binary Search Trees:** AVL trees- definition, rotations, insertion.
	UNIT IV **Efficient Multi Search Trees:** Introduction to m-way Search Trees, B Trees-insertion in to a B tree, deletion from a B tree. **Heaps:** Priority queues, Definition of max heap, insertion into a max heap, deletion from a max heap, Heap Sort. **Hashing:** General idea, Hash Functions, separate chaining, open addressing, rehashing, extendable hashing.
Text books and Referenc e books	**Text Book(s):** [1]. Horowitz Sahni and Anderson-Freed, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2011. [2]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C", 2nd edition, Addison Wesley Publication, 2010. **Reference Books:** [1]. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999. [2]. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd edition, McGraw Hill, 2008.
E-resources and other digital material	[1]. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/ [2]. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/

20IT3304 – COMPUTER ORGANIZATION

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand register transfer operations, Multiprocessors, CPU organizations and various addressing modes
	CO2	Identify the design requirements in organization of hardware that enables the CPU to fetch and execute instructions.
	CO3	Illustrate Fixed Point and Floating Point Arithmetic Operations.
	CO4	Analyze different ways of communicating with I/O devices and Memory organizations.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	3												1	2	1.5.1, 2.1.2
CO2		1											1	3	2	2.1.2
CO3	3												1	3	2	1.5.1
CO4		1												1	4	2.2.4

Course Content

UNIT I:

Register Transfer and Micro-Operations: Register Transfer Language, Register Transfer, Bus and memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

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

UNIT II:

Micro Programmed Control: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

Central Processing Unit: Introduction**,** General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Reduced Instruction Set Computer - CISC Characteristics, RISC Characteristics.

UNIT III:

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating point Arithmetic operations

Memory Organization: Memory Hierarchy, Associative Memory, Cache Memory

UNIT IV:

Input-Output Organization: Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).

Multiprocessors: Characteristics of Multiprocessors, Interconnection structures.

Text books and Reference books	**Text Book(s):** [1]. M.Morris Mano, "Computer System Architecture, Revised Third Edition, Pearson publications, 2020. **Reference Books:** [1]. V.CarlHamachar, "Computer Organization", Fifth edition, McGraw Hill Edition, 2011 [2]. J.P.Hayes, "Computer Architecture and Organization" TMH, International Second Revised Edition, 1998 [3]. William Stallings, "Computer Organization and Architecture", Ninth Edition, Pearson/PHI, 2013 [4]. Andrew S. Tanenbaum, "Structured Computer Organization", Fifth Edition, PHI/Pearson, 2009
E-resources and other digital material	[1]. Prof.D.Roychoudhury, Department of Computer Science and Engineering,IITKharagpur **, "Lecture Series on Digital Systems", Nov 2008 https://www.youtube.com/watch?v=wXnVAcvJWDk** [2]. **Prof. S. Raman** CSE Department, **IIT Madras**. Computer Organization lecture series, NPTEL videos http://www.nptelvideos.com/course.php?id=396 [3]. Prof. Kamakoti, IIT, Chennai, May 2017 https://www.youtube.com/watch?v=MIWTxHbPBA0 [4]. Prof. Anshul Kumar, Department of Computer Science and Engineering, IIT Delhi. September 2008 http://www.infocobuild.com/education/audio-video-courses/computer-science/computer-architecture-kumar-iit-delhi.html [5]. Prof.P.K. Biswas, Department of Electronics and Electrical Communication Engineering, IITKharagpur. Introduction to Digital Computer Organization, 2009, Sep 24 https://www.youtube.com/watch?v=TH9nd-KdVHs

20IT3305 - OPERATING SYSTEMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103 : Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the concepts of operating system operations services, Process, Multithreading, file, directory and RAID structures.
	CO2	Apply synchronization, Page Replacement, CPU scheduling algorithms.
	CO3	Analyze the techniques for handling IPC, deadlocks & memory management.
	CO4	Illustrate various file allocation, free space management and disk scheduling techniques.

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

CO	PO												PS0		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	1											1	1	2	1.5.1, 2.2.2,
CO2	3	2	2										2	1	3	1.5.1, 2.3.1, 3.2.2.
CO3	1	3	2										2	1	4	1.5.1, 2.2.3, 3.2.2
CO4	2	2	1										1	1	2	1.5.1, 2.2.5. 3.2.1

Course Content

UNIT I

Introduction: Operating System Operations, Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls.

Process Concept: Process Concept, Process Scheduling, Operations on Processes, Inter Process Communication.

Multithreaded Programming: Overview, Multicore Programming, Multi-Threading Models, Threading Issues.

UNIT II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization.

UNIT III:

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging.

Virtual Memory Management: Background, Demand Paging, Copy-on-Write, Page

	Replacement- FIFO, LRU, OPTIMAL, Thrashing.
	UNIT IV: **File System:** File Concept, Access Methods, Directory and Disk Structure, Protection. **Implementing File Systems:** Allocation Methods, Free-Space Management. **Mass-Storage Structure:** Overview of Mass-Storage Structure, Disk Scheduling, RAID Structure.
Text books and Reference books	**Text Book(s):** [1]. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts", 10th ed, John Wiley &Sons (Asia) Pvt. Ltd, 2018. **Reference Books:** [1]. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd edition, McGraw-Hill Education India Pvt. Ltd, 2017. [2]. William Stallings, "Operating System: Internals and Design Principles", 8thed, Prentice Hall ,2014. [3]. Andrew S. Tanenbaum, "Modern Operating Systems", 4th ed, PHI, 2014.
E-resources and other digital material	[1]. Prof. Chester Rebeiro Department of CSE,IITM "Introduction to Operating Systems" [NPTEL] dated 08thSep 2016 https://nptel.ac.in/courses/106/106/106106144/ [2]. MythiliVutukuru,Dept of CSE ,IITB "Lectures on Operating Systems" dated 14thMar 2018 https://www.cse.iitb.ac.in/~mythili/os/ [3]. Prof. P.K. Biswas,Dept of EEC,IITK "Operating Systems" dated 06thApr 2013 http://www.satishkashyap.com/2013/02/video-lectures-on-operating-systems-by.html

20TP3106 LOGIC AND REASONING

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Learning by Doing	**Lecture-Tutorial-Practice:**	1 - 0-1
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Think reason logically in any critical situation
	CO2	Analyze given information to find correct solution
	CO3	Reduce the mistakes in day to day activities in practical life
	CO4	Develop time management skills by approaching different shortcut methods
	CO5	Use mathematical based reasoning to make decisions
	CO6	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1						2									2	6.2.1
CO2		2													4	2.2.3
CO3								2							2	8.2.2
CO4									2						3	9.2.1
CO5	2														3	1.4.1
CO6	1														3	1.4.1

Course Content

UNIT I

1. Series Completion
2. Coding-Decoding
3. Blood Relation Blood
4. Puzzles test
5. Direction sense test

UNIT II

1. Logical Venn diagrams
2. Number test, Ranking test
3. Mathematical operations
4. Arithmetical Reasoning
5. Syllogism

UNIT III

1. Binary Logic
2. Inserting missing character

	3. Data sufficiency 4. Analogy 5. Classification
	UNIT IV **Non – Verbal:** 1. Water images 2. Mirror images 3. Paper folding 4. Paper cutting 5. Embedded Figures 6. Dot situation 7. Cubes & Dice
Text books and Reference books	**Text Book(s):** **[1].** R. S. Aggarwal, " Verbal and non-verbal reasoning", Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6
E-resources and other digital material	[1]. https://www.indiabix.com [2]. http://www.treeknox.com [3]. https://www.examveda.com

20MC3107A: ENVIRONMENTAL STUDIES

Course Category:	Environmental Studies	**Credits:**	
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	Consciousness of Environment	**Continuous Evaluation:**	46+46+3+5
		Semester end Evaluation:	
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify various factors causing degradation of natural resource and Control Measures
	CO2	Identify various ecosystem and need for biodiversity
	CO3	Realize and explore the problems related to environmental pollution and its management
	CO4	Apply the information and technology to analyze social issues, use acts associated with environment

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1							1					1		2	1.3.1
CO2		1	1							1			1		2	
CO3				1	1							1	1		2	
CO4						1	1	1					1		3	

Course Content

UNIT I

The Multidisciplinary Nature of Environmental Studies Definition, scope and importance Need for public awareness.

Natural Resources :

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a)Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.

(b)Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c)Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

(d)Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

(e)Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

(f)Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

	UNIT II **Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and Its Conservation** Introduction, definition: genetic, species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.
	UNIT III **Environmental Pollution** Definition, Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards **Solid waste management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. **Disaster management:** Floods, earthquake, cyclone and landslides.
	UNIT IV **Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. **Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. **Environment Protection Act** Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. **Public awareness** Human Population and the Environment, Population growth, variation among nations, Population explosion—Family Welfare Programme. **Environment and human health** Human rights, Value education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in environment and human health. **Field Work/ Case Studies** Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. Study of common plants,

	insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.
Self-Study	Water resources, Threats to biodiversity, Solid waste management, Role of Information Technology in environment and human health.
Text books and Reference books	**Text Book(s):** [1].ErachBharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research. **Reference Books:** [1].AnjaneyuluY. Introduction to Environmental sciences, B S Publications PVT Ltd, Hyderabad [2].Anjireddy.M Environmental science & Technology, BS Publications PVT Ltd, Hyderabad. [3]. Benny Joseph, 2005, Environmental Studies, The Tata McGraw- Hill publishing company limited, New Delhi. [4]. Principles of Environmental Science. & Engg. P.Venu GopalaRao, 2006, Prentice-Hall of India Pvt. Ltd., New Delhi. [5]. Ecological and Environmental Studies – Santosh Kumar Garg, Rajeswari Garg (or) RajaniGarg, 2006, Khanna Publishers, New Delhi. [6]. Essentials of Environmental Studies, Kurian Joseph & R Nagendran, Pearson Education publishers, 2005. [7]. A.K Dee – Environmental Chemistry, New Age India Publications. [8]. BharuchaErach- Biodiversity of India, Mapin Publishing Pvt.Ltd..
E-resources and other digital material	[1]. ErachBharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, BharatiVidyapeeth Institute of Environment Education and Research. https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf [2]. NPTEL Courses - Environmental Studies By Dr. Tushar Banerjee | Devi AhilyaViswavidyalaya, Indore.

20IT3308 – OBJECT ORIENTED PROGRAMMING USING C++

Course Category:	**Program Core**	**Credits:**	2
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	**20ES2103A Object Oriented Programming using python**	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Outline the essential features and elements of the C++ programming language
	CO2	Identify class hierarchies using the object-oriented design process
	CO3	Apply exception handling mechanism to handle errors occur at runtime
	CO4	Summarize generic classes with C++ templates.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1												1	1	2	1.5.1
CO2		2	3										2	1	2	2.1.2, 3.2.2
CO3		2											2	1	3	2.2.3,
CO4			3									2	1	1	2	3.2.2, 12.1.1

Course Content	**UNIT I:** **Object Oriented Programming:** Introduction, Encapsulation, Polymorphism, Inheritance, Dynamic binding, Structure of C++ program. **Classes & Objects:** Classes, Structures vs Classes, Unions vs Classes, Friend Functions, Friend Classes, Inline functions, Constructors – default, parameterized, Static Class Members – Constructors and Destructors. The Scope Resolution Operator, Passing Objects to Functions, Returning Objects, this Pointer
	UNIT II: **Overloading**: Function Overloading, Overloading Constructor Functions, Copy Constructors, Operator Overloading, creating a Member Operator Function, Operator Overloading Using a Friend Function, overloading new and delete **Inheritance**: Base-Class Access Control, Inheritance and protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Virtual Base Classes.
	UNIT III: **Virtual Functions**: Calling a Virtual Function through a Base Class, Virtual attribute inheritance, Virtual functions are hierarchical, Pure Virtual Functions, early vs. Late Binding, Abstract Class **Exception Handling**: Exception Handling Fundamentals, catching class types, using multiple catch, Handling Derived Class Exceptions, Exception Handling Options – Catching all exceptions, Restricting Exceptions, Rethrowing an Exception. **Templates:** Generic Functions, overloading a Generic Function, Overloading a function Template, Generic classes

	UNIT IV: **C++ Standard Template Library:** **Algorithms**: Searching, Sorting **Sequence Containers**: Vectors, Strings, Lists, Dequeues **Iterators**: as Smart Pointers, as an Interface, matching algorithms with containers
Text books and Reference books	**Text Book(s):** [1]. Herbert Schildt, "C++: The Complete Reference", Fourth Edition, The McGraw-Hill Companies, 2003. [2]. Robert Lafore, "Object-Oriented Programming in C++", Fourth Edition, Sams Publishing, USA, 2002. **Reference Books:** [1]. Ulla Kirch-Prinz&Peter Prinz, "A Complete Guide to Programming in C++", Jones and Bartlett Publishers, Canada.
E-resources and other digital material	[1]. Dr. ParthaPrathim Das, Professor, IIT Kharaghpur, " Programming in C++ ",2016, https://nptel.ac.in/courses/106/105/106105151/ [2]. Dr. AbiramRanade, Professor, IIT Bhombay, " Introduction to programming through C++", 2016, https://nptel.ac.in/courses/106/101/106101208/ [3]. Jesse Dunietz, Instructional designer, Massachusetts Institute of Technology, USA,2011, https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/index.htm [4]. A comprehensive material from pool of developers at geeks for geeks webpage, https://www.geeksforgeeks.org/c-plus-plus/ [5]. Anh Le, Programming in C++: A Hands-on Introduction Specialization, https://www.coursera.org/specializations/hands-on-cpp

20ES3351- WEB PROGRAMMING LAB

Course Category	Engineering Science	**Credits:**	1.5
Course Type	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20ES2103A: Object Oriented programming using Python	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:
	CO1 Develop static web pages using open source technologies.
	CO2 Analyze different types of Cascading Style sheets
	CO3 Design web application that interacts with a web server
	CO4 Implement Model-View-Controller pattern for web applications development
	CO5 Apply custom validations to validate web forms.
	CO6 Create websites using Django framework with interactive server side scripting.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1											1	1	2	3	1.5.1, 12.1.1
CO2					3							3	2	1	4	5.2.2, 12.1.1
CO3					2							2	2	2	3	5.2.2, 12.1.1
CO4	1				3							1	1	2	3	1.5.1, 5.2.2, 12.1.1
CO5	1				2							2	2	1	3	1.5.1, 5.2.2, 12.1.1
CO6	1				3							2	2	2	6	1.5.1, 5.2.2, 12.1.1

Course Content

Week 1: Understanding Hyper Text Markup Language

a. Differentiate HTML and HTML5
b. Design a static web page using head, body and frames.
c. Design a home page which will display your information, i.e. Bio data, using Image Link and File Link to upload images and necessary documents

Week 2: Image map and Hot spots

a. Create a HTML web page with the following:
b. To embed an image map in a web page
c. To fix the hot spots
d. Show all the related information when the hot spots are clicked

Week 3: Designing Home page

a. Create a webpage with HTML describing your department.
b. Use paragraph and list tags.
c. Apply various colors to suitably distinguish key words.
d. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.
e. Create links on the words e.g. “Wi-Fi” and “LAN” to link them to Wikipedia pages.

Week 4:Use HTML form tags

a. Insert an image and create a link such that clicking on image takes user to other page.

	b. Change the background color of the page. At the bottom create a link to take user to the top of the page c. Use HTML form tag d. Usage of textbox, paragraph, checkboxes, radio button, DropdownList and submit Button.
	Week 5: Table formatting in HTML a. Design a timetable and display it in tabular format b. Design a mark sheet and display all your marks with subjects in a tabular format c. Create a table to show your class time-table d. Design a webpage to List a table of content and navigate within the pages
	Week 6: Cascading style sheets(CSS) a. To create a web page that displays college information using various Style sheets. b. Differentiate among different types of CSS c. Design a webpage i.e. Bio data using CSS.
	Week 7:Django Introduction a. Django Basics b. Understand the MVT structure in Django
	Week 8:Django Forms a. create a form using Django. b. GET & POST in Django c. Django form fields d. Design an web page using Django validation
	Week 9: Django views Design Django CRUD (Create, Retrieve, Update, Delete) Class Based Generic Views
	Week 10: Django Models and templates a. Template filters in Django b. Template tags and variables in Django c. Explain how Django web applications access and manage data through Python objects referred to as models. d. Understand the importance of Register / Use Model e. Implement Django Model Fields and Field Options
	Week 11: Dijango forms and validation of forms a. Understand how is_valid() method is used in Instantiation of form() b. Design an web page using Django validation
	Week 12: Case study Design an interactive web pages with Dijango database connectivity
Text books and Reference books	**Text Books:** [1]. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel," Internet& World Wide Web How to Program", Prentice Hall, Fifth Edition, 2011 [2]. Dauzon Samuel, "Django: Web Development with Python", Packt Publishing Limited. ISBN: 9781787121386, 9781787121386 **Reference Books:** [1]. DT editorial services, " HTML 5 Black Book "Dreamtech Press; Second edition, 2016 [2]. Mele Antonio ,"Django 3 By Example", Packt Publishing Limited, ISBN: 9 781838981952, 9781838981952
E-resources and other digital	[1]. Charles RusellServance, Clinical professor, University of Michigan "Django for everybody specialization", (20, May, 2021) https://www.coursera.org/specializations/django

material	[2]. Colleen van Lent ,Lecturer, University of Michigan “Introduction to HTML”, (20, May, 2021) ,https://www.coursera.org/learn/html

20IT3352-DATA STRUCTURES LAB

Course Category:	Program core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20ES1103 Programming for Problem Solving 20ES1152 Programming for Problem Solving Laboratory	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement various searching and sorting algorithm techniques
	CO2	Demonstrate various operations of stack and queue data structures for problem
	CO3	Implement different types of operations on lists.
	CO4	Implement operations on basic tree data structures.
	CO5	Perform operations on balanced data structures - AVL and B-trees
	CO6	Solve scenario based problems using appropriate data structures

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	1										3		3	1.5.1, 2.2.4, 3.2.2
CO2	2		1										1	2	4	1.5.1, 3.2.2
CO3	2	1	1										2	2	3	1.5.1, 2.2.4, 3.2.2
CO4	2	2	2										3	1	3	1.5.1, 2.2.4, 3.2.2
CO5	2	1	1										1	2	4	1.5.1, 2.2.4, 3.2.2
CO6	2	2	2									2	2	2	3	1.5.1, 2.2.4, 3.2.2, 12.1.1

Course Content

Week 1: Programs on Searching & Sorting techniques

a. Implement linear and binary search techniques
b. Internal sorting techniques: :Insertion Sort, Bubble sort , Radix sortand Selection sort
c. External sorting techniques: Merge Sort and Quick Sort
d. Design experiment using Searching and sorting techniques

Week 2&3: Stack using array and its applications

a. Implementation of possible operations on stacks using arrays
b. Application-1: Convert given infix expression to postfix using stacks
c. Application-2: Evaluate given postfix expression using stacks
d. Application-3: Check for Balanced Brackets in given expression using Stack

Week 4: Queue using array and its applications

a. Implementation of possible operations on Queue using arrays
b. Implementation of possible operations on circular queue using arrays
c. Design experiment using Queue and circular Queue

Week 5&6: linked list and its types

a. Implementation of all possible operations on single linked list.
b. Implementation of all possible operations on double linked list.

	c. Implementation of all possible operations on circular linked list. **Week 7&8: linked list applications** a. Application-1: Implementation of possible operations on stacks using list b. Application-2: Implementation of possible operations on queue using list c. Application-3: Addition of two polynomials using linked list d. Application-4: Subtraction of two polynomials using linked list **Week 9: Binary search tree and applications** a. Implementation of Binary search tree operations. b. Application-1: Implement tree traversal techniques using recursion **c.** Application-2: Implement XML Parser tree algorithm **Week 10: AVL,B- tree and applications** a. Insert and delete operations on AVL-tree b. Insert and delete operations on B-tree c. Design experiment using AVL ,B-Tree **Week 11: Design experiments/scenario based problem solving using linear Data structures** **Week 12: Design experiments/scenario based problem solving using nonlinear Data structures**
Text books and Reference books	**Text Book(s):** [1]. Horowitz Sahni and Anderson-Freed, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2011. [2]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C", 2nd edition, Addison Wesley Publication, 2010. **Reference Books:** [1]. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999. [2]. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning
E-resources and other digital material	[1]. Erik Demaine, Advanced Data Structures, [MIT- OpenCourseWare]. (26, May, 2021). Available: http://ocw.mit.edu/ [2]. Dr. Naveen Garg, Department of Computer Science & Engineering ,IIT Delhi, Lecture Series on Data Structures and Algorithms [NPTEL], (26,May,2021) Available: https://nptel.ac.in/courses/106/102/106102064/ [3]. Data Structures and applications on, [Geeksforgeeks], (25, May, 2021) Available: https://www.geeksforgeeks.org/data-structures/ [4]. Data Structures and challenges [Hacker rank], (25,May,2021) Available: https://www.hackerrank.com/domains/data-structures

20IT3353 - OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Course Category:	Program Core Lab	Credits:	2
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	20ES2103A: Object Oriented programming using Python	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes		
	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate an understanding of the overall syntax and semantics of C++ programs by writing programs from specifications given in class.
	CO2	Develop C++ programs to implement overload of functions, constructors and operators
	CO3	Implement inheritance and its variants using C++
	CO4	Apply virtual and pure virtual function & complex programming situation.
	CO5	Apply the knowledge of exception handling to design error free applications
	CO6	Create programs using generic classes and Standard Template Libraries for solving real time scenarios.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		3										1		3	1.5.1, 3.2.2
CO2			2									2		1	3	3.2.2, 12.1.1
CO3		2												2	3	2.2.4
CO4		2													3	2.2.4
CO5				2									2		3	4.3.2
CO6			2									2	2	2	3	3.2.2, 12.1.1

Course Content	
	Week 1: Classes and Objects 1. Understand and implement the concept of class and object 2. Implement data members and member functions in the class. 3. Identify the difference in implementation of single and multiple objects.
	Week 2: Constructors & Inline functions 1. Understand the concept of Constructor and its advantages, 2. Implement default and parameterized constructors 3. Understand how to implement inline functions in a class.
	Week 3: Static Data members and static members functions: 1. Understand the concept of static data member and static member function 2. Implement static member function in a class for the given application
	Week 4: Passing objects to function & friend functions 1. Implement the concept of passing object to a function. 2. Implement the concept of returning object from a function. 3. Understand the concept of friend functions. 4. Implement the concept of friend function for the given example.
	Week 5: Constructor overloading 1. Implement method overloading for the given example. 2. Implement constructor overloading for the given example

	3. Understand copy constructor and implement the copy constructor for the given example.
	Week 6: Operator Overloading 1. Implement overloading of operators. a. binary operator b. unary operator c. new and delete operators d. unary operator overloading using friend functions
	Week 7: Implement programs on Inheritance 1. Design solutions that make use of the concept of different types of inheritance 2. Implement how constructors are invoked in a. Multiple Inheritance b. Multilevel Inheritance c. Hierarchical Inheritance
	Week 8: Implement programs on virtual functions and abstract classes 1. Implement Virtual base class concept in Inheritance, 2. Understand and implement the concept of Virtual Base class. 3. Differentiate between virtual function and pure virtual function and implement them as necessary in the given application. 4. Create a solution using abstract classes by crating abstract methods.
	Week 9: Handling Exceptions **1.** Develop programs to handle run-time errors using exception handling. 2. Design applications to make use of user defined exceptions. 3. Implement programs to freeup the resource using finally
	Week 10: Generic Templates - class Templates **1.** Implement function template for the given example **2.** Create a solution for the given example using overloading a function template. 3. Understand the differences between function templates and class templates 4. Implement class templates for the given application.
	Week 11: Standard Template Library **1.**Implement operations on a. STL Vectors. b. STL List c. STL Deques d. STL Strings
	Week 12: Case study Simulate the Bank Application, Library application, Movie ticket Booking , Train ticket booking applications etc., by using C++ concepts
Text books and Reference books	**Text Book(s):** [3]. Herbert Schildt, "C++: The Complete Reference", Fourth Edition, The McGraw-Hill Companies, 2003. [4]. Robert Lafore, "Object-Oriented Programming in C++", Fourth Edition, Sams Publishing, USA, 2002. **Reference Books:** [2]. Ulla Kirch-Prinz& Peter Prinz, "A Complete Guide to Programming in C++", Jones and Bartlett Publishers, Canada.
E-resources and other digital	[1]. Dr. ParthaPrathim Das, Professor, IIT Kharaghpur, " Programming in C++ ", 2016, https://nptel.ac.in/courses/106/105/106105151/ [2]. Dr. AbiramRanade, Professor, IIT Bhombay, " Introduction to programming through

material	C++", 2016, https://nptel.ac.in/courses/106/101/106101208/ [3]. Jesse Dunietz, Instructional designer, Massachusetts Institute of Technology, USA,2011, https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/index.htm [4]. A comprehensive material from pool of developers at geeks for geeks webpage, https://www.geeksforgeeks.org/c-plus-plus/ [5]. Anh Le, Programming in C++: A Hands-on Introduction Specialization, https://www.coursera.org/specializations/hands-on-cpp

SEMESTER IV

20BS4101 – STATISTICS WITH R

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT3302 Discrete Mathematical Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the fundamental syntax of R through readings, practice exercises, demonstrations, writing R code and Visualize data attributes using ggplot2 and other R packages.
	CO2	Manipulate numeric and textual data types using the R programming language and RStudio.
	CO3	Apply the knowledge of Probability and conduct Tests of Hypothesis for Statistical Inference.
	CO4	Fit some basic types of Statistical Models.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2											2	2	2	1.5.1, 2.2.2
CO2	2	1			2								2	2	3	1.5.1, 2.2.2, 5.2.2
CO3	3	2		3							2		3	2	3	1.2.2, 2.4.1 4.3.1, 11.3.1
CO4	3	2	3	2	2						3		3	2	3	1.5.1, 2.4.1, 3.2.2, 4.3.3, 5.2.2, 11.3.1

Course Content

UNIT I:

The R Environment : Command Line interface, R Studio, Installing R Packages.

Basics of R : Basic math, variable, data types, vectors, calling function, missing data, data.frames, lists, matrices, arrays.

Reading data into R : Reading CSVs, Excel Data.

Case Study: Loading data from mysql into RStudio.

Writing R functions, control statements – if and else, switch, compound tests, for loops, while loops.

Statistical Graphs : Base Graphs, ggplot2.

UNIT II:

Group manipulation : Apply Family, aggregate, plyr, data.table.

Data Reshaping : cbind, rbind, joins, reshape2.

Strings :paste, sprint, extracting text, regular expressions.

Case Study:String Theory: To focus on manipulating unstructured data, this in most cases means

	natural language texts. Tweets are again a useful source of data for this because tweets are mainly a short (140 characters or less) character strings. **Math Functions :** Calculating a Probability, cumulative sums and products, minima and maxima, calculus, sorting, set operations.
	UNIT III: **Probability Distributions**: Normal Distribution, Binomial Distribution, Poisson Distribution. **Basics Statistics**: Summary statistics, correlation and covariance, t-tests, ANOVA. **Case Study: Popularity Contest:** Develop a test to compare two different Twitter topics to see which one is most popular(or at least which one has a higher posting rate)
	UNIT IV: **Linear Models** : Simple Linear Regression, Multiple Regression, Logistics Regression, PIsson Regression. **Nonlinear Models** : Nonlinear least squares, splines, generalized additive models, decision trees, random forests. **Time Series** : Autoregressive Moving Average, VAR, GARCH. **Clustering** : K Means, PAM, Hierarchical Clustering **Case Study:** 1. **Word Perfect:** Analyze the actual words that appear in text documents. 2. **Decision Tree:** Implement Decision Tree, Random Forest in R for party package.
Text books and Reference books	**Text Book(s):** [1]. Jared P. Lander, "R for Everyone, Addison Wesley Data &Analytics Series, Pearson", 2014. **(UNIT-I,II(Except Math Functions), III &IV)** [2]. Norman Matloff, "The Art of R Programming, No Strach Press", San Francisco, 2011**. (UNIT-II Math Functions)** **Reference Books:** [1]. Jeffrey Stanton, "An Introduction To Data Science", 2012 [2]. G. Jay Kerns, Introduction to Probability and Statistics using R, First Edition, 2010
E-resources and other digital material	[1]. Rafael Irizarry, Michael Love, Statistics with R, Harvard University (18, May, 2021). Available: https://www.edx.org/course/statistics-r-harvardx-ph525-1x-1 [2]. Mine Çetinkaya-Rundel, David Banks, Colin Rundel, Merlise A Clyde, Duke University, (18, May, 2021). Statistics with R Specialization. Available: https://www.coursera.org/specializations/statistics

20IT4302-JAVA PROGRAMMING

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103Programming for Problem Solving 20IT3303 Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand object-oriented programming principles to build classes and create objects
	CO2	Analyze assertions and exception handling techniques to debug correctness and handle run time errors
	CO3	Apply the knowledge of generics, collections and multi-threading to solve the problems
	CO4	Demonstrate the knowledge of lambda expressions and Stream API operations to solve the problems.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	2													2	1.5.1, 2.1.2
CO2		2	3									2	1	2	4	2.1.2, 3.2.2, 12.2.1
CO3	1	3	2									3	3	3	3	1.5.1, 2.2.4, 3.2.2, 12.2.1
CO4			2									2	2	3	2	3.1.5, 12.2.1

Course Content

UNIT I:

Introduction: Overview of Java, Data Types, Variables and arrays.

Classes and objects: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, overloading methods, static and final keywords.

String Handling: The String Constructors, String Tokenizer class**.**

UNIT II:

Inheritance: Inheritance basics, using super, creating a multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance.

Packages & Interfaces: Defining a package, finding package and CLASSPATH., Packages and Member access, importing packages, Defining an interface, implementing interfaces, nested interfaces, applying interfaces, variables in interfaces.

Exception handling:

Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, throw, throws, finally, creating your own exception subclasses.

	UNIT III: **Generics:** Generic class with two type parameters, the general from of a generic class, Bounded types **Assertions:** Using assert statement, Assertion enabling and disabling options **Multithread Programming:** The Java thread model, creating a thread: implementing runnable, extending thread, creating multiple threads, thread priorities **Collections Framework:** Collections overview, Collection interfaces: Collection, List and Set. Collection Classes: ArrayList, LinkedList, HashSet,TreeSet
	UNIT – IV **Lambda Expressions:** Lambda Expression fundamentals, function interfaces, lambda expression examples, Block lambda expressions, Passing lambda expressions as arguments. **Method References:** to static methods, to instance methods, with generics **Stream API: Stream Basics:** Stream interfaces, obtaining a Stream, Stream examples **Reduction Operations, using parallel streams, Mapping, Collecting, Iterators and Stream:** Use an Iterator with a Stream, Use Spliterator**.**
Text books and Reference books	**Text Books:** [1] Herbert Schildt, "Java The Complete Reference", 11th Edition, McGraw-Hill Education, New Delhi, 2019. **Reference Books:** [1] Kathy Sierra & Bert Bates, Head First Java, Second edition, Shroff/O'Reilly, 2009 [2] Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2013. [3] Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", 9th Edition, Prentice-Hall, Pearson Education, 2011. [4] Timothy Budd, "Understanding Object Oriented Programming with Java ", Updated edition, Pearson Education, 2013.
E-resources and other digital material	[1] Prof. I. Sengupta. (19-05-2021), Department of Computer Science & Engineering, I.I.T.,Kharagpur, "Internet Technologies", NPTEL, http://nptel.ac.in/video.php?subjectId=106105084 [2] Mia Minnes, Leo Porter, Christine Alvarado, University of California, San Diego (19-05-2021) Object Oriented Programming in Java Available: https://www.coursera.org/learn/object-oriented-java [3] Cay Horstmann, Cheng-Han Lee, Sara Tansey, San Jose State University, (19-05-2021) Intro to Java Programming Available https://eu.udacity.com/course/intro-to-java-programming--cs046

20IT4303- ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	20IT3302- Discrete Mathematics for Information Technology 20IT3303- Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the asymptotic performance of algorithms and various operations on data structures
	CO2	Synthesize design techniques and choose appropriate technique to solve problems.
	CO3	Analyze algorithm design techniques to provide optimal solution for given problem.
	CO4	Distinguish deterministic and non-deterministic algorithms and their performances.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	1	3										2	1	2	1.5.1, 2.2.4, 3.2.2
CO2	1	2	3	2								2	1	1	3	1.5.1,2.2.4, 3.2.1, 4.2.1, 12.2.1
CO3	1	2	3	2								1	1	3	4	1.5.1, 2.2.4, 3.2.2, 4.2.1,12.2.1
CO4		3	2										3	2	2	2.1.2,3.2.1,

Course Content

UNIT I:

Trees: Splay trees: A simple idea, splaying, Top-Down splay trees, Red-Black trees: Bottom-up insertion, Top-down-red-black trees, top-down deletion, Treaps, Suffix Arrays and Suffix Trees: Suffix Arrays, Suffix Trees, Linear-Time Construction of Suffix Arrays and Suffix Trees.

Introduction: Algorithm Specification: Pseudo code Conventions, Recursive Algorithms, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big ―oh, Omega, Theta, Little ―oh).

UNIT II:

Divide and Conquer: General method, Binary search, Finding the Maximum and Minimum, Merge sort, Quick sort, Strassen‘s matrix multiplication.

Greedy method: General method, knapsack problem, Job Sequencing with deadlines, Minimum cost spanning trees: Prim‘s and Kruskal‘s algorithms, Single source shortest path problem

	UNIT III: **Dynamic Programming:** General method, All pairs shortest Path problem, Travelling sales person problem, 0/1 knapsack problem, Reliability Design **Backtracking:** General method, 8-queens problem, sum of subsets, graph colouring, Hamiltonian cycles.
	UNIT IV: **Branch and Bound:** The method: Least Cost (LC) Search, Control Abstractions for LC-Search, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling Salesperson. **NP-Hard and NP-Complete problems**: Basic concepts, non-deterministic algorithms, the classes NP Hard and NP Complete..
Text books and Reference books	**Text Book(s):** [1]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C++", 4th edition, Addison Wesley Publication, 2014. [2]. E. Horowitz, et al, ―Fundamentals of Computer Algorithms, University Press(India)Pvt. Ltd, 2 Edition 2011. **Reference Books:** [1]. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", PHI learning Pvt.Ltd., New Delhi, 2010. [2]. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python", 1st edition, Springer International Publishing, 2015.
E-resources and other digital material	[1] SudarshanIyengar,AssistantProfessor,CSE department, IIT Ropar, Programming, Data Structures and Algorithms [NPTEL], (26, May, 2021) Available: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/ [2] Erik Demaine, professor of Computer Science at the Massachusetts Institute of Technology , Advanced Data Structures [MIT- Open Course Ware], (26, May, 2021) Available: http://ocw.mit.edu/

20IT4304 – DATABASE MANAGEMENT SYSTEMS

Course Category:	Program Core	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	20IT3303-Data Structures	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes		
	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate DBMS architecture and conceptual database modeling for database design
	CO2	Formulate solutions to handle databases using indexing, SQL, relational algebra and NOSQL
	CO3	Develop database schemas using normalization approaches.
	CO4	Apply the concepts relevant to transaction processing in database systems.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		1								1		2	1	2	1.5.1, 3.2.2, 11.3.1
CO2	3		2								3		2	1	3	1.5.1, 3.2.2, 11.3.1
CO3	3		2								3		2	2	3	1.5.1, 3.2.2, 11.3.1
CO4	2		3								1		2	3	3	1.5.1, 3.2.2, 11.3.1

Course Content

UNIT I:

Databases And Database Users: Introduction, characteristics of the database approach, actors on the scene, workers behind the scene, advantages of using the DBMS approach

Database System Concepts And Architecture: Data models, schemas, and instances, three schema architecture and data independence, Database languages and interfaces, The database system environment

Relational Data Model And Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas

UNIT II:

SQL:SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, Insert, Delete and Update Statements in SQL

More SQL : Complex Queries, Views and Schema Modification : More Complex SQL Retrieval Queries, Views (Virtual Tables) in SQL, Schema Change Statements in SQL.

Indexing Structures for files and Physical Database Design : Primary indexes, Clustering indexes, Secondary indexes, Multilevel indexes.

	The Relational Algebra: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION
	UNIT III: **Data Modeling Using The Entity-Relationship (ER) Model:** Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types **Database Design Theory And Methodology: Basics of Functional Dependencies and Normalization for Relational Databases -** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal forms based on Primary keys, First Normal Form, Second Normal Form, Third Normal Form, Boyce-CoddNormal Form, Multi valued dependency and Fourth normal form, Properties of Relational Decompositions.
	UNIT IV: **Introduction to Transaction Processing Concepts And Theory :** Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing schedules based on Recoverability, Characterizing schedules based on Serializability. **Concurrency Control Techniques:** Two Phase Locking Techniques for concurrency control – Types of locks and system lock tables, Guaranteeing Serializability by Two-Phase Locking. **NoSQL Databases :**Introduction to NoSQL systems -Emergence of NOSQL Systems, Characteristics of NOSQL Systems, Categories of NOSQL Systems**.** **Graph Database :** Introduction, High level view of graph space, The Power of Graph Databases.
Text books and Reference books	**Text Book(s):** [1]. Elmasri and Navathe. "Fundamentals of Database Systems", Ed 7. Pearson Education, 2016 [2]. Ian Robinson, Jim Webber, Emil Efriem, "Graph Databases", OReilly Media, 2015. **Reference Books** [1].Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, TATA McGrawHill, 2008. [2].Silberschatz, Korth and Sudharshan. Data base System Concepts. Ed4. McGrawHill, 2009
E-resources and other digital material	[1]. Jennifer widom,(09,05,2018). Introduction to Databases https://www.youtube.com/watch?v=ShjrtAQmIVg [2]. P. B. Mahanty,(09,05,2015). DBMS and RDBMS. http://nptel.iitm.ac.in/video.php?courseId=1128&v=7952RsbAx2w8 [3]. Prof.D.Janakiram,(09,05,2015). DBMS. https://www.youtube.com/watch?v=EUzsy3W4I0g&list=PL53624456284 0E982 [4]. Karl seguin, "The Little MongoDBBooK", 2/E version 2.6, 2011.

20HS4105 UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Mandatory course (suggested by AICTE)	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	None. Universal Human Values 1 desirable.	**Continuous Evaluation:**	50
		Semester end Evaluation:	50
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand and aware of themselves and their surroundings (family, society and nature).
	CO2	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind.
	CO3	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society.
	CO4	Apply what they have learnt to their own self in different day-to-day settings in real life.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1						1			2						2	
CO2			3												2	
CO3						2									3	
CO4								3				2			3	

Course Content

UNIT I

Course introduction, need, basic guidelines, content and process for value education:

Part-1: Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it?, its content and process, 'Natural acceptance' and experiential validation- as the process for self-exploration. Continuous Happiness and Prosperity – A look at basic Human Aspirations.

Part-2: Right understanding, Relationship and Physical Facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

(Practice sessions are to be included to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).

UNIT II

Understanding Harmony in the Human Being – Harmony in Myself:

Part-1: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

	Understanding the needs of Self ('I') and 'Body' – happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). **Part-2:** Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. (Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease).
	UNIT III **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** **Part-1:**Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. **Part-2:** Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society–Undivided Society, Universal Order–from family to world family. (Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives).
	UNIT IV **Part-1: Understanding Harmony in Nature & Existence – Whole existence as Coexistence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of Nature – recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. **Part-2: Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, humanistic constitution and humanistic universal order, Competence in professional ethics: a) ability to utilize the professional competence for augmenting universal human order, b) ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) at the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) at the level of society: as mutually enriching institutions and organizations. (Part-1: Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc.

	Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.)
Text books and Reference books	**Text Book(s):** [4]. Human values and professional ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, New Delhi (2010). **Reference Books:** [1]. JeevanVidya: EkParichaya, A. Nagaraj, JeevanVidyaPrakashan, Amarkantak (1999). [2]. Human Values, A. N. Tripathi, New Age International Publishers, New Delhi (2004). [3]. The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York (2010). [4]. The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing (2008). [5]. Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London (1993). [6]. Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada (2006). [7]. Economy of Permanence, J. C. Kumarappa, Sarva-Seva-SanghPrakashan, Varanasi (2017). [8]. Bharat Mein Angreji Raj, PanditSunderlal, PrabhathPrakashan, Delhi (2018). [9]. Rediscovering India, Dharampal, Society for Integrated Development of Himilayas (2003). [10]. Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad (1909). [11]. India Wins Freedom: The Complete Version, MaulanaAbulKalam Azad, Orient Blackswan (1988). [12]. The Life of Vivekananda and the Universal gospel, Romain Rolland, AdvaithaAshrama, India (2010). [13]. Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi (2002).
E-resources and other digital material	[1]. AICTE–SIPYoutubeChannel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ [2]. AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1

20IT4351- JAVA PROGRAMMING LAB

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20ES1103: Programming for Problem Solving 20IT3303 : Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design solutions to applications using object oriented approach using Java
	CO2	Implement java technology to solve runtime errors and test the correctness of programs using exception handling and assertions
	CO3	Develop java applications to make use of collections framework and generics to solve real world problems
	CO4	Apply the knowledge of delegation event model to handle semantic and low level events
	CO5	Solve real world problems using Java legacy classes
	CO6	Design graphical user interface applications using Java Swings

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2										3		2	1	3	1.5.1, 11.3.1
CO2		2	3								2		3	1	3	2.2.5, 3.2.2, 11.3.1
CO3		2	2						3		2	2	2	2	3	2.2.5, 3.2.2, 9.1.1, 11.3.1, 12.2.1
CO4		2	2						2		1	3	2	3	3	2.2.5, 3.2.2, 9.1.1, 11.3.1, 12.2.1
CO5		2	2						3		2	2	2	2	3	2.2.5, 3.2.2, 9.1.1, 11.3.1, 12.2.1

CO6		2	2						2		1	3	2	3	3	2.2.5, 3.2.2, 9.1.1, 11.3.1, 12.2.1

Course Content

Week 1:
Java Applications to demonstrate the knowledge in working with classes and objects
a. Creation of Classes with data members and member functions
b. Design the main method to create single and multiple objects to the classes

Week 2:
Developing java applications on the concept of Arrays, single dimension, multi-dimension arrays and constructors
a. Generate applications to make use of all types of arrays
b. Create java application to create default and parameterised constructors
c. Design a solution to make use of function overloading in polymorphism

Week 3:
Solve the problems using java with Strings:
a. Practice the various String operations on a given sentence
b. Java applications to make use of String Tokenizer class to find the individual words in a given sentence/paragraph

Week 4:
Create java applications to implement inheritance, abstract classes and interfaces
a. Design solutions that make use of the concept of different types of inheritance
b. Create a solution using java abstract classes by crating abstract methods
c. Design an interface and implement the same to a class
d. Design different interfaces and implement to a class, make it as abstract and extend to another class
e. Java application on implementing abstract classes and implement run time polymorphism

Week 5
Create classes and interfaces and make it as single unit suing java packages
a. Create classes and interfaces to generate as a package
b. Usage of user defined packages in another package / another class

Week 6 & 7
a. Java application on Exception Handling techniques and assertions
b. Java application on user defined exceptions, throw and throws keywords
c. Implementing the concept of Multithreading in Java, practical aspects of concurrency control
d. Java application to create threads using Thread Class and Runnable interfaces

Week 8 :
Implementation of Collections and legacy classes
a. Java application to explore the Collections Framework and various collection types in Java.
b. Solve the problems using legacy classes from different coding platforms

Week 9:
Creation of java web based applications using Swings
a. Java application to develop web based programs
b. Java application to implement mouse event handling and key event handlings
c. Generate Java Web based applications to solve variety of problems

	Week 10 **a.** GUI Development in Java by means of Swings Framework **b.** Design java solutions to various e-commerce applications **Week 11 & Week 12:** **Case Studies:** 1. Simulate the bank, college, library applications using java technology 2. Develop GUI based application using Applets and handle events raised by the application 3. Develop Web based applications using java swings to various applications
Text books and Reference books	**Text Books:** [1] Herbert Schildt, "Java The Complete Reference", 11th Edition, McGraw-Hill Education, New Delhi, 2019. **Reference Books:** [1] Kathy Sierra & Bert Bates, Head First Java, Second edition, Shroff/O'Reilly, 2009 [2] Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2013. [3] Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", 9th Edition, Prentice-Hall, Pearson Education, 2011. [4] Timothy Budd, "Understanding Object Oriented Programming with Java ", Updated edition, Pearson Education, 2013.
E-resources and other digital material	[1] Prof. I. Sengupta. (19-05-2021), Department of Computer Science & Engineering, I.I.T.,Kharagpur, "Internet Technologies", NPTEL, http://nptel.ac.in/video.php?subjectId=106105084 [2] Mia Minnes, Leo Porter, Christine Alvarado, University of California, San Diego (19-05-2021) Object Oriented Programming in Java Available: https://www.coursera.org/learn/object-oriented-java [3] Cay Horstmann, Cheng-Han Lee, Sara Tansey, San Jose State University, (19-05-2021) Intro to Java Programming Available https://eu.udacity.com/course/intro-to-java-programming--cs046

20IT4352 DATABASE MANAGEMENT SYSTEMS LAB

Course Category:	Laboratory	**Credits:**	1.5
Course Type:	Program Core	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Experiment DDL and DML statements with integrity constraints
	CO2	Apply various SQL functions and operators in RDBMS
	CO3	Develop solutions to query problems using nested queries with various operators.
	CO4	Implement PL/SQL on stored databases.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		1								1		2	1	3	1.5.1, 3.2.2, 11.3.1
CO2	2		2								1		2	1	3	1.5.1, 3.2.2, 11.3.1
CO3	2		2								2		2	1	3	1.5.1, 3.2.2, 11.3.1
CO4	1		2								2		2	2	3	1.5.1, 3.2.2, 11.3.1

Contents

Week 1:

a. Implement the Data Definition language
b. Apply different Integrity Constraints , aliasing on relations

Week 2:

a. Construct an ER-Diagram for the given information model by using appropriate tool.
b. Convert entities and relationships to relation table for a given scenario.

Week 3:

a. Implement Data Manipulation Language on Relational Model.
b. Solving queries using different formal and informal query languages

Week 4:

Implement Queries using operators like :

a. Logical operators
b. Relational operators
c. Comparison operators

Implement Queries using functions like :

a. Aggregate functions
b. String functions
c. date/time functions
d. Mathematical functions
e. Sorting

	Week 5: Implement Nested Queries using operators a. Set comparison operators b. Correlated sub queries c. Group By Clause d. Having Clause e. Set operators **Week 6:** To implementation the concept of (a) joins (b) Views(c) Indexes (d)Commit (e)Save PInt (f)Rollback **Week 7:** PL /SQL programming: Blocks, Operators and Control structures **Week 8:** PL /SQL programming: Triggers, Functions and Procedures **Week 9:** Case Study on a given application: Refine the schemas up to 4th normal form. (Mini Project). **Week 10:** Installing , Configuring and Execution of MongoDBNoSQL **Week 11:** Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators) **Week 12:** Implement aggregation and indexing with suitable example using MongoDB
Text books and Reference books	[1]. Sanjay Mishra, Alan eaulieu, "Mastering Oracle SQL Paperback ", 2nd edition ,O'Reilly Media, 2004. [2]. Steven Feuerstien,"Oracle Pl/SQL Best Practices, 2/E (Covers Oracle Database11G)", O'Reilly Media ,2007. [3].Karl seguin, "The Little MongoDBBooK", 2/E version 2.6, 2011.
E-resources and other digital material	[1]. ShyamalalKumawat,(09,05,2015). MYSQL.https://www.youtube.com/watch?v=XiDnK9Lq-Ng [2]www.techgig.com/practice/Specializations/Databases [3] www.w3schools.com/sql/ [4] https://www.tutorialsPInt.com/sql/index.htm

20IT4353-ADVANCED PROGRAMMING LAB-I

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	**20ES1103** Programming for Problem Solving **20ES2103** Object Oriented Programming using Python	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate the knowledge of problem solving and to find solutions that use different types of programming paradigms.
	CO2	Apply the knowledge of number theory to solve problems and generate solutions
	CO3	Design solutions to the problems by applying linear and non-linear data structures
	CO4	Develop combinatory solutions to the real world problems
	CO5	Execute basic algorithmic ideas using greedy approach to solve competitive programming problems
	CO6	Analyze dynamic programming approaches to generate solution to the problems

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	2								3	3	2	3	3	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1
CO2	1	2	2								2	2	1	1	3	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1
CO3	3	2	3								3	3	3	3	3	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1
CO4	1	2	2								2	2	1	1	3	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1
CO5	3	2	3								3	3	3	3	3	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1
CO6	3	2	3								3	3	3	3	4	1.5.1, 2.2.4, 3.2.2, 11.3.1,12.2.1

Course Content

Week 1: Understand and identify the time complexity of a real world problem

a. Identify the time complexity of loops and write it in asymptotic notations

b. Solve the real world array problems and find their time complexities

Week 2& 3: Design Solutions using searching and sorting algorithms

a. Solve programs from different coding platforms to make use of searching and sorting algorithms

Week 4: Derive solutions to problems that make use of Graph algorithms

a. Design and develop programs using Depth and breadth first search algorihtms

	b. Identify the solutions using Warshalls and Bellman Ford's alogirthms **Week 5, 6 & 7: Identify the need and importance in the use of Greedy and dynamic algorithms in problem solving** a. Apply greedy technique to find the solutions to real world problems **Week 8:Programs on the implementation of methods and operations of data structures of Python** a. Practice all the methods of all the data structures from python **Week 9& 10: Implement programs to solve the problems using String manipulation and string matching algorithms** a. Design solutions by make use of string manipulation and matching algorithms **Week 11 &12: Solve programming problems based on math and combinatorics** a. Modular arithmetic b. Modular exponentiation and multiplicative inverse c. Greatest common Divisor d. Mike and Matrix Game e. Sum of Series and other problems
Text books and Reference books	**Text Book(s):** [1]. Halim, Steven and Halim, Felix, Competitive Programming 1, 2013 [2]. ReemaThareja,"Python ProgrammingUsing Problem Solving Approach", Oxford University Press, 2019. **Reference Books:** [1]. AnttiLaaksonen, "Guide to Competitive Programming", 1st edition, Springer International Publishing, 2017 [2]. Ahmed ShamsulArefin, Art of Programming Contest, ACMSolver, Second Edition, 2012 [3]. Zed Shah, "Learn PythonThe Hard Way", Third edition, Addison-Wesley, 2013. [4]. John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013
E-resources and other digital material	[1]. FilippRukhovich, Competitive Programming for beginners, [COURSERA]. (19-05-2021), Available: https://www.coursera.org/learn/competitive-programming-for-beginners [2]. Prof Neeldhara, IIT Gandhinagar, Getting Started with Competitive Programming,[NPTEL],(19-05-2021),Available :https://onlinecourses.nptel.ac.in/noc21_cs99/preview [3]. Prof. Erik Demaine,Prof. Ronald Rivest,Prof. SriniDevadas MIT Open Courseware, Introduction to Algorithms, Getting Started with Competitive Programming,[MIT], (19-05-2021),Available:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-spring-2008/index.htm [4]. Hacker Rank, 19-05-2021 Available https://www.hackerrank.com/ [5]. Leet Code, 19-05-2021 Availablehttps://leetcode.com/ [6]. Hacker Earth, 19-05-2021 Available https://www.hackerearth.com/ [7]. Topcoder, 19-05-2021 Available https://www.topcoder.com/challenges/ [8]. Coder Byte, 19-05-2021 Available https://www.coderbyte.com/ [9]..Code wars, 19-05-2021 Available https://www.codewars.com/ [10]. Code Signals, 19-05-2021 Available https://codesignal.com/ [11]. Code Chef, 19-05-2021 Available https://www.codechef.com/

20TP4106 ENGLISH FOR PROFESSIONALS

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0 - 0- 2
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester End Evaluation:	0
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Present themselves effectively in the professional world by shedding off their inhibitions about communicating in English
	CO2	Introduce themselves as well as others appropriately
	CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills
	CO4	Involve in practical activity oriented sessions and respond positively by developing their analytical thinking skills.
	CO5	Learn about various expressions to be used in different situations.

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

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

Course Content

UNIT I

1.Beginners, Functional, Situational Conversations: Introduction, Importance of spoken English in the placements and Group Discussion Beginners Conversation, Self Introduction-Introducing Self, Introducing each other in a team (Pair Activity) Functional Conversation, Seeking Permission from Seniors Teachers and other superiors (Team Activity), Asking Direction-Direction from stranger or from Helpline, Making Requests, Requests for borrowing books, applications, or any other help from office staff in college or outside.

2. Just a minute: Give a topic and ask the student to talk impromptu, To present the topic in a structured manner.3

UNIT II

3. Structuring and forming sentences: Structure of mother tongue and pit falls in translation to English, Formation of sentences in English

4. Errors in Usage: Difficulty in right usage of words, Difficulty in Pronunciation-Phonetic differences in mother tongue and English –areas to improve, Idioms and Phrase –Frequently used Idiom and Phrases which help to enhance the quality of presentation and make the presentation meaningful, Meaning of frequently used Idioms and Phrases.

UNIT III

5. Introduction to different ways of speaking: Elocution, Debate and Extempore, Principles of Elocution and its challenges practice in session, Principles of Debates and its challenges –practice session, Principles of Extempore - its pitfalls- practice sessions.

UNIT IV

7. Etiquette: Need of Etiquette in Social arena, Dining Etiquette, Social Etiquette in conversation -formal and informal gathering, Book a table etc.

	8. Versant Test: Mode of versant Test, Aim of the test and various methods it follows, Practice session.
Text books and Reference books	**Text Book(s):** **Reference Books:** [1]. KamaleshSadanand, "A Spoken English", VOL 1&2; Orient BlackSwan, Second Edition,2014. [2]. "Communicative English"; Pearson; 2010

20IT4607-ETHICAL HACKING

Course Category:	Skill Oriented - 1	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic concepts of hacking in computer networks
	CO2	Apply various tools to identify foot printing and open ports
	CO3	Analyze vulnerabilities in operating systems and web applications
	CO4	Interpreting the reconnaissance and the publicly available tools used to gather information on potential targets.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1								1				1			2	8.2.2, 12.2.1
CO2						2						2		2	3	6.2.1, 12.2.1
CO3		1			2								1	1	4	2.2.3, 5.2.2
CO4		1						2					1		2	2.2.3. 8.2.2

Course Content

UNIT I:

Introduction To Hacking: Introduction to Hacking, Important Terminologies, Penetration Test, The Role of Security and Penetration testers, Penetration testing methodologies: OSSTMM, NIST, OWASP, Categories of Penetration Test, Types of Penetration Tests, Ethical Hacking is a nutshell.

Network Sniffing: Introduction, Types of sniffing, Hubs versus Switches, Promiscuous versus Non Promiscuous mode, ARP Protocol Basics, ARP attacks, Denial of service attacks, Tools of the Trade: Dsniff

UNIT II:

Footprints and Social Engineering: Using Web tools for Foot printing: SamSpade,Web data Extractor, Conducting Competitive Intelligence, Using Domain Name System Transfers.

Port Scanning: Introduction to Port Scanning, Types of Port Scans, Using Port Scanning tools: Nmap, Unicornscan, Conducting Ping Sweeps

UNIT III:

Desktop and OS Vulnerabilities: Windows OS Vulnerabilities, Tools for identifying vulnerabilities in Windows: Microsoft Baseline Security Analyzer. Linux OS Vulnerabilities.

Hacking Web Servers: Understanding Web Applications, Understanding Web Application Vulnerabilities, Application Vulnerabilities and Countermeasures, Tools for Web attackers and Security testers, Web tools.

	UNIT IV: **Information Gathering Techniques**: Active Information Gathering, Passive Information Gathering, Sources of Information Gathering, Copying Websites Locally,Yougetsignal.com, Tracing the Location, Trace route, ICMP Trace route, TCP Trace route, Usage, UDP Trace route, NeoTrace, Cheops-ng, Net craft, Google Hacking, Some basic parameters, TIP regarding file type, Google Hacking Database
Text books and Reference books	**Text Book(s):** [1].RafayBaloch, "Ethical Hacking and Penetration Testing Guide", CRC Press,2014. [2]. Michael T. Simpson, Kent Backman, James E. Corley, "Hands -On Ethical Hacking and Network Defense", Second Edition, Cengage Learning, 2012. **ReferenceBooks:** [1]. Steven DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", Cengage Learning, 2009. [2]. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series – Elsevier, 2011. [3]. Whitaker & Newman, "Penetration Testing and Network Defense", CiscoPress, Indianapolis, 2006
E-resources and other digital material	[1]. Scott D Clary Hacking wireless networks with fluxion and Kali Linux, dated on 28th Mar 2021, **https://www.youtube.com/watch?v=oU2_lEqqLwU** [2]. Prof. Sourav Mukhopadhyay, IIT Kharagpur, "Network and computer attacks" [NPTEL], dated on 03rd April 2017**https://nptel.ac.in/courses/106/105/106105162/**

20MC4108B - INDIAN CONSTITUTION

Course Category:	Humanities elective	**Credits:**	1
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Know the fundamental law of the land
	CO2	Understand how fundamental rights are protected
	CO3	Perceive the structure and formation of the Indian Government System
	CO4	Explain when and how an emergency can be imposed and what are the consequences.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1										2					2	
CO2															2	
CO3							1								2	
CO4							2					3			2	

Course Content	**UNIT I:** **Introduction to Constitution of India:** Meaning of the Constitution Law and Constitutionalism, Historical perspective of constitution of India, Salient features of Constitution of India.
	UNIT II: **Fundamental rights**: Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under Article 19, scope of the right of life and personal liberty under Article 21, writs jurisdiction
	UNIT III: **Nature of the Indian constitution:** Federal structure and distribution of legislative and financial powers between the Union and states **Parliamentary form of government in India:** The Constitution powers and status of the President of India, Amendment of the Constitutional powers and Procedure, Historical Perspectives of the constitutional amendments in India **Local Self Government:** Constitutional Scheme in India
	UNIT IV: **Emergency Provisions:** National Emergency, President rule, financial emergency
Text books and Reference books	**Text Book(s):** [1] Dr. J.N. Pandey, Constitutional Law of India published by Central law Agency, Allahabad, Edition 2018 **Reference Books**: [1] V.N Shukla's, Constitution of India Eastern Book Company, Lucknow. [2] M.P. jain, Indian Constitution Law, Wadhwa and Company, Nagpur. [3] D.D. basu, Constitution of India, Wadhwa and Company, Nagpur.

Reference books	Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher
E-resources and other digital material	[1] Prof. SandeepShuklaCSE**, IIT Kanpur** ,February 2020 ,https://onlinecourses.nptel.ac.in/noc20_cs01/preview [2] Prof. SandipChakraborty, Department of Computer Science and Engineering, **IIT Kharagpur.** April 2018 http://www.infocobuild.com/education/audio-video-courses/computer-science/BlockchainArchitectureDesign-IIT-Kharagpur/lecture-02.html [3] Steven Pu ,Founder& CEO of Taraxa,**Stanford** Seminar - Practical Blockchain Applications May 2020https://www.youtube.com/watch?v=q6WEe4ws-pE

V SEMESTER

20IT3501-COMPUTER NETWORKS

Course Category:	Programme core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	---	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the functioning of the network components in wired and wireless communication
	CO2	Apply error detection, correction and security methods in a network
	CO3	Analyze different protocols functioning at Application layer, Transport layer and Network layer.
	CO4	Evaluate the shortest path in data transfer with Routing algorithms

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	3	2	1										2	1	3	1.5.1, 2.1.2, 3.2.2
CO3		3			1								2		4	2.2.4, 5.2.2
CO4	2	1	3										3		3	1.5.1, 2.2.5, 3.2.2

Course Content	**UNIT I:** **Introduction:** Uses of Computer Networks, Network Hardware, LANs, MANs, WANs, Network Software. The Network core **Reference Models**: The OSI Reference Model, TCP/IP Reference Model, the comparison of OSI, and TCP/IP reference models
	UNIT II: **Application Layer**: Principles of network applications, The Web and HTTP, FTP, E-Mail in the internet, DNS-The internet's directory service. **Transport Layer**: Connectionless Transport: UDP, Connection-Oriented Transport: TCP, Principles of congestion control, TCP Congestion Control.
	UNIT III: **The Network Layer**: Introduction, Virtual circuits and Datagram Networks, The Internet Protocol(IP), Routing Algorithms **Case studies-Distance Vector, Link State algorithms** **The Link Layer and Local Area Networks** :Introduction and services, Error Detection and Correction Techniques,Switched Local Area Networks
	UNIT IV: **Wireless and Mobile Networks:** Introduction, Wireless links and Network characteristics, Wi-fi, Mobile IP **Network Security:** Cryptography, Symmetric-key algorithms-DES, AES, Public-key algorithms- RSA, Firewalls.
Text books and Reference books	**Text Book(s):** [1]. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Sixth ed.: Pearson Education,2013 [2]. A. S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education / PHI, 2011

	Reference Books: [1]. Behrouz A Fourzan, Data communications and networking 4th edition, TMH [2]. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5thedition, Morgan Publishers, 2011.
E-resources and other digital material	[1] Prof. Robert Morris and Prof. Samuel Madden MIT.2014 https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/ [2] Prof.SOUMYA K GHOSH, Prof. SANDIP CHAKRABORTY, Department of Computer Science & Engineering , IIT Kharagpur , NPTEL, "Computer Networks and Internet protocol" , July 2018 https://nptel.ac.in/courses/106105183/ [3] Prof.A. Pal, Department of Computer Science Engineering,IIT Kharagpur. On 2018 NPTEL http://nptel.iitm.ac.in [4] Jason Dion, "An in-depth look at Layer 3 of the OSI Model (Network Layer) and examples" ,December 2021 https://www.udemy.com/tutorial/networkplus/layer-3-network-layer/ [5] Keith Winstein Congestion-Control Contest,2017 https://web.stanford.edu/class/cs344g/contest.html

20IT5302- SOFTWARE ENGINEERING

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic fundamentals of software development life cycle.
	CO2	Apply process models and testing techniques to real time applications.
	CO3	Analyze requirements, specifications to build system architecture.
	CO4	Create UML diagrams that represent static and dynamic aspects of a software.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1													3	1	2	
CO2	1			2						2			2		3	1.5.1, 4.1.2, 10.1.3
CO3		2								3	2			1	4	2.2.4, 10.3.2, 11.3.1
CO4			3							2	3		2	2	3	3.2.2, 10.3.2, 11.3.1

Course Content

UNIT I:

Introduction: Software, Software Myths, Capability Maturity Model Integration.

Software Process Models: Prescriptive process model, Waterfall Model, Incremental process model, Evolutionary process model, Unified process.

Agile Process Models: Agility, Agile Process, Agile Process Models.

UNIT II:

Software Requirements: Functional, Non-Functional requirements, User requirements, System Requirements, Software Requirements Specification Document,

Requirements Engineering: Requirements Engineering tasks, Initiating the Requirements engineering process, Eliciting Requirements- Developing use cases, Building the Analysis model, Negotiating, Validating Requirements.

UNIT III:

Architectural Design: Architectural Styles and Patterns

Design Engineering: Design Process and Design Quality, Design Concepts.

Introduction to UML: An Overview of the UML, A Conceptual Model of UML, Class Diagrams, Object Diagrams, Use Case Diagrams, Interaction Diagrams, Activity Diagram, State Diagrams, Deployment Diagrams.

Case studies: Library management, ATM, Online Reservation system.

UNIT IV:

Testing Strategies: A Strategic Approach to Software Testing – Verification and Validation, Organizing for software testing, Test Strategies for Conventional software, Validation

	Testing, System Testing, Art of Debugging **Testing Tactics:** Software Testing Fundamentals, Black Box Testing, White Box Testing, Basis Path Testing, Control Structure Testing. **Case studies**: Income tax calculator.
Text books and Reference books	Text books: [1] Roger S Pressman, "Software Engineering – A Practitioner's Approach", Sixth Edition, MCGRAW Hill Publications, 2010. [2] I. Somerville, "Software Engineering", 6 ed.: Pearson Education. [3] Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language user guide", Tenth Edition, Pearson, 2011. References: [1] C. Ghezzi, et al., "Fundamentals of Software Engineering", Second Edition, PHI. [2] Rajib Mall, "Fundamentals of Software Engineering", Second Edition, PHI.
E-resources and other digital material	[1] Prof. N.L. Sarda, Prof. Umesh Bellur, Prof. R.K. Joshi and Prof. Shashi Kelkar, Department of Computer Science & Engineering, IIT Bombay, Oct 8, 2008. NPTEL, Lecture Series on Software Engineering by https://www.nptelvideos.com/lecture.php?id=7041 [2] Prof. Umesh Bellur, Computer Science & Engineering, Indian Institute of Technology, Bombay, Software engineering: Requirements Engineering/Specification NPTEL pdf, 2008 . Available by https://drive.google.com/file/d/1DC6FXZfYeQ42PODWTNfB4mkIE5WnTSDM/view **[3] Kenneth W T Leung, Assistant Professor of Engineering Education , The Hong Kong University of Science and Technology, Software Engineering Specialization Coursera 2022. Availble by https://www.coursera.org/specializations/software-engineering** [4] Ron Burback, Department of Computer Science, Graduate Studies of Stanford UniversityDecember 1999 on Software Engineering Methodologies by http://infolab.stanford.edu/~burback/watersluice/watersluice.html

20HS5103 - ENGINEERING ECONOMICS AND MANAGEMENT

Course Category:	Humanities and Social Sciences	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand various forms of organizations and principles of management
	CO2	Understand the various aspects of business economics.
	CO3	Perceive the knowledge on Human resources and Marketing functions
	CO4	Evaluate various alternatives economically.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3											3		3		
CO2	3				3							3		3		
CO3	3											3		3		
CO4	3				3							3		3		

Course Content

UNIT I:

Forms of Business Organization: Salient Features of Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Society and Public Sector.

Management: Introduction to Management, Functions of Management, Principles of Scientific Management, Modern Principles of Management.

UNIT II:

Introduction to Economics: Introduction to Basic Economic Concepts, Utility Analysis: Marginal Utility and Total Utility, Law of Diminishing Marginal Utility, Law of Equi Marginal Utility.

Demand Analysis: Theory of Demand: Demand Function, Factors Influencing Demand, Demand Schedule and Demand Curve, Shift in Demand, Elasticity of Demand: Elastic and Inelastic Demand, Types of Elasticity.

Supply Analysis: Supply Schedule and Supply Curve, Factors Influencing Supply, Supply Function.

UNIT III:

Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.

Marketing Management: Concept of Selling And Marketing – Differences, Functions of Marketing, Product Life Cycle, Concept of Advertising, Sales Promotion, Types of Distribution Channels, Marketing Research, Break-Even Analysis

UNIT IV:

Financial Management: Functions of Financial Management, Time value of money with cash flow diagrams, Concept of Simple and Compound Interest.

	Depreciation: Causes of depreciation, Factors influencing depreciation, common methods of Depreciation: Straight Line Method, Declining Balance Method, Sum of Year's Digits Method –Problems. **Economic Alternatives:** Methods of Evaluating Alternatives under Present worth method, Future worth method, Annual Equivalent method - Problems.
Text books and Reference books	**Text Book(s):** [1] M. Mahajan *Industrial Engineering and Production Management* Dhanpat Rai Publications2nd Edition. **[2]** Martand Telsang" Industrial & Business Management" S.Chand publications **Reference Books:** [1] R.Paneerselvam "Production and Operations Management" PHI [2]Philip Kotler & Gary Armstrong "Principles of Marketing" ,pearson prentice Hall,New Delhi,2012 Edition. [3] IM Pandey, "*Financial Management*" Vikas Publications 11th Edition [4] B.B Mahapatro, ***"Human Resource Management".***,New Age International ,2011
E-resources and other digital material	[1]https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/ [2]https://keydifferences.com/difference-between-personnel-management-and-human-resource-management.html [3] http://productlifecyclestages.com/ [4] https://speechfoodie.com/cash-flow-diagrams/

20IT5404A- DATA MINING

Course Category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic concepts of warehousing and mining.
	CO2	Derive various interesting patterns and associations in datasets.
	CO3	Design classifier models to predict future trends.
	CO4	Apply unsupervised learning techniques for a given application.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	1	2	3										2	1	3	1.5.1, 2.2.4,3.2.2
CO3	2	3	3										3	2	3	1.5.1, 2.2.4, 3.2.2
CO4	2	2	3										3	1	3	1.5.1, 2.2.4, 3.2.2

Course Content	**UNIT I:** **Data Warehouse and Online Analytical Processing:** Data Warehouse basic concepts, Data Warehouse Modelling: Data cube and OLAP, Data Warehouse Implementation, Data Generalization by Attribute Oriented Induction. **Data Pre-processing:** Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.
	UNIT II: **Data Mining Introduction:** Introduction, Why Data Mining, kinds of Data that can be mined, Patterns that can be Mined, technologies where it can be used, major issues in data Mining. **Mining Frequent Patterns, Associations, and Correlations:** Basic Concepts, Frequent Item-set Mining Methods, Which Patterns Are Interesting—Pattern Evaluation Methods.
	UNIT III: **Classification:** Introduction, Decision tree induction, Bayesian Classification, Model Evaluation and Selection, Techniques to improve Classification Accuracy. **Classification: Advanced Methods:** Classification by Backpropagation. **Case Studies on Classification**
	UNIT IV: **Cluster Analysis:** Introduction, overview of basic clustering methods, Partitioning methods, Hierarchical methods, Density-Based Methods: DBSCAN, Evaluation of Clustering **Outlier Detection:** Outliers and Outlier Analysis. **Case Studies on Clustering.**
Text books and Reference books	**Text Book(s):** [1]. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Third Edition, Elsevier, 2012.

	Reference Books: [1]. G. K. Gupta ,"Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006 [2]. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Second Edition Pearson Education, 2016 [3]. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006
E-resources and other digital material	[1].Data Mining by Prof. Pabitra Mitra, Department of CSE, IIT Kharagpur, https://nptel.ac.in/courses/106105174 [2].Jiawei Han, John C. Hart, ChengXiang Zhai, Department of Computer Science, University of Illinois, https://www.coursera.org/specializations/data-mining

20IT5404B-DOT NET TECHNOLOGIES

Course Category:	Program Elective-I	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT4302 : Java Programming	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the Microsoft .NET Framework Architecture and its features such as delegates and Lambda expressions.
	CO2	Apply the object oriented features of Dot Net frame work in solving Real world applications.
	CO3	Implement modern database interactivity using the Entity framework for database connectivity.
	CO4	Develop a dynamic web application using ASP.net core Razor pages.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	3					2							2		3	1.5.1, 6.2.1
CO3	3			2	3								2	2	3	1.5.1, 4.2.1, 5.1.1
CO4			3		3								3	2	3	3.2.2, 5.1.1

Course Content

UNIT I:

Introducing C# and .NET: Object Orientation, Type Safety, Memory Management, Platform Support, CLRs, BCLs, and Runtimes, Common Language Runtime, Base Class Library

Creating Types in C#: Classes, Fields, Constants, Methods, Instance Constructors, de-constructors, Object Initializers, this Reference, Properties, Indexers, Static Constructors, Static Classes, Finalizers.

Inheritance: Polymorphism, Casting and Reference Conversions, Virtual Function Members, Abstract Classes and Abstract Members

UNIT II:

Advanced C#:

Delegates: Writing Plug-In Methods with Delegates, Instance and Static Method Targets, Multicast Delegates, Generic Delegate Types, The Function and Action Delegates, Delegates Versus Interfaces, Delegate Compatibility. Events: Standard Event pattern, Event Accessors, Event Modifiers. Lambda Expressions: Explicitly Specifying Lambda Parameter and Return Types. Anonymous methods. Try Statements and Exceptions, The catch Clause, The finally Block, Throwing Exceptions..

UNIT III:

Working with data using Entity Framework core:

Understanding modern databases: Understanding legacy Entity Framework, Understanding Entity Framework Core, Creating a console app for working with EF Core, Using a sample relational database, Using Microsoft SQL Server for Windows, Creating the Northwind sample database for SQL Server.

Setting up EF Core: Choosing an EF Core database provider, Connecting to a database, Defining the Northwind database context class

Defining EF Core models: Using EF Core conventions to define the model, Using EF Core annotation attributes to define the model, Using the EF Core Fluent API to define the model, Building an EF Core model, Adding tables .

Querying EF Core models: Filtering included entities, Filtering and sorting pro, Getting the

	generated SQL, Logging EF Core using a custom logging provider, Pattern matching with Like. Loading patterns with EF Core: Eager loading entities, Enabling lazy loading, Explicit loading entities. Manipulating data with EF Core: Inserting entities, Updating entities, Deleting entities, Pooling database contexts
	UNIT IV: **Building Websites Using ASP.NET Core Razor Pages:** Understanding web development: Understanding HTTP, Using Google Chrome to make HTTP requests, Understanding client-side web development technologies Understanding ASP.NET Core: Classic ASP.NET versus modern ASP.NET Core, Creating an empty ASP.NET Core project, Testing and securing the website, controlling the hosting environment, separating configuration for services and pipeline, enabling a website to serve static content Exploring ASP.NET Core Razor Pages: Enabling Razor Pages, Adding code to a Razor Page, Using shared layouts with Razor Pages, Using code-behind files with Razor Pages Using Entity Framework Core with ASP.NET Core: Configure Entity Framework Core as a service, Manipulating data using Razor Pages, Injecting a dependency service into a Razor Page
Text books and Reference books	**Text Book(s):** [1]. Mark J.Price, " C# 10 and .NET 6 – Modern Cross-Platform Development - Sixth Edition", Oreilly publications.Nov2021 [2]. Joseph Albahari,"C#10 in a Nut Shell", Oreillym publications.Nov 2021 **Reference Books**: [1]. Kemal Birer," ASP.NET Core for Jobseekers"bpb publications 2021. [2]. Kogent Learning Solutions, "ASP.NET4.5 PROGRAMMING" Black Book, dreamtech press, 2013.
E-resources and other digital material	[1]. Scott Hanselman, Maira Wenzel, Modern Web Development with .NET 6 Ep1: Create a web UI with ASP.NET Core, https://docs.microsoft.com/en-us/shows/learn-live/modern-web-development-net6-ep01-create-web-ui-aspnet-core (16-05-2022) [2]. RehanSaeed, Upgrading ASP.NET Core to .NET 6 & C# 10, https://techcommunity.microsoft.com/t5/web-development/upgrading-asp-net-core-to-net-6-amp-c-10/m-p/2927530 and https://www.youtube.com/watch?v=T6iP7QPWmPI (Microsoft) (16-05-2022) [3]. Cam Sopar, Getting Started with Entity Framework Core, https://docs.microsoft.com/en-us/shows/entity-framework-core-101/getting-started-with-entity-framework-core (16-05-2022) [4] Kaushik Roy Chowdhury, ASP.NET 6.0 - Build Hands-On Web Projects, https://www.udemy.com/course/aspnetcore-31-build-hands-on-web-projects/(16-05-22)

20IT5404C- BLOCKCHAIN TECHNOLOGIES

Course Category:	Program Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand blockchain terminologies and its properties and the emerging models for blockchain technology
	CO2	Evaluate the functional and operational aspects of crypto currency ecosystem.
	CO3	Apply the life cycle of a smart contract and design solutions with smart contracts using Solidity and Remix IDE.
	CO4	Develop use cases and private-permissioned blockchain-based applications for enterprise level organizations

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	1.5.1, 2.2.4, 5.1.2, 11.3.1
CO2		3	3		2								1	2	2	1.5.1, 2.2.5, 11.3.1
CO3		3	3		2								2	2	3	1.5.1, 2.2.2
CO4		3	2			3						2	3	3	3	1.5.1, 2.2.4, 4.1.2, 11.3.1

Course Content	**UNIT I:** **Understanding Blockchain**: Introduction – Structure of a Block, Block Header, Block Identifiers : Block Header Hash and Block Height, Genesis Block, Linking Blocks in the Blockchain, Merkle Trees, Tiers and Types of Blockchain, Features of a Blockchain, Benefits and Limitations of Blockchain
	UNIT II: **Crypto currency:** Introduction – History of Bitcoin and its Uses, Hash Functions, Transactions, Blocks, Mining, Keys, Addresses, Digital Signatures, Wallets, Types of Consensus, Bitcoin Improvement Proposals (BIPs), Namecoin, Litecoin, Primecoin, Zcash.
	UNIT III: **Ethereum and Smart Contracts**: The Birth of Ethereum, Stages of Development, Components of Ethereum, Development Tools and Frameworks, Tokens on Ethereum – ERC20 Token, What is a Smart contract, Life Cycle of a Smart Contract, Ethereum Virtual Machine and Gas, Ethereum Improvement Proposals (EIPs) , DApp and its Full Ecosystem, Operations of a DApp
	UNIT IV: **Decentralized Applications and Hyperledger**: Hyperledger Architecture, Projects under Hyperledger, Consensus and Transaction Life Cycle in Hyperledger Fabric, Ripple, Storj, Multichain, BigchainDB, Quorum **Application of Blockchain Technology:** Introduction to major Blockchain platforms, Government, Aviation, Voting, Identity Management, Health , Finance – Insurance,Stock Trading, Agriculture
Text books and Reference	**Text Book(s):** [1]. Mastering Bitcoin: Antonopoulos, Andreas M.

books	[2]. Mastering Blockchain: Distributed Ledgers, Decentralization and Smart Contracts Explained by Bashir, Imran. [3]. Mastering Ethereum: Building Smart Contracts and DApps. [4]. The NFT Handbook: How to Create, Sell and Buy Non-Fungible Tokens **Reference Book(s):** [1]. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. [2]. Bitcoin: A Peer-to-Peer Electronic Cash System. Satoshi Nakamoto.
E-resources and other digital material	[1]. Blockchain Demohttps://tools.superdatascience.com/blockchain/hash/ [2]. Bitcons Monetary Policyhttps://www.blockchain.com/explorer [3]. Blockchain &Web3.0 Why the Web 3.0 Matters and you should know about it [4]. Ethereum Virtual Machine & Gas Calculating Costs in Ethereum Contracts [5]. Mempools : An in-depth guide into how the mempool works [6]. Bina Ramamurthy, University at Buffalo, State University of New York, Blockchain Basics and Smart Cotracts [7]. https://www.coursera.org/specializations/blockchain [8]. Prof. Sandeep Shukla, IIT Kanpur, Introduction to Blockchain Technology and Applications, 2020, https://nptel.ac.in/courses/106105184/

20IT5205A - AI TOOLS, TECHNIQUES AND APPLICATIONS

Course Category:	Open Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103-Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
	CO2	Analyze Reinforcement Learning to real life planning problems.
	CO3	Evaluate techniques for computer-based representation and manipulation of complex information, and uncertainty.
	CO4	Create chat bots for various application using AI tools.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3					1							1	1	3	1.5.1, 6.2.1
CO2					2		1						2	3	4	5.1.2, 7.1.2
CO3			1	3									3	2	3	3.2.2, 4.1.2
CO4					3					2			1	2	3	5.1.2, 10.1.3

Course Content

UNIT I

Introduction- AI, Foundations of AI, Solving Problems by Searching- Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies, Constraint Satisfaction Problems- Backtracking Search for CSPs, Logical Agents- Knowledge-based Agents, Wumpus World, Logic, Propositional Logic, First order logic-Syntax and Semantics of First-Order Logic

UNIT II

Uncertainty - Acting under Uncertainty, Basic Probability Notation, Bayes' Rule and its Use, Probabilistic Reasoning- Representing Knowledge in an Uncertain Domain.

Learning: Learning from observations- Forms of Learning, Inductive Learning, Learning decision trees, Decision trees as performance elements, Expressiveness of decision trees, Inducing decision trees from examples, Choosing attribute tests

UNIT III:

Natural Language Processing: Overview of NLP, The Components of NLP, Enterprise Applications of NLP, Usage of NLP, Challenges of NLP

Chatbots: Chatbot, The Rise of Chatbots, NLP in the cloud, NL Interface, Build a Chatbot, Challenges of Building a Successful Chatbot, Best practices,

Industry Case Studies: E-commerce Chatbots.

UNIT IV:

Introduction to Reinforcement Learning, Game Playing [Deep Blue in Chess, IBM Watson in Jeopardy, Google's DeepMind in AlphaGo], Agents and Environment, Action-Value Function, Deep Reinforced Learning

Applications: Robotics, Gaming

Case Studies: Apply Reinforcement Learning techniques on real-time game applications

Text books and Reference books	**Text Book(s):** [1]. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Second Edition, Pearson. [2]. Tom Markiewicz& Josh Zheng,Getting started with Artificial Intelligence, Published by O'Reilly Media,2017 **Reference Books:** [1]. AurélienGéron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017 [2]. Vinod chandra s.s. anand hareendran s. Artificial Intelligence And Machine learning PHI Learning
E-resources and other digital material	[1]. Prof.SudeshnaSarkar and Prof.AnupamBasu, Department of Computer Science Engineering,I.I.T, Kharagpur https://nptel.ac.in/courses/106/105/106105077/ [2]. RavAhuja Global Program Director Coursera, https://www.coursera.org/learn/ai-with-ibm-watson [3]. Deep Learning.Ai: https://www.deeplearning.ai/ **[4].Machine Learningby Stanford University** https://see.stanford.edu/Course/CS229/47

20IT5205B–MOBILE APPLICATION DEVELOPMENT

Course Category:	Open Elective - 1	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT4302: Java Programming	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Interpret features of android environment and development tools.
	CO2	Design rich user interfaces by using various controls & views.
	CO3	Apply the knowledge of fragment and activity life cycles to design apps
	CO4	Analyze various layout managers and widgets to develop Android

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1		1											2		2	2. 2.2
CO2			3		2									2	3	3. 2.2, 5.1.2
CO3					3								3		3	5.2.2
CO4		2												3	4	2.2.2

Course Content

UNIT I

Getting Started With Android Programming: What is Android - Android Versions, Features of Android, Architecture of Android, Android Devices in the Market.

Obtaining the Required Tools: Android Studio, Android SDK, Creating Android Virtual Devices (AVDs), Launching Your First Android Application.

Using Android Studio for Android Development: Exploring the IDE, Debugging Your Application, Publishing Your Application.

Activities, Fragments, and Intents: Understanding Activities, Applying Styles and Themes to an Activity, Hiding the Activity Title, Displaying a Dialog Window, Displaying a Progress Dialog.

UNIT II

Activities, Fragments, and Intents: Linking Activities Using Intents, Returning Results from Intent, Passing Data Using an Intent Object.

Activities, Fragments, and Intents: Fragments, Adding Fragments Dynamically, Life Cycle of a Fragment, Interactions between Fragments, Displaying Notifications.

Getting to know the Android User Interface: Understanding the Components of a Screen - Views and View Groups, Frame Layout, Linear Layout (Horizontal & Vertical), Table Layout, Relative Layout, Frame Layout, Scroll View.

UNIT III:

Getting to know the Android User Interface: Managing changes to Screen Orientation-Persisting State Information During Changes in Configuration, Detecting Orientation Changes, Controlling the Orientation of the Activity.

Designing your User Interface with Views: Using Basic Views - TextView View, Button, Image Button, Edit Text, Checkbox, Toggle Button, Radio Button, and Radio Group Views, Progress Bar View, Auto Complete TextView View, Using Picker Views - TimePicker View, Date Picker View.

UNIT IV:

Designing your User Interface with Views: Using List Views to Display Long Lists-ListView View, Using the Spinner View, Understanding the Dialog Fragment, Using a

	Preference Fragment. **Displaying Pictures and Menus with Views:** Using Image Views to Display Pictures- ImageView View, Image Switcher, GridView, Using Menus with Views- Creating the Helper Methods, Options Menu, and Context Menu, Using WebView-WebView. **Location - Based Services:** Displaying Google Maps in Your Android Application, Displaying zoom controls on the map, Switching between the different map views, Retrieving the address location touched on the map.
Text books and Reference books	**Text Book(s):** [3]. J. F. DiMarzio, Beginning Android Programming with Android Studio,Wiley India, 4th Edition, 2017. **Reference Books:** [1]. Neils Smyth, Android Stduio Development Essentials, Creative Space Independent publishing platform, Seventh edition 2016 [2]. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015. [3]. Reto Meier, "Professional Android 4 Application Development", 3rd edition, Wiley Publishers, 2012.
E-resources and other digital material	[1]. Developer Guides, https://developer.android.com/guide [2]. DanGalpin,https://www.udacity.com/course/new-android-fundamentals--ud851 [3]. Dr.JerryRoth,https://www.coursera.org/specializations/android-app-development by Vanderbilt University.

20IT5205C–INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	17IT3302 – Discrete Mathematical Structures	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand functional components of the DBMS and ER Modeling.
	CO2	Design different data models for real-time applications.
	CO3	Develop queries using Structured Query Language.
	CO4	Apply normalization technique for schema refinement.

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

CO	PO												POS		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	2		2		2						2		1		3	1.5.1, 3.2.2, 5.2.2, 11.3.1
CO3	2				2						2		2		3	1.5.1, 5.2.2, 11.3.1
CO4	3										2		2	2	3	1.5.1, 11.3.1

Course Content

UNIT I:

Overview of Data base systems: File systems vs DBMS, advantages of a DBMS, Describing and storing data in a DBMS, structure of a DBMS, People who work with databases.

Introduction to Database Design: Database Design and ER Diagrams; Entities, attributes and Entity sets; Relationships and relationship sets; additional features of the ER Model.

UNIT II:

Relational Model: Introduction to the Relational Model; Integrity Constraint Over relations ; Querying relational data ; Logical data base Design ; Introduction to Views; Destroying / altering Tables and Views.

SQL: Queries And Constraints – Part I: Form of Basic SQL Query - Examples of Basic SQL Queries ; UNION, INTERSECT, and EXCEPT;

UNIT III:

SQL: Queries And Constraints – Part II: Nested Queries - Introduction to Nested Queries , Correlated Nested Queries , Set - Comparison Operators ; Aggregative Operators ; NULL values - Comparison using Null values , Logical connectivity's - AND, OR and NOT, Impact on SQL Constructs, Outer Joins, Disallowing NULL values ;

UNIT IV:

Schema Refinement and Normal forms: Schema refinement - Problems Caused by redundancy; Functional Dependencies: reasoning about FDS, Closure of a Set of FDs; NORMAL FORMS-FIRST, SECOND, THIRD Normal forms, BCNF; properties of decomposition - Lossless join Decomposition, Dependency preserving Decomposition; Multi valued Dependencies - forth Normal Form.

NoSQL: An Overview of NoSQL, List of NoSQL Databases.

Text books and

Text Book(s):

[1].Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd

Reference books	Edition,2003, TATA McGrawHill. [2].Gauravvaish,"Getting Started with NoSQL"(Kindle Edition),1st edition,2007. **Reference Books:** [1].Elmasri and Navathe.Fundamentals of Database Systems. Ed 5. Pearson Education. [2].Silberschatz, Korth and Sudharshan. Data base System Concepts. Ed4. McGrawHill.
E-resources and other digital material	[1]. Prof.Partha Pratim Das , IIT Kharagpur "Database Management System", 2022 https://nptel.ac.in/courses/106105175 [2]. Rakesh Gopalakrishnan, Udemy," Introduction to Databases and SQL Querying", 2022 https://www.udemy.com/course/introduction-to-databases-and-sql-querying/ [3]. Charles Russell Severance ,University of Michigan, " Introduction to Structured Query Language (SQL)", 2017, https://www.coursera.org/lecture/intro-sql/basic-sql-operations-0jEbQ

20IT5451A- DATA MINING LAB

Course Category:	Program Elective I	**Credits:**	1
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	20IT4304: DBMS	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Create a Data warehouse for the given database.
	CO2	Implement data preprocessing to the given dataset.
	CO3	Design a model to extract the patterns from the data.
	CO4	Evaluate the model designed for pattern extraction.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	2	2	1	3						1	2	3	1	3	1.5.1, 2.2.2, 3.2.2, 4.1.2, 5.1.2,11.3.1, 12.2.1
CO2		1	2		2								3	1	3	1.5.1, 2.2.2, 3.2.2, 4.1.2, 5.2.2,11.3.1,12.2.1
CO3	1	2	3	2	3						1	2	3	2	3	1.5.1, 2.2.2, 3.2.2, 4.1.2, 5.2.2,11.3.1,12.2.1
CO4		2			2									1	5	1.5.1, 2.2.2, 3.2.2, 4.1.2, 5.2.2,11.3.1,12.2.1

Course Content

Week 1:

1. Installation of MS SQL SERVER
2. Create a Database and Executing DDL, DML and basic queries in MS-SQL Server

Week 2:

1. Moving the Excel file data into SQL server management studio database using Data Import Wizard
2. Moving the flat file data into SQL server management studio database using Data Import Wizard

Week 3:

1. Loading flat file into Management Studio Database using SQL Server Integration Services
2. Loading Excel file into Management Studio Database using SQL Server Integration Services

Week 4:

Performing various types of Join Operations using SSIS and loading the data into

	SQL server database. **Week 5:** Creating Star schema, Snowflake schema for the given database **Week 6:** 1. Introduction to WEKA Data Mining Tool. 2. Apply Preprocessing concepts - Removal specified attribute, discrimination of a continuous valued attribute, standardization and normalization of data. **Week 7:** 1. Selecting the features subset using different attribute selection measures. 2. Create own dataset using ARFF files. **Week 8:** 1. Finding Association Rules using Apriori, FP-Growth algorithm in WEKA. 2. Finding Association Rules using Apriori FP-Growth algorithm in RAPIDMINER. **Week 9:** 1. Decision Tree based classification model in WEKA on an existing data. 2. Decision Tree based classification model in Rapid Miner on an existing data. **Week 10:** 1. Classify given dataset records with Naïve Bayes classification using WEKA. 2. Classify given dataset records with Naïve Bayes classification using RAPID MINER. **Week 11:** 1. K-means clustering technique to classify the given dataset using WEKA. 2. K-means clustering technique to classify the given dataset using RAPIDMINER. **Week 12:** 1. Case study/Project
Text books and Reference books	**Text Book(s):** [1]. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Third Edition, Elsevier, 2012. **Reference Books:** [1]. G. K. Gupta ,"Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006 [2]. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Second Edition Pearson Education, 2016 [3]. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006
E-resources and digital material	[1]. Data Mining with WEKA. http://www.cs.waikato.ac.nz/ml/weka/ [2]. RapidMiner: Data Mining Use Cases and Business Analytics Applications by Markus Hofmann (Editor), Ralf Klinkenberg (Editor)

20IT5451B DOTNET TECHNOLOGIES LAB

Course Category:	Program Elective1	Credits:	1
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	20ES2103A: Object Oriented programming using Python	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes		
	Upon successful completion of the course, the student will be able to:	
	CO1	Implement the Console Applications in C#.
	CO2	Implement the object oriented features of Dot Net frame work in solving Real-world Applications.
	CO3	Design web application with variety of web controls and validation controls.
	CO4	Develop dynamic web applications that include database interactivity.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1		1													3	2.2.4
CO2												2	2		3	12.2.1
CO3		2			3									3	3	2.2.4
CO4		3			3				3			2		3	6	2.2.5,5.2.3, 9.1.2, 12.2.1

Course Content

Week 1: Classes and Objects

4. Write a console application that performs type conversion.
5. Understand the concept that performs boxing and unboxing of different types of variables.
6. Implement arithmetic, logical and relational operators.
7. Understand the concept of classes and objects.

Week 2: Static Data members, static members functions and properties

4. Identify the differences in the implementation of single and multiple objects.
5. Understand the concept of static data members and member functions.
6. Implement the static member functions in a class for the given application.
7. Understand the concept of properties.

Week 3: Indexes and Structs

1) Implement the concept of Indexers and identify the differences between Properties and Indexers.
2) Understand and implement the concept of Structs.

Week 4: Interfaces, Pointers, Delegates and Events

1) Implement the concept for Interfaces.
2) Implement different types of Flow controls.
3) Implement the concept for Delegates.
4) Implement the concept for Events.

Week 5: Exception Handling

1) Implement the concept for Exception Handling.
2) Create an application for performing Calculator Operations.
3) Design a Registration form with different types of controls using ASP.NET

Week 6: Data Access with Entity Framework

5. Understand the concept of Data Access using Entity Framework
6. Create a website for a bank and include types of navigation.

	7. Create a Web App to display all the Emp name and Dept id of the employee from the database using SQL source control and bind it to Grid View . Database fields are (DeptId, Dept Name, Emp Name, Salary).
	Week 7: Data Access with Entity Framework-II 1) Create a Login Module which adds Username and Password in the database. Username in the database should be a primary key. 2) Create a web application to insert 3 records inside the SQL database table having following fields (DeptId, DeptName, EmpName, Salary). Update the salary for any one employee and increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.
	Week 8: Dynamic Data Application using Razor Pages Develop a dynamic website for Hotel Management using ASP.NET Razor pages .
	Week 9: Dynamic Data Application using Razor Pages Develop a dynamic website for Bank Application using ASP.NET Razor pages
	Week 10: Dynamic Data Application using Razor Pages Case Study to develop a dynamic website using Dynamic controls using ASP.NET Razor Pages.
Text books and Reference books	**Text Book(s):** [1]Kogent Learning Solutions, "NET4.5 PROGRAMMING" Black Book, dreamtech press, 2013. [2]Kogent Learning Solutions, " ASP.NET4.5 PROGRAMMING" Black Book, dreamtech press, 2013. **Reference Books:** [1] HerbertSchildt, "C# 4.0:complete reference",McGrawHill,2010. [2]Matthew MacDonald, "ASP.NET: The complete Reference", McGrawHill, 2002. [3] Chris Hart, John Kauffman, Dave Sussman, Chriss Ullman "ASP.Net 2.0 with c#" Wrox, 2006.

20IT5451C- BLOCKCHAIN TECHNOLOGIES LAB

Course Category:	Program Elective1	Credits:	2
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	-	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Build smart contracts using Remix IDE, Ganache and Myether Wallet in Ethereum Platform.
	CO2	Build private-permissioned blockchain-based applications for enterprises and businesses.
	CO3	Develop IPFS file system using peer to peer networks
	CO4	Build a blockchain raffle using Solidity programming language

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	1											1	1	3	1.5.1, 2.2.5
CO2		1	3		1								2	1	6	2.2.5
CO3				3					1				1	2	3	4.1.2, 9.1.2
CO4	1	1											2	3	6	1.5.1, 2.2.4

Course Content	**Week 1:** Deploy a smart contract using Java Script VM, Injected Web3 and Web3 Provider using Metamask and Ganache.
	Week 2: Write a smart contract to check whether a number is Incrementing or Decrementing and try to deploy it in the blockchain using metamask and creating a local blockchain using Ganache.
	Week 3: Build a smart contract in which you can print any string and deploy the smart contract in the Ropsten Test Network and in the Main Ethereum Network using Metamask.
	Week 4: How to write a smart contract to insert value into the Ethereum blockchain using metamask.
	Week 5: How to transfer ethers through online using Ropsten Test Network and Main Ethereum Network using Metamask.
	Week 6: Building a blockchain raffle using Solidity programming language. Apart from a coin toss, the most straightforward example of gambling is probably araffle. Let's build one to see who wins the game
	Week 7: A finance company wishes to use Ethereum platform to speed up and simplify payments deposits. You are an Ethereum developer and have been asked by the company to create a Smart Contract for a banking application. Create a Smart Contract for a banking application in solidity which allows users to do the following • Mint money into your account

	• Withdraw money from your account • Send money from your account to smart contract address Check balance • After a contract is created, deploy the contract on Ethereum Testnet network
	Week 8: To design an electronic voting system, using the ethereum blockchain (smart contracts) and more precisely the RPC test which enables account generation with a private and public key. Blockchain electronic voting system using smartcontracts.
	Week 9: Data Access with ADO.NET Building an improved P2P file system to provide originality and authenticity of published and posted free online digital content such as books, music, and movies. Our solution utilizes a blend of the latest emerging technologies that include IPFS and blockchain smart contracts.
	Week 10: Smart cities and smart houses are in fashion and thus all this can be blockchained. The student can focus on building system which can manage all the real estate related contracts through blockchain technology using IPFS which will enhance security and will provide more efficiency How to write a smart contract to insert value into the ethereum blockchain using Ganache (using intranet)
	Week 11: **Case studies**
Text books and Reference books	**Text Book(s):** [1]. Mastering Bitcoin: Antonopoulos, Andreas M. [2]. Mastering Blockchain: Distributed Ledgers, Decentralization and Smart Contracts Explained by Bashir, Imran. [3]. Mastering Ethereum: Building Smart Contracts and DApps. **Reference Books:** [1]. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. [2]. Bitcoin: A Peer-to-Peer Electronic Cash System. Satoshi Nakamoto.
E-resources and other digital material	[1]. Prof Sandeep Shukla,Department of CSE, IIT, Kharagpur, "Introduction to Blockchain technology and Applications", 2019 https://nptel.ac.in/courses/106104220/ [2]. Prof. Sandip Chakraborty, Department of CSE, IIT, Kharagpur, "Blockchain Architecture Design and Use Cases", 2018 https://www.youtube.com/watch?v=I2mJazpVfCo

20IT5352- ADVANCED PROGRAMMING LAB - II

Course Category:	Program Core Lab	Credits:	2
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	20ES1152: Programming for problem solving using C Laboratory 20ES2152: Object Oriented programming using Python Laboratory 20IT3352: Data Structures Lab 20IT3353: Object Oriented Programming using C++ Lab	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes		Upon successful completion of the course, the student will be able to:
	CO1	Combine fundamental data structures and algorithmic techniques in building a complete solution to a given problem
	CO2	Solve recurrences describing the performance of string algorithms.
	CO3	Develop combinatory solutions to the real-world problems
	CO4	Analyze dynamic programming strategies to solve a given problem.
	CO5	Derive solutions to the problems based on Computational Geometry
	CO6	Evaluate new techniques for solving specific problems in line with space and time requirements.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	3			2						3		3	3	1.5.1,2.3.1,3.2.2,6.2.1, 12.2.1
CO2	2	2	2			2						2	1	1	3	1.5.1, 2.2.5, 3.2.1, 6.2.1, 12.2.1
CO3	3	2	3			2						2	2	2	3	1.5.1, 2.2.5, 3.2.1, 6.2.1, 12.2.1
CO4	3	2	2			2						2	3	1	4	1.5.1, 2.2.5, 3.2.1, 6.2.1, 12.2.1
CO5	3	2	3			3						2		2	3	1.5.1, 2.2.5, 3.2.1, 6.2.1, 12.2.1
CO6	3	2	3			3						2	3	2	4	1.5.1, 2.2.5, 3.2.1, 6.2.1, 12.2.1

Course Content	
	Week 1&2: Design advanced Solutions for Basic Data Structures a. Fibonacci Heaps. Van Emde Boas Priority Queues. Dynamic Data Structures for Graph Connectivity/Reachability.
	Week 3&4: Understand and Identify String algorithms to solve real world problems a. Develop and use Rabin-Karp Fingerprinting algorithm for advanced problems. b. Using suffix trees solve programs from different coding platforms
	Week 5: Derive solutions for problems that make use of Dynamic Programming. a. Understanding the problem and identify the proper way of DP design using i) Trees ii) Bitmapping iii) Digit Dynamic Programming
	Week 6: Implement programs to solve problems using Tree algorithms a. Trie

	b. Fenwick Tree c. Segment Tree d. Sparse Table
	Week 7: Solve problems on programming platform using decomposition a. Identify solutions using Sqrt and Heavy Light decomposition
	Week 8: Solve programming problems based on Computational Geometry a. Line-segment Intersection b. Sweep Lines c. Range Trees d. Seidel's Low-dimensional LP Algorithm
	Week 9: Design efficient solutions using recursion a. Solve the problem on online coding platforms using recursion b. Identify the need of backtracking in solving the problems on online programming platforms.
	Week 10: Programs on Implementation of methods and operations on Maximum flows a. Augmenting Paths and Push-Relabel Methods. b. Minimum Cost Flows. c. Bipartite Matching.
	Week 11&12: Implement programs to solve real-world problems with NP-Completeness solutions a. Understand and analyze Polynomial time and polynomial time verification b. Using reducibility, design solutions for problems on various online coding platforms.
Text books and Reference books	**Text Book(s):** [3]. Halim, Steven and Halim, Felix, Competitive Programming 1, 2013 [4]. Reema Thareja,"Python Programming Using Problem Solving Approach", Oxford University Press, 2019. **Reference Books:** [5]. Antti Laaksonen, "Guide to Competitive Programming", 1st edition, Springer International Publishing, 2017 [6]. Ahmed Shamsul Arefin, Art of Programming Contest, ACM Solver, Second Edition, 2012 [7]. Zed Shah, "Learn Python The Hard Way", Third edition, Addison-Wesley, 2013. [4]. John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013
E-resources and other digital material	[1]. Filipp Rukhovich, Competitive Programming for beginners, [COURSERA]. (11-12-2021), Available: https://www.coursera.org/learn/competitive-programming-for-beginners [2]. Prof Neeldhara, IIT Gandhinagar, Getting Started with Competitive Programming,[NPTEL],(11-12-2021),Available :https://onlinecourses.nptel.ac.in/noc21_cs99/preview [3]. Prof. Erik Demaine, Prof. Ronald Rivest,Prof. SriniDevadas MIT Open Courseware, Introduction to Algorithms, Getting Started with Competitive Programming,[MIT], (11-12-2021),Available:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-spring-2008/index.htm [4]. Erik Demaine, Prof. Ronald Rivest, Prof. Srini Devadas, Lecture notes by EE & CSE of MIT https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2005/lecture-notes/ [5]. Hacker Rank, 11-12-2021 Available https://www.hackerrank.com/ [6]. Leet Code, 11-12-2021Availablehttps://leetcode.com/ [7]. Hacker Earth, 11-12-2021Available https://www.hackerearth.com/ [8]. Topcoder, 11-12-2021Available https://www.topcoder.com/challenges/ [9]. Coder Byte, 11-12-2021Available https://www.coderbyte.com/ [10]. Code wars, 11-12-2021Available https://www.codewars.com/ [11]. Code Signals, 11-12-2021Available https://codesignal.com/ [12]. Code Chef, 11-12-2021 Available https://www.codechef.com/

20IT5554 – ENGINEERING PROJECT FOR COMMUNITY SERVICES

Course Category:	Project	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify societal problem from the villages or towns with well-defined objectives.
	CO2	Build a model for the problem chosen using modern tools and technology.
	CO3	Organize the Technical report effectively.

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3-High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	BTL
	CO1	1	3	l	2	2	3	3	3	3		1	2	1	2	2
	CO2	2	2	2	2	3	1		2	2		1	1	2	1	4
	CO3						1		3	2	3	2	1	1	2	4

Guidelines:

- Students need to identify the problem going to society (Villages / Towns)
- Students should survey the literature for the problem identified for a feasible solution.
- Work will be carried out during summer vacation after IV semester
- Students need to take up a real life problem leading to innovative model building.

20TP5106 PERSONALITY DEVELOPMENT

Course Category:	Skill Oriented	**Credits:**	1
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:**	100
		Semester End Evaluation:	0
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the corporate etiquette.
	CO2	Make presentations effectively with appropriate body language
	CO3	Be composed with positive attitude
	CO4	Understand the core competencies to succeed in professional and personal life

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1								2		3					2	
CO2									2	3					2	
CO3										3					3	
CO4									2	3					2	

Course Content	**UNIT I: Analytical Thinking &Communication Skills** 1. Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception. 2. Verbal Communication; Non Verbal Communication (Body Language)
	UNIT II: Self-Management Skills & Etiquette 3. Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities 4.Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette
	Unit III : Standard Operation Methods & Verbal Ability 5. Note Making, Note Taking, Minutes Preparation, Email & Letter Writing 6. Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work
	UNIT – IV : Career-Oriented Skills 7. Group Discussion, Mock Group Discussions 8. Resume Preparation, Interview Skills, Mock Interviews
Text books and Reference books	**Reference Books:** [1] Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. [2] S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010. [3] R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018. [4] Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and

	Practice, Oxford University Press, 2011.
E-resources and other digital material	[1] www. Indiabix.com [2] www.freshersworld.com

20IT5607A -GOOGLE GO

Course Category:	Skill Oriented -2	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:	20ES1103- Programming for Problem Solving	**Continuous Evaluation:**	100
		Semester End Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the Go Language Environment and its features.
	CO2	Manipulate GO language data types such as Arrays, Strings and PInters.
	CO3	Implement code reusability, modularity, and flexibility to solve complex compositions.
	CO4	Analyze predefined and user defined packages, servers to develop real time applications

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	3				2								2		3	1.5.1,5.2.1
CO3		2			2								3	2	3	2.1.2, 5.2.1
CO4		3			3								3	2	4	2.1.2, 5.2.1

Course Content	**UNIT I:** **Getting Started:** Machine Setups: Text Editor, Terminal, Environment, Go. First Program, Read a Go Program. **Types:** Numbers: Integers, Floating point Numbers, Examples, Booleans and Strings. **Variables:** Name a variable, Scope, Constant, Multiple variables. **Control Structures**: For, if, Switch.
	UNIT II: **Array, Slices and Maps:** Arrays, Slices: append, copy, Maps. **Functions:** Function Declarations, Variadic Functions, Closure, Recursion, Differ, Panic and Recover: panic and recover. Pointers: * and & operators, new.
	UNIT III: **Structs and Interfaces:** Structs: Initialization, Fields. Methods: Embedded Types. Interfaces. **Concurrency:** Go routines, Channels: Channel Direction, Select, Buffered Channel.
	UNIT IV: **Packages:** Core Packages: Strings, Input/output, Files and Folders, Errors, Containers and sort, Hashes and Cryptography. Servers: TCP, HTTP: RPC. Parsing Command Line Arguments. Creating Packages. **Testing:** Testing.
Text books and Reference books	**Text Book(s):** [1] Caleb Doxsey, Introducing Go, O'Reilly Publications, 2016. **Reference Books:** [1] Alan A.A. Donovan, Brain W.Kernighan, The Go Programming Language, Addison-Wesley, 2016. [2] Jay McGavren, Head First Go, O'Reilly Publications, 2019.

E-resources and other digital material	[1]. Ian Harris, Programming with Google Go Specialization, University of California, Irvine, https://www.coursera.org/specializations/google-golang#courses (13-05-2022) [2]. Angad Sharma,GetGoing: Introduction to Golang, DSC VIT Powered by Google Developers, https://www.udemy.com/course/getgoing/(13-05-2022) [3]. Andrei Dumitrescu, Master Go (Golang) Programming:The Complete Go Bootcamp 2022, Crystal Mind Academy,https://www.udemy.com/course/master-go-programming-complete-golang-bootcamp/(13-05-2022)

20IT5607B- REACT PROGRAMMING

Course Category:	Skill Oriented -2	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:	20ES1103- Programming for Problem Solving	**Continuous Evaluation:**	100
		Semester End Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the client-side JavaScript application development through React library
	CO2	Apply React features such as forms, reuse and nest components
	CO3	Develop functional front-end web application using React
	CO4	Implement state management, routing and data incorporation in React

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1													1	1	2	
CO2	2												1	1	3	1.5.1
CO3		2			2								2	2	3	2.1.2, 5.2.1
CO4	3				2								1	3	3	2.1.2, 5.2.1

Course Content	**UNIT I:** **React introduction:** Strong foundation, React past and future, working with the files **JavaScript for React:** Declaring variables, Creating functions, Compilation, Objects and Arrays, Asynchronous JavaScript, Classes
	UNIT II: **Functional programming with JavaScript**: Introduction, imperative versus declarative, functional concepts. **Working with React:** Page setup, React Elements, React DOM, React Components
	UNIT III: **React with JSX:** React Elements in JSX, Babel, Recipes as JSX, React Fragments, Introduction to webpack **State Management**: Building a star rating component, use State Hook, Refactoring, State in component trees, Building forms
	UNIT IV: **Incorporation of Data:** Requesting data, Render Props, Virtualized Lists, Suspense: Error boundaries, Code splitting **React Router: I**ncorporating router, Router properties,
Text books and Reference books	Text Book(s): [1] Alex Banks and Eve Porcello, Learning React, O'Reilly Publications, 2020. Reference Books: [1] Robin Wieruch, The Road to React, 2022 edition, independently published, 2022 [2] KirupaChinnathambi Learning React: A Hands-On Guide to Building Web Applications Using React and Redux 2nd Edition Addison-Wesley Professional; 2nd edition, 2018

E-resources and other digital material	[1] Andrei Neagoie, Yihua Zhang, Complete React Developer in 2022, Available: 08-06-2022, https://www.udemy.com/course/complete-react-developer-zero-to-mastery/ [2] Jogesh K. Muppala, Front-End Web Development with React, The Hong Kong University of Science and Technology, Available: 08-06-2022**https://www.coursera.org/learn/front-end-react** [3] React, Official documentation,Available: 08-06-2022, **https://reactjs.org/**

VI SEMESTER

20IT6301-CLOUD COMPUTING

Course Category:	**Program Core**	**Credits:**	3
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	**Computer networks**	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Interpret the concepts of cloud computing and its standards.
	CO2	Analyze cloud models, security and storage accessibility in different cloud ecosystems
	CO3	Illustrate cloud services offered by various cloud vendors for an enterprise
	CO4	Implement cloud environment for various real time applications.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	2											1		2	1.5.1, 2.1.2
CO2		2									2			1	4	2.2.4, 11.3.1
CO3		1			3						2		2	1	2	2.1.2, 5.2.1, 11.3.1
CO4		2			2								3		3	2.1.2 5.2.1

Course Content	**UNIT I:** **Cloud Computing Basics:** Cloud Computing Overview – Cloud Components, Infrastructure, Cloud Services, and Applications – Storage, Database services. **Organizing the Cloud computing:** When You can use Cloud Computing, Benefits, Limitations and Security Concerns. **Hardware and Infrastructure:** Clients, Security, Network.
	UNIT II: **Accessing the Cloud:** Platforms, Web Applications, Web APIs, and Web Browsers. **Cloud Storage:** Overview, Cloud Storage Providers – Amazon S3, Google Bigtable Datastore, MobileMe, Live Mesh. **Standards**: Application, Client, Infrastructure, Service.
	UNIT III: **Software as a service :** Overview, Advantages, Driving Forces, Company Offerings – Intuit, Google, Microsoft **Software plus services :** Overview, Pros, Cons, Vendors, Mobile Device Integration, Providers-Adobe AIR, Microsoft Online **Developing Applications:** Google, Microsoft
	UNIT IV: **Local clouds and Thin Clients:** Virtualization in an organization, Server Solutions-Microsoft HyperV, VMWare, **Cloud Applications**: Scientific applications: Healthcare, Business and consumer applications: CRM, Salesforce.com, Productivity: Drop box and icloud, Social Networking: Facebook. **Fundamental Cloud Security:** Basic Terms and Concepts, Threat Agents, Cloud Security Threats, Cloud Security Mechanisms - Encryption, Hashing, Digital Signature, IAM, SSO
Text books and Reference	**Text Book(s):** [1]. Velte T. Antony, Velte J. Toby., Elsenpeter Robert, “Cloud Computing: A Practical

books	Approach", Tata McGraw- Hill , 2010 [2] Thomas Erl and RicardoPuttini Cloud Computing-Concepts, Technology andArchitecture, Pearson, 2013. **Reference Books:** [1]. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishers, 2012 [2]. Miller Michael, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, 2008.
E-resources and other digital material	[1].John R Williams, Abel Sanchez , MIT Professional Education, "Cloud DevOps", 2022 https://professional.mit.edu/course-catalog/cloud-devops-continuous-transformation [2]. Courseera, "Cloud Application Security", 2021, https://www.mooc-list.com/course/cloud-application-security-coursera [3].Suresh S, Udemy, "Server Virtualization", 2021 https://www.udemy.com/tutorial/cloud-computing-the-technical-essentials/basics-of-virtualization/ [4] Prof.SowmyaKantiGhosh,IITKharagpur, "Cloud Computing"2022 https://nptel.ac.in/courses/106/105/106105167/

20IT5302–MACHINE LEARNING

Course Category:	ProgrammeCore	**Credits:**	4
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-2
Prerequisites:	---	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the fundamental concepts of machine learning
	CO2	Apply linear, distance based, and decision tree based models
	CO3	Analyze probabilistic, neural network models
	CO4	Design a suitable machine learning model for a given scenario

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1													1		2	
CO2	2	2											3	1	3	1.5.1, 2.1.2
CO3	2	2											3	1	4	1.5.1, 2.1.2
CO4	2	3											3	2	3	1.5.1, 2.1.2

Course Content	**UNIT I** **The ingredients of machine learning**: Tasks, Models, Features **Binary classification and related tasks**: Classification, Assessing classification performance, Visualizing classification performance **Beyond binary classification**: Multi-class classification, Regression, Unsupervised and descriptive learning
	UNIT II **Decision Tree learning** – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Inductive bias in decision tree, Issues in decision tree learning. **Linear models**: The least-squares method, Multivariate linear regression, The perceptron, Support vector machines, Soft margin SVM, Going beyond linearity with kernel methods.
	UNIT III: **Distance Based Models:** Introduction, Neighbours and exemplars, Nearest Neighbours classification, K-Means algorithms, Clustering around medoids **Probabilistic Models:** Using Naïve Bayes Model for classification, Expectation Maximization, Gaussian Mixture models
	UNIT IV: **Artificial Neural Networks**: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation, Advanced topics in Artificial Neural Networks **Reinforcement Learning:** Introduction, Learning tasks, Q-learning.
Text books and Reference books	**Text Book(s):** [1]. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012 [2]. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill

	Education **Reference Books:** [1] Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition [2] Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014 [3] EthemAlpaydın, Introduction to machine learning, second edition, MIT press. [4] T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition
E-resources and other digital material	[1]. Kevin Murphy,"Machine Learning: AProbabilistic Perspective" , MIT Press, 2012, https://www.cs.ubc.ca/~murphyk/MLbook/pml-intro-5nov11.pdf [2] Machine Learning by Andrew Ng, Stanford University https://www.coursera.org/learn/machine-learning **[3] Professor S. Sarkar IIT Kharagpur "Introduction to machine learning" , https://www.youtube.com/playlist?list=PLYihddLF- CgYuWNL55Wg8ALkm6u8U7gps** [4] Professor Carl GustafJansson, KTH, Video Course on Machine Learning https://nptel.ac.in/noc/individual_course.php?id=noc19-cs35 [5]. Tom Mitchell, *"Machine Learning", http://www.cs.cmu.edu/~tom/10701_sp11/lectures.shtml*

20IT6303 - WEB PROGRAMMING AND DEVELOPMENT

Course Category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT4302 Java Programming	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand features of Spring Boot, Spring Framework and process involved to connect to Java Database Connectivity
	CO2	Apply concepts of Servlets to develop server side applications
	CO3	Design web applications connecting to JPA with Spring MVC and Spring Boot
	CO4	Develop Spring Boot Applications using Spring Boot Annotations

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1													1	1	2	
CO2	2				2								1		3	1.5.1, 5.2.1
CO3			3		2								2		3	3.2.2, 5.2.1
CO4			3		2								2		3	3.2.2, 5.2.1

Course Content	**UNIT I:** **JDBC**: The concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview Of The JDBC Process, Database Connection, Associating The JDBC/ODBC bridge with the Database, **Statement objects**-Statement, Prepared Statement and Callable Statement, Result Set.
	UNIT II: **Java Servlets :** Java Servlets and common gateway interface programming, benefits of using a java servlets, simple java servlet, anatomy of a java servlet, deployment descriptor, reading data from a client, sending data to a client, working the cookies, tracking sessions.
	UNIT III: **Getting started with Spring Boot:** Structure, objectives, introduction, features, advantages of Spring Boot, Breaking the monolithic way of developing software, system requirements, setting up of the environment, the 12-factor app, Spring initializer **Developing Spring Boot Application**: Starting with Spring initializer, Build tools, building an application using Maven, understanding the entry point class and Spring Boot Application annotation
	UNIT IV: **Spring Boot Annotations**: Java Annotations, existence of spring annotations, Spring and Spring Boot annotations, Stereotype annotations, Spring Boot Annotations **Working with Spring Data JPA**: Accessing relational data using JDBC Template and Spring data JPA in memory database, Spring data JPA with MySQL, Query methods in Spring data JPA
	Case Study: Deploy Web application into a server using Servelt/Spring Technology

Text books and Reference books	**Text Book(s):** [1]. James Keogh, "J2Ee: The Complete Reference", 1st Edition, McGraw Hill Education, 2002 [2]. ShagunBakliwal, Hands-on Application Development using Spring Boot, BPB Publications, First Edition, 2022 **Reference Book(s):** [1]. Craig Walls, Spring in Action, Sixth Edition, MEAP Edition, Manning Early Access Program, Version 4, 2021 [2]. Mark Heckler, Spring Boot: Up and Running, O'Reilly Media,2021
E-resources and other digital material	[1]. RangaKaranam, Java Servlets and JSP - Build Java EE(JEE) app in 25 Steps, 04-06-2022 Available: https://www.udemy.com/course/learn-java-servlets-and-jsp-web-application-in-25-steps/ [2]. Spring-Official documentation, 04-06-2022 Available:https://spring.io/projects/spring-boot [3]. Advanced Java Programming by Infinite Skills, 04-06-2022 Available: https://www.udemy.com/advanced-java-programming/ [4]. Derek Parsons , Spring MVC, Spring Boot and Rest Controllers, Available: 04-06-2022, LearnQuest, https://www.coursera.org/learn/spring-mvc-rest-controller [5]. RangaKaranam, Spring Framework Master Class - Java Spring the Modern Way, Available: 04-06-2022 https://www.udemy.com/course/spring-tutorial-for-beginners/

20IT6404A -DATA VISUALIZATION

Course Category:	Program Elective - 1	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Illustrate visualizations that represent the relationships contained in complex data sets and their interpretation.
	CO2	Analyze data to create a visualization for a particular research application.
	CO3	Identify appropriate visualization chart to present and represent design solutions.
	CO4	Choose leading open source software packages to create and publish visualizations that enable clear interpretations of big, complex and real world data.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	1	2								1		1	1	2	1.5.1, 2.1.2, 3.2.2
CO2	1	1	2								1		1	1	3	1.5.1, 2.1.2, 3.2.2
CO3		2											1	2	2	2.2.4
CO4	1		1		2								2	1	4	1.5.1, 3.2.2, 5.2.1

Course Content

UNIT I:

The Context of Data Visualization: Visualization as a discovery tool, The bedrock of visualization knowledge, Defining data visualization, Visualization skills for the masses, the data visualization methodology.

Setting the Purpose and Identifying Key Factors: Establishing intent – the visualization's function, Establishing intent – the visualization's tone, Key factors surrounding a visualization project, The " eight hats" of data visualization design

UNIT II:

Conceiving and Reasoning Visualization Design Options: Data visualization design is all about choices, The visualization anatomy – data representation, The visualization anatomy – data presentation

Taxonomy of Data Visualization Methods: Data visualization methods, Choosing the appropriate chart type, Assessing hierarchies and part-to-whole relationships

UNIT III:

Constructing and Evaluating Your Design Solution: For constructing visualizations, technology matters, The construction process, Approaching the finishing linePost-launch evaluation.

Case Studies on real-time applications.

UNIT IV:

An Introduction to Connecting to Data: An Introduction to Connecting to Data in Tableau, Shaping Data for Use with Tableau, Getting a Lay of the Land: Tableau Terminology, View the Underlying Data, View the Number of Records, Dimension Versus Measure, What Is a Measure? What Is a Dimension? Discrete Versus Continuous

Five Ways to Make a Bar Chart/An Introduction to Aggregation: Five Ways to Create a

	Bar Chart in Tableau An Introduction to Aggregation in Tableau, Line Graphs, Independent Axes, and Date Hierarchies, How to Make a Line Graph in Tableau, Independent Axes in Tableau, Date Hierarchies in Tableau, Marks Cards, Encoding, and Level of Detail, An Explanation of Level of Detail, An Introduction to Encoding, Label and Tooltip Marks Cards.
Text books and Reference books	**Text Book(s):** [1] Andy Kirk, "Data Visualization: a successful design process", Packt Publishing (26 December 2012) [2] Ryan Sleeper, Practical Tableau, O'Reilly Media, Inc. April 2018. **Reference Books:** [1]. Chakrabarti, S,"Mining the web: Discovering knowledge from hypertext data ",Morgan Kaufman Publishers, 2003. [2]. Fry, Vilisualizing data, Sebastopo,O'Reily, 2007.
E-resources and other digital material	[1]. Dr. GauravDixit,Department of Management Studies, Indian Institute of Technology, Roorkee: https://nptel.ac.in/courses/110107092/7,2017 [2]. P Adam Marcus, and Eugene Wu. RES.6-009 How to Process, Analyze and Visualize Data. January IAP 2012. Massachusetts Institute of Technology: MIT Open Courseware, https://ocw.mit.edu.,2012 [3] Prof.ShankarNarasimhan,Ragunathan, Rengasamy,IIT Madras Data Visualization in R Basic graphics, https://nptel.ac.in/courses/106106179/11,2016 [4] Statistics and Visualization for Data Analysis and Inference, Dr. Ed Vul, Dr. Mike Frank, Massachusetts Institute of Technology, https://ocw.mit.edu/resources/res-9-0002-statistics-and-visualization-for-data- analysis-and-inference-january-iap-2009/, 2009.

20IT6404B – BIG DATA

Course Category:	Program Elective-2	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT4304: Database Management Systems	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand Big data characteristics, Hadoop, Hive, HDFS and Map Reduce architectures.
	CO2	Use Nosql Databases to process different varieties of Data.
	CO3	Apply Pig Latin, Hive Scripts and Map Reduce programming on real time applications.
	CO4	Develop In-Memory Data Analytics with Spark and Spark Streaming.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	2	2			2								3		3	1.5.1, 2.1.2, 5.2.1
CO3	2		3		3								3	2	3	1.5.1, 3.2.2, 5.2.1
CO4	1		2		2								2		3	1.5.1, 3.2.2, 5.2.1

Course Content

UNIT I

Introduction to Big Data:

Big Data-definition, Characteristics of Big Data (Volume, Variety, Velocity), Data in the Warehouse and Data in Hadoop, Importance of Big Data and Patterns for Big Data Development.

Introduction to Hadoop:

Data, Data Storage and Analysis, Comparison with Other Systems: RDBMS, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem, Hadoop Releases.

UNIT II

Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Datanodes, Basic Filesystem Operations, Hadoop Files systems, Interfaces, The Java Interface, Reading Data from a Hadoop URL, Data Flow, Anatomy of a File Read and Anatomy of a File Write.

Map Reduce–A Weather Dataset, Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop, Map and Reduce, Java Map Reduce, Scaling Out, Hadoop Streaming, Hadoop Pipes.

UNIT III:

NoSQL: Introduction to NOSQL, Types of NoSQL Databases, Advantages of NoSQL databases, SQL versus NoSql.

NoSQL databases: Introduction to MongoDB, Data types in MongoDB, MongoDB query language.

Pig-Installation and Running of Pig, Execution Types, Running Pig Programs, Pig Latin Editors, Comparison with databases, Pig Latin, Functions, Data Processing Operators.

UNIT IV:

	Hive-Installing Hive, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data. **Spark:** Introduction to data analytics with Spark, Spark Stack, Programming with RDDS, Working with key/value pairs and Spark SQL.
Text books and Reference books	**Text Book(s):** [1] Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data" 1st Edition, TMH, 2012. [2] Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012. [3] SeemaAcharya, SubhashiniChellappan, Big Data and Analytics, Wiley Publishers. **Reference Books:** [1] Holden Karau, Andy Konwinski, Patrick Wendell, MateiZaharia, "Learning Spark: Lightning-Fast Big Data Analysis", O'Reilly Media, Inc.
E-resources and other digital material	[1]. https://www.tutorialsPInt.com/hive/hive_introduction.htm [2]. Alexey Grishchenko, Hadoopvs MPP, https://0x0fff.com/hadoop-vs-mpp/ [3].Random notes on bigdata- SlideShare: Available www.slideshare.net/yiranpang/random-notes-on-big-data-26439474

20IT6404C - INTERNET OF THINGS

Course Category:	Programme Elective 2	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT5301 – Computer Networks	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze various protocols, privacy and security of Internet of Things.
	CO2	Apply the methods of data acquiring, organizing and analytics using Cloud platform for IoT applications.
	CO3	Design portable IoT system using Rasperry Pi and Arduino.
	CO4	Apply the steps of the design methodology in developing IoT applications.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		3		1		2					2	1		2	1.5.1, 3.2.2, 5.2.1, 7.1.2
CO2	1		2		2		2						1	2	3	1.5.1, 3.2.2, 5.2.1, 7.1.2
CO3	1		2		2		3						1		3	1.5.1, 3.2.2, 5.2.1, 7.1.2
CO4	1		2		2		3					2	1	2	3	1.5.1, 3.2.2, 5.2.1, 7.1.2

Course Content	**UNIT I:** **Introduction to Internet of things:** Introduction, Physical design of IoT, Logical Design of IoT, IoT Enabling technologies, IoT levels & Deployment templates. **Domain Specific IoTs:** Home Automation, Cities **IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

	UNIT II: **Internet Connectivity Principles:** Introduction, Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Media Access Control, Application Layer Protocols-HTTP, HTTPS, FTP, Telnet and others. **Data Acquiring, Organizing, Processing and Analytics:** Introduction, Data Acquiring and Storage, Organizing the Data
	UNIT III: **Sensors, Participatory Sensing, RFIDs and Wireless Sensor Networks:** Introduction, Sensor Technology, Actuator, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology. **IoT physical devices & End Points: IoT Device,** Raspberry Pi Board, Raspberry Pi interfaces, Programming Raspberry pi with python.
	UNIT IV: **IoT Platforms Design Methodology:** Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring**.** **IoT Privacy, Security and Vulnerabilities Solutions:** Vulnerabilities, Security Requirements and Threat Analysis, IoT Security Tomography and Layered Attacker Model.
Text books and Reference books	**Text Book(s):** [1] Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands- on-Approach)",** 1st Edition, University Press Private Limited,2017 [2] Raj Kamal, "**Internet of Things, Architecture and Design Principles**" 1st Edition, McGraw Hill Education Private Limited, 2017. **Reference Books:** [1] Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications,2013 [2] Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
E-resources and other digital material	[1] Prof SudipMisra, IIT, Kharagpur, "Introduction to Internet of Things",2017 https://www.youtube.com/watch?v=WUYAjxnwjU4 [2] IoT Tutorial for Beginners | Internet of Things (IoT) | Edureka,2017 https://www.youtube.com/watch?v=UrwbeOIlc68,

20IT6404D -INFORMATION RETRIEVAL SYSTEM

Course Category:	Program Elective - 2	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Data Visualization	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic concepts and techniques in Information Retrieval
	CO2	Evaluate information retrieval system performance and queries formulation
	CO3	Infer relevance feedback and query operations on a text database
	CO4	Analyze the web characterization and digital libraries implications

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	1	1			2								1	1	4	1.5.1, 2.1.2, 5.2.1
CO3	1	2	2		3								1	1	3	1.5.1, 2.1.2, 3.2.2, 5.2.1
CO4	1	2	2		3								2	2	4	1.5.1, 2.1.2, 3.2.2, 5.2.1

Course Content

UNIT I

Introduction: Motivation, Information versus Data Retrieval, Information Retrieval at the Centre of the Stage.

Basic Concepts: The User Task, Logical View of the Documents.

Past, Present, and Future: Early Developments, Information Retrieval in the Library, The Web and Digital Libraries, The Retrieval Process.

Modeling: Introduction, A Taxonomy of Information Retrieval Models, Retrieval: Ad Hoc and Filtering, A Formal Characterization of IR Models, Classic information retrieval.

UNIT II

Retrieval Evaluation: Introduction, Retrieval Performance Evaluation : Recall and Precision, Alternative Measures ,Reference Collections : The TREC Collection

Query Languages: Keyword-Based Querying, Pattern Matching, Structural Queries, Query Protocols.

UNIT III

Query Operations : User Relevance Feedback, Query Expansion and Term Reweighting for the Vector Model, Term Reweighting for the Probabilistic Model, A Variant of Probabilistic Term Reweighting, Evaluation of Relevance Feedback Strategies

Text Operations : Introduction ,Document Preprocessing

Indexing and Searching : Introduction, Inverted Files, Boolean Queries, Sequential Searching : Brute Force, Knuth-Morris-Pratt

UNIT IV

Searching the Web : Introduction, Challenges, Characterizing the Web, Search Engines, Browsing

Digital Libraries : Introduction, Definitions, Architectural Issues, Document Models, Representations, and Access

Case Studies: Page ranking, Retrieval evaluation of Web Search Engines

Text books and Reference

Text Books:

[1] Ricardo Baeza-Yaets and BerthierRibeiro-Neto, Modern Information Retrieval: The

books	Concept and Technology behind Search, 2nd Edition, Pearson, 2020. **Reference Books:** [1] G. G. Chowdhurry,Introduction to Modern Information Retrieval, Neal-Schuman Publishers; Third edition , 2019 [2] Christopher D. Manning, PrabhakarRaghavan and HinrichSchütze, *Introduction to Information Retrieval*, Cambridge University Press. 2008..
E-resources and other digital material	[1] Information Retrieval,Prof.PabitraMitra,IITKharagpur, http://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html [2] Information Retrieval,Prof.PawanGoyal,IITKharagpur, http://cse.iitkgp.ac.in/~pawang/courses/IR16/lec1.html [3] Natural Language Processing by Prof. Pushpak Bhattacharyya, Department of Computer science &Engineering,IIT Bombay, https://www.youtube.com/watch?v=m0oiAOgSQFw [4] Introduction to Information Retrieval ,University of South Carolina, https://www.youtube.com/watch?v=yluvahNq3wk

20IT6205A - AGILE SOFTWARE DEVELOPMENT

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT5302 : Software Engineering	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply software development methods for time management of agile projects.
	CO2	Analyze agile software development processes, quality and team work in learning.
	CO3	Evaluate measures that suit agile software development environments to process and product quality which delves into the details of TDD implementation.
	CO4	Build teams to establish a professional software development that promotes team members accountability and responsibility.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3										2		3		3	1.5.1, 11.3.1
CO2		3									2		1		4	2.1.2, 11.3.1
CO3				3							1		1	1	4	4.1.2,11.3.1
CO4					3				1				1	1	3	5.2.1, 9.1.2

Course Content

UNIT I:

Agile and Scrum Principles-Three Perspectives on Software Engineering, Agile Manifesto, Definition of Scrum, Uses of Scrum, Scrum Theory, Scrum Values, The Scrum Team, Scrum Events, Scrum Artifacts.

Teamwork- Objectives, A Role Scheme in Agile Teams, Dilemmas in Teamwork, Teamwork in Learning Environments,

UNIT II:

Customers and Users-Objectives, The Customer, The User, Customers and Users in Learning Environments

Time- Objectives, Time-Related Problems in Software Projects, Tightness of Software Development Methods, Sustainable Pace, Time Management of Agile Projects, Time in Learning Environments,

UNIT III:

Measures- Objectives, Importance of Measures,

Case Study- Monitoring a Large-Scale Project by Measures, Measures in Learning Environments.

Quality- Overview, Objectives, The Agile Approach to Quality Assurance, Test-Driven Development, Measured TDD, Quality in Learning Environments.

UNIT IV:

Learning- Objectives, How Does Agile Software Development Support Learning Processes, Learning in Learning Environments

Abstraction- Objectives, Abstraction Levels in Agile Software Development, Abstraction in Learning Environments

Trust-, Objectives, Software Intangibility and Process Transparency, Game Theory Perspective in Software Development, Ethics in Agile Teams, Diversity, Trust in Learning Environments,

Text books and Reference books	**Text Book(s):** [1] Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009. [2] Scrum creators: Ken Schwaber and Jeff Sutherland, The Scrum Guide- The Definitive Guide to Scrum: The Rules of the Game, November 2017. **Reference Books:** [1]. Craig Larman, ―Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004. [2]. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.
E-resources and other digital material	[1] Praveen Mittal, Adjunct Professor, University of Minnesota [2] https://www.coursera.org/learn/agile-software-development **Prof. Rajib Mall, CSE IIT Kharagpur, Course name: Agile model https://archive.nptel.ac.in/courses/106/105/106105182/** [3] Nate Dinet, Author & Co-founder of Conquer Life & Enterprise Agile Coach Course name: An overview of agile methodologies https://www.udemy.com/course/agile-methodologies-overview/ [4] Bertrand Meyer : Agile methods are one of the most important developments https://learning.edx.org/course/course-v1:ETHx+ASD.1x+2T2020/home

20IT6205B- AUTOMATA AND COMPILER DESIGN

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze the concepts of abstract machines, compiler design, language classes & grammar relationships and variants of syntax trees.
	CO2	Apply code generation and code optimization techniques, top down and bottom up parsing techniques on context free grammars
	CO3	Construct finite state machines, Parsing Tables and regular expressions for modeling and solving computation problems.
	CO4	Design Context free grammars, Pushdown Automata and Turing machines for the formal languages.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2	2	2												2	1.5.1, 2.1.2, 3.2.2
CO2	3		2										1		3	1.5.1, 3.2.2
CO3	2		3										1	1	3	1.5.1, 3.2.2
CO4	2		3											2	3	1.5.1, 3.2.2

Course Content

UNIT I:

Finite Automata: Deterministic Finite Automata-Definition of DFA, How a DFA processes strings, Simpler Notations for DFA's, Extending the Transition Function to Strings, The Language of DFA, Nondeterministic Finite Automata – Definition of NFA, Extended Transition Function, Language of NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Finite automata with Epsilon –Transitions – Uses of €-Translations, Formal notation for an €-NFA, Epsilon-Closures, Extended Transitions and Languages for €-NFA's, Eliminating €-Transitions.

Regular Expressions and Languages: Regular expressions – Operators of Regular Expressions, Building Regular Expressions, Finite Automata and Regular Expressions - Converting DFA's to Regular expressions by eliminating states, Converting regular expressions to automata.

UNIT II:

Introduction: Structure of a compiler **Lexical Analysis** – Role of Lexical Analyzer – Lexical Analysis Vs. Parsing, Token, patterns and Lexemes, Lexical Errors

Simple Syntax Directed Translator: Syntax definition – Definition of Grammars, Derivations, Parse Trees, Ambiguity, Parsing-Top-Down Parsing, Predictive Parsing, When to use € Productions, Designing a Predictive Parser, Left Recursion

Syntax Analysis : Introduction - Role of a parser, Context Free Grammars – definition of CFG, Derivations, Parse Trees and Derivations, Ambiguity, Top Down Parsing-Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Nonrecursive Predictive Parsing, Bottom Up Parsing – Reductions, Handle Pruning, Shift Reduce Parsing, Introduction to LR Parsing – Why LR Parsers, Items and the LR(0)Automaton, LR-Parsing Algorithm, Construction of SLR-Parsing Tables, More Powerful LR Parsers- Canonical LR(1) Items, Constructing LR(1) Sets of Items, Canonical LR(1) Parsing Tables, Constructing LALR Parsing Tables

	UNIT III: **Syntax Directed Translation**: Syntax Directed definition, Evaluation orders for SDD's, Applications of Syntax Directed Translation **Intermediate Code Generation** : Variants of Syntax Trees, Three Address Code, Type Checking- Rules for Type Checking, Type Conversions **Code generation:** Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Simple code Generator, Peephole Optimization.
	UNIT IV: **Pushdown Automata**: Definition of the Pushdown automata, The languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata. **Turing Machines**: Introduction, The Turing Machine – Notations, Descriptions, Transition diagrams, Language of a Turing Machine, Turing Machines and Halting.
Text books and Reference books	**Text Book(s):** [1] John E..Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, " Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2011 [2] Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers Principles, Techniques and Tools", Pearson Education, Second Edition, 2008. **Reference Books:** [1]. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing. [2]. Lewis H.P. & Papadimitriou C.H , "Elements of Theory of Computation", Second edition, Pearson /PHI. [3]. K.L.P.Mishra and N. Chandrashekaran, "Theory of computation" , 2ndedition, PHI
E-resources and other digital material	[1]. Prof.KamalaKrithivasan, IIT, Madras, "Theory of Automata, Formal Languages and Computation" , 2011, https://nptel.ac.in/courses/106106049/http://dev.tutorialsPInt.com/automata_theory/index.htm [2]. Neso Academy, "Introduction to Theory of Computation", Dec 2016. https://www.youtube.com/watch?v=58N2N7zJGrQhttp://www.nptelvideos.in/2012/11/theory-of-computation.html [3]. Prof. SouravMukhopadhyay, Department of Mathematics, IIT, Kharagpur, ntroduction to Automata, Languages and Computation, NPTEL, 2021. https://nptel.ac.in/courses/106105196 [4]. Compiler design, learning material https://www.tutorialsPInt.com/compiler_design/compiler_design_useful_resources.htm

20IT6205C–INTRODUCTION TO DATA STRUCTURES

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103 : Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply linear data structures to solve different applications.
	CO2	Develop algorithms to solve a given problem using appropriate data structure.
	CO3	Implement operations on binary trees, binary search trees and sorting.
	CO4	Solve problems using algorithm design methods such as the divide and conquer, greedy method and dynamic programming.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1	2											2	1	3	1.5.1, 2.1.2
CO2	1												1		3	1.5.1
CO3		1										1	2	2	3	2.1.2, 12.2.1
CO4				1					1			1			3	4.1.2, 9.1.2

Course Content

UNIT I

Introduction: Basic Terminology, Classification of Data Structures, Operations on Data Structures, Abstract Data Type, Algorithms, Different Approaches to Designing an Algorithm, Control Structures Used in Algorithms, Time and Space Complexity.

Searching: Linear Search and Binary Search Techniques

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked Representation of Stacks, Operations on a Linked Stack, Applications of Stacks- Evaluation of Arithmetic Expressions, Recursion.

UNIT II

Queues: Introduction to Queues, Array Representation of Queues, Linked Representation of Queue, Types of Queues-Circular Queues, Dequeues, Priority Queues, Multiple Queues, Applications of Queues

Linked list: Introduction, Singly linked lists-Traversing, Searching, Inserting, Deleting a Node from a linked list

Doubly linked list: Inserting and deleting a Node from a Doubly linked list.

UNIT III:

Trees–Introduction, Binary trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree

Efficient Binary Trees– Binary search tree, Operations on Binary Search Trees- Searching, Inserting and Deleting a node

Sorting: Bubble sort, Insertion sort, Selection sort, Merge sort and Quick sort

UNIT IV:

Divide and Conquer: General Method, Binary Search, Finding Minimum and Maximum

	Greedy Algorithm: General Method, Knapsack Problem, Single-Source Shortest Paths **Dynamic Programming:** General Method, Multistage Graph, All Pairs Shortest Paths, The Traveling salesperson Problem
Text books and Reference books	**Text Book(s):** [1]. ReemaThareja ”Data structures using C” 2nd edition Oxford University press,2014 [2]. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekharan” Computer Algorithms”, Computer Science Press **Reference Books:** [1]. Thomas H Corman, E Leiserson, Ron Rivest, ”Introduction to Algorithms” , MIT Press, 2nd Edition, Jan 2001. [2]. Alfred V Aho, J D Ullman, J E Hopcroft, ”Data Structures and Algorithms” , Addison Wesley Longman, 1983. [3]. Mark Allen Weiss, ”Data Structures in C++”, Addison Wesley Longman, 2nd Edition, 1998. [4]. Horowitz E and Sahni S, “ Fundamentals of Computer Algorithms”, Computer Science Press, 1984.
E-resources and other digital material	[1]. SudarshanIyengar: IIT Ropar (12, August, 2018). Data Structures and Algorithms[NPTEL]. Available: http://nptel.ac.in/ [2]. Erik Demaine, (12, may, 2018). Advanced Data Structures [MIT-OpenCourseWare]. Available: http://ocw.mit.edu/ [3]. https://www.coursera.org/learn/data-structures [4]. https://www.coursera.org/specializations/data-structures-algorithms

20IT6351 - WEB PROGRAMMING AND DEVELOPMENT LAB

Course Category:	Program Core Lab	**Credits:**	2
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	20IT4302 Java Programming	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement Java Database Connectivity Application Programming Interface to connect to relational databases
	CO2	Build server side applications to interact with server using Java Servlets
	CO3	Design Web applications that interact with server as well as the relational databases
	CO4	Implement dependency injection and inversion of control to solve problems in Spring Boot
	CO5	Apply Spring Boot annotations to provide solutions to real world problems
	CO6	Create Spring Boot applications that uses Representational State Transfer services

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1		2			2										3	2.1.2, 5.2.1
CO2	3				2										3	1.5.1, 5.2.1
CO3			3		2								2	2	3	3.2.2, 5.2.1
CO4	2				3								1		3	5.2.1
CO5	3				2								2	2	3	5.2.1
CO6			3		3								2	2	6	3.2.2,5.2.1

Course Content	**Week 1:** Create JDBC programs to connect to relational databases
	Week 2: Connect to a database using different type of Statement Interfaces and process the results using ResultSet a. Implementation of CRUD operations on a relational database
	Week 3: Create server side applications using Java Servlets
	Week 4: Servlet programs on sessional tracking using **a.** Cookies **b.** Sessions
	Week 5: Creation of Spring programs via SpringBoot Application and Spring Initializer in Spring
	Week 6: Implementation of 12-factor App in Spring Boot
	Week 7 : Implement dependency injection into a program in Spring Boot
	Week 8: Use of annotations in developing applications in Spring Boot
	Week 9: Accessing of relational databases via JDBC and JPA

	Week 10: Implement RESTFul Services in Spring Boot
	Week 11&12:Case Studies- 1. Develop web applications using Java Servlets 2. Web applications that handles the sessions via session tracking 3. Develop Spring Boot applications to real world problems 4. Make use of Representational State Transfer in building applications in Spring Boot
Text books and Reference books	**Text Book(s):** [1]. James Keogh, "J2Ee: The Complete Reference", 1st Edition, McGraw Hill Education, 2002 [2]. Shagun Bakliwal, Hands-on Application Development using Spring Boot, BPB Publications, First Edition, 2022 **Reference Book(s):** [1]. Craig Walls, Spring in Action, Sixth Edition, MEAP Edition, Manning Early Access Program, Version 4, 2021 [2]. Mark Heckler, Spring Boot: Up and Running, O'Reilly Media,2021
E-resources and other digital material	[1]. Ranga Karanam, Java Servlets and JSP - Build Java EE(JEE) app in 25 Steps, 04-06-2022 Available: https://www.udemy.com/course/learn-java-servlets-and-jsp-web-application-in-25-steps/ [2]. Spring-Official documentation, 04-06-2022Available:https://spring.io/projects/spring-boot [3]. Advanced Java Programming by Infinite Skills, 04-06-2022 Available: https://www.udemy.com/advanced-java-programming/ [4]. Derek Parsons , Spring MVC, Spring Boot and Rest Controllers, Available: 04-06-2022, LearnQuest, https://www.coursera.org/learn/spring-mvc-rest-controller [5]. RangaKaranam, Spring Framework Master Class - Java Spring the Modern Way, Available: 04-06-2022 https://www.udemy.com/course/spring-tutorial-for-beginners/

20IT6452A -DATA VISUALIZATION LAB

Course Category:	Program Elective 2	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the visualization pipeline with its relationship to other
	CO2	Design considerations for the components of the good visualization
	CO3	Construct visualizations for effective data analysis
	CO4	Build interactive dashboards for better decision making

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1															2	
CO2	1	1	2								1			2	3	1.5.1, 2.1.2, 3.2.2
CO3		2												3	3	2.1.2
CO4	1		1								1		3		3	1.5.1, 3.2.2

Course Content	**Week 1:** Implement Pie chart, Area Chart and Bubble plot on real-time data
	Week 2: Implement visualization techniques on textual data
	Week 3 & 4: Implementing data visualization using R 1. Find the data distributions using box and scatter plot. 2. Find the outliers using plot. **3.** Plot the histogram, bar chart and pie chart on sample data.
	Week 5 & 6: Implementing basic operations in Tableau to get accustomed to its interface and Emphasizing the Results and Map View [1] Tableau Workspace, Connecting to a Data Source, Creating a view and Refining the view [2] Adding Filters to the view, Adding Colors to the view and Key Findings [3] Building a Map View, Getting into details and Identifying the Key PInts
	Week 7: Creating a dashboard and building story to showcase stories in presentation mode [1] Creating a dashboard and Adding Interactiveness [2] Building a Story and Making a Conclusion
	Week 8: Tracking Twitter data to see how fast information spreads online: Create a data visualization to understand the spread of information and miss information insights of individual tweets online.
	Week 9: Loan risk analysis : Create visualization to analyze bank loan data to assess the risk of loan defaulters.
	Week 10: Motivate sales teams by modelling commission rates: Create a visualization to explore the relationships between compensation type, commission for sales people to motivate them.

Text books and Reference books	**Text Book(s):** [1] Andy Kirk, "Data Visualization: a successful design process", Packt Publishing (26 December 2012) [2] Ryan Sleeper, Practical Tableau, O'Reilly Media, Inc. April 2018. **Reference Books:** [1]. Chakrabarti, S,"Mining the web: Discovering knowledge from hypertext data ", Morgan Kaufman Publishers, 2003. [2]. Fry ,Vilisualizing data, Sebastopo, O'Reily, 2007.
E-resources and other digital material	[1]. Dr. GauravDixit,Department of Management Studies, Indian Institute of Technology, Roorkee: https://nptel.ac.in/courses/110107092/7,2017 [2]. P Adam Marcus, and Eugene Wu. RES.6-009 How to Process, Analyze and Visualize Data. January IAP 2012. Massachusetts Institute of Technology: MIT Open Courseware, https://ocw.mit.edu.,2012 [3] Data Visualization in R Basic graphics, Prof.ShankarNarasimhan, RagunathanRengasamy,IIT Madras, https://nptel.ac.in/courses/106106179/11,2016 [4] Statistics and Visualization for Data Analysis and Inference, Dr. Ed Vul, Dr. Mike Frank, Massachusetts Institute of Technology, https://ocw.mit.edu/resources/res-9-0002-statistics-and-visualization-for-data-analysis-and-inference-january-iap-2009/, 2009.

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20IT6452B - BIG DATA LAB

Course Category:	Program Elective- 2	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20IT4352: Database Management Systems Lab	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement Map Reduce programming on real time applications.
	CO2	Apply NOSQL Concepts on real time applications.
	CO3	Apply Pig Latin and Hive Script programming on real time applications.
	CO4	Solve various business applications using Big data concepts.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	2		3		3								3	2	3	1.05.1, 3.3.1, 5.2.1
CO2	2	2			3								3	2	3	1.5.1, 2.1.2, 5.2.1
CO3	2		3		3								3	2	3	1.5.1, 3.2.2, 5.2.1
CO4	2		3		3								3	3	3	1.5.1, 3.2.2, 5.2.1

Course Content	**Week 1** • Introduction, Applications, Tools related to Big data and NOSQL.
	Week 2 NOSQL: Mangodb installation and querying in Mangodb
	Week 3 Querying in Mangodb • Create Database • Drop Database • Create collection • Drop collection • Indexing • Aggregation
	Week 4 Installation of Cloudera
	Week 5 Exploring HDFS and Listing of files.
	Week 6 HDFS Operations using various commands

	Week 7 HiveQL • Create Database • Drop Database • Create table • Alter table • Drop table • Partitioning • Built-in operators • Built-in functions • Views and indexes
	Week 8 HiveQl • Select where • Order by • Group by • Joins
	Week 9 Map Reduce Applications • Mapper code • Reducer code • Combiner code
	Week 10 Pig Latin Scripts • Operators • Load & Store • Diagnostic • Grouping and Joining • Combining and Splitting • Filtering • Sorting
	Week 11 **Spark SQL**
	Week 12 Case Study on Hive and Pig from kaggle
	Week 13 Case Study on Map reduce
Text books and reference books	**Text Book(s):** [1]. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data" 1st Edition, TMH,2012. [2]. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.

	Reference Books: [1]. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley Publishers. [2]. Holden Karau, Andy Konwinski, Patrick Wendell, MateiZaharia, “Learning Spark: Lightning-Fast Big Data Analysis", O'Reilly Media, Inc.
E-resources and other digital material	[1]. https://www.tutorialsPInt.com/hive/index.htm [2]. https://www.tutorialsPInt.com/apache_pig/index.htm [3]. https://www.tutorialsPInt.com/mongodb/index.htm [4]. https://www.tutorialsPInt.com/map_reduce/index.htm

20IT6452C–INTERNET OF THINGS LAB

Course Category:	Program Elective-II	**Credits:**	1
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-2
Prerequisites:	Computer Networks	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.
	CO2	Choose the right sensors and actuators for an application.
	CO3	Test and experiment different sensors for application development.
	CO4	Develop IoT applications using Arduino/Raspberry Pi/open platform.
	CO5	Develop smart IoT Applications using smart sensor devices and cloud systems.
	CO6	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

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

CO	**PO**												**PSO**		**BTL**	**PI**
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		1									3		1	2	1.5.1, 3.2.2, 12.2.1
CO2	1		1									3	1		4	1.5.1, 3.2.2, 12.2.1
CO3				2	2							3	2	2	5	4.1.3, 5.2.1, 12.2.1
CO4				2	2							3	1	2	3	4.1.3, 5.2.1, 12.2.1
CO5			1	2											3	3.2.2, 4.1.3
CO6			1	2											3	3.2.2, 4.1.3

CourseContent	**Week1&2:** • Select anyone development board (Ex Arduino, Node MCU, Raspberry Pi) and control LED using the board. By using the Arduino / Raspberry Piboard read data from a sensor. Experiment with both analog and digital sensor. • WriteanArduinoprogramtocontrolanLEDlightusingpushbuttonandprintthestatusofbuttonandLEDonserialmonitor.
	Week3 • Write an Arduino program for interfacing the Arduino board with the LDR sensor and print output on Serial monitor. • ArduinoboardinterfacingwiththetemperatureandhumiditysensorandprintstheoutputonLCD/serialmonitor
	Week4 • Control any two actuators which are connected to development board using Bluetooth • Write an Arduino program for interfacing the Arduino board with the LDR sensor and activate the LED based on threshold value and print on LCD.
	Week5: • WriteanArduinoprogramforactivatingthebuzzerwhenmotionisdetectedusingrelay • Write an Arduino program for interfacing Arduino board with the Ultrasonic sound sensor and print the output on Serial monitor
	Week6: • Write an Arduino program for interfacing Arduino board with the IR sensor and print output on Serial monitor • Write an Arduino program for interfacing Arduino board with the Gas sensor and activate the buzzer if the value is greater than threshold value and print output on Serial monitor
	Week7: • Write a Python program to control an LED light using switch with Raspberry Pi board • Write a Python program to blink an LED using Raspberry Pi board
	Week8: • Write a Python program to interface LDR sensor with Raspberry Pi board. • WriteaPythonprogramtointerfaceIRsensorwithRaspberryPiboardanddisplaythedistanceoftheobject.
	Week9: • Write a Python program to interface Ultrasonic sensor with Raspberry Pi board and display the values of the sensor • DevelopaPythonprogramtointerfacetemperatureandhumiditysensorwithRaspberryPiboardanddisplaythe DHT values on LCD
	Week10: Case Study • Create any cloud platform account. Explore IoT Services. Register a thing in the platform and push the sensor data to cloud using MQTT protocol

Text books and Referenc e books	**Text Book(s):** [1] Vijay Madisetti and Arshdeep Bahga,**"**InternetofThings(AHands-on-Approach)**",** 1st Edition, VPT,2014. [2] Charalampos Doukas "Building Internet of Things with the Arduino" **Reference Books:** [1]. FrancisdaCosta,**"**RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything**",**1st Edition,ApressPublications,2013 [2]. JanHoller,Vlasios Tsiatsis,Catherine Mulligan, Stefan Aves and, Stamatis [3]. Karnouskos, David Boyle, **"**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**",**1st Edition,AcademicPress,2014.
E-resources and other digital material	[1].Raspberryt Pi3 Tutorial, Edureka, Decemberhttps://www.youtube.com/watch?v=QlApoEKGfU4 [2].SudipMishra, IIT,Kharagpur, "IntroductiontoIoT", NPTEL,https://nptel.ac.in/courses/106105166/2017.

20IT6452D - INFORMATION RETRIEVAL SYSTEM LAB

Course Category:	Program Core	**Credits:**		1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**		0-0-3
Prerequisites:	Data Mining lab	**Continuous Evaluation:**		30
		Semester end Evaluation:		70
		Total Marks:		100

Course Outcomes		Upon successful completion of the course, the student will be able to:
	CO1	Demonstrate genesis and diversity of information retrieval situations for text and hypermedia.
	CO2	Interpret different types of algorithms to provide better search results
	CO3	Analyze the functions of web search engines.
	CO4	Apply techniques for compressing dictionaries and inverted indexes

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	1		1									3		1	2	1.5.1,2.1.2, 3.2.2, 11.3.1
CO2	1		1									3	1		4	1.5.1,2.1.2, 3.2.2, 11.3.1
CO3				2	2							3	2	2	5	2.2.4, 5.2.1
CO4				2	2							3	1	2	3	1.5.1, 3.2.2, 5.2.1, 11.3.1

Course Content	**Week 1 :** Implement text processing using given text
	Week 2 : Perform lemmatization and Stemming on given text
	Week 3 : Create a inverted index for given text file Implement program to search for words and patterns in a given text file using inverted index
	Week 4 : Implement token normalization of a given text Perform count word frequency in a given text file
	Week 5 : Measure the rank of the specific word for its relevancy with in the text document using IDF Implement document ranking using vector space model
	Week 6 : Compute Similarity between two text documents Implement a basic IR system using Lucene
	Week 7: Extract data using web scraping and web crawling with python
	Week 8 : Build a corpus of language data and analyze this text, and visualize the results.
	Week 9 : Implementation of Retrieval evaluation of Web Search Engines

	Week 10 : Represent the likelihood of randomly clicking on links of a particular page using PageRank algorithm to output probability distribution.
	Week 11&12 : Case studies on Sentiment Analysis, image query processing
Text books **Reference books**	**Text Book(s):** [1]Stefan Buttcher , Charles L. A. Clarke , Gordon V. Cormack ,Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2016. **Reference Books:** [1] Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004. [2] SoumenChakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002. [3] Christopher D Manning, PrabhakarRaghavan, HinrichSchutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009
E-resources and other digital material	[1]PabitraMitra , Professor,CSEDepartment, IIT Khargapur, Information Retrieval, https://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html [2] Shehzaad Dhuliawala Maulikachhani, Information Retrieval, http://www.cfilt.iitb.ac.in/viva_workshop/Day4-Information_Retrieval-ShehzaadDhuliawala

20IT6353 - ADVANCED PROGRAMMING LAB – III

Course Category:	Programming Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20IT3353: Object Oriented Programming using C++ Lab 20IT5352- Advanced Programming Lab - II	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the basic concepts such as Stacks, Queues, Linked Lists and Hashing Techniques in the programming language.
	CO2	Demonstrate the use of stacks, queues and sequences in solving real world scenarios.
	CO3	Apply tries and trees in solving network related scenarios.
	CO4	Solve the problems with given test cases.
	CO5	Analyze the solutions for the problems using algorithm analysis concepts
	CO6	Apply programming skills for optimized code and derive the solutions according to the provided constraints.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1													1		2	
CO2	2				2								2		3	1.5.1, 5.2.1
CO3	2												2		3	1.5.1
CO4		2			2								1		3	2.1.2,2.3.1, 5.2.1
CO5		2											2		4	2.3.1
CO6	2	2											1		3	1.5.1, 2.3.1

Course Content

Course Content:

Solving the programs under “Easy / Medium” category in Leetcode, Topcoders, Codewars, CodeChef, HackerEarth, Hackerrank etc., Students must solve 100 problems from any of the online platforms. Students shall perform minimum of one contest for a month, with the support of online judges. Problems to be solved using either Python, C++, etc.,

Students should solve the problems on the following list of topics

- Stacks
- Queues, Sequences
- Dynamic Programming
- Tries
- Trees
- Decomposition
- Strings

	• Collections • Sequences • Computational Geometry Results of regular contests can be considered as day-to-day assessment of the laboratory. Monthly one such evaluation. Different problems should be solved by the students in the lab slot & at their homes with minimum of 15 problems per week.
Text books and Reference books	**Text Book(s):** [1]. Halim, Steven and Halim, Felix, Competitive Programming 1, 2013 [2]. Reema Thareja,"Python Programming Using Problem Solving Approach", Oxford University Press, 2019. **Reference Books:** [1]. Antti Laaksonen, "Guide to Competitive Programming", 1st edition, Springer International Publishing, 2017 [2]. Ahmed ShamsulArefin, Art of Programming Contest, ACMSolver, Second Edition, 2012 [3]. Zed Shah, "Learn PythonThe Hard Way", Third edition, Addison-Wesley, 2013. [4]. John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013
E-resources and other digital material	[1]. FilippRukhovich, Competitive Programming for beginners, [COURSERA]. (11-12-2021), Available: https://www.coursera.org/learn/competitive-programming-for-beginners [2]. Prof Neeldhara, IIT Gandhinagar, Getting Started with Competitive Programming,[NPTEL],(11-12-2021),Available :https://onlinecourses.nptel.ac.in/noc21_cs99/preview [3]. Prof. Erik Demaine,Prof. Ronald Rivest,Prof. SriniDevadas MIT Open Courseware, Introduction to Algorithms, Getting Started with Competitive Programming,[MIT], (11-12-2021),Available:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-spring-2008/index.htm [4]. Erik Demaine, Prof. Ronald Rivest, Prof. SriniDevadas, Lecture notes by EE & CSE of MIThttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2005/lecture-notes/ [5]. Hacker Rank, 11-12-2021 Available https://www.hackerrank.com/ [6]. Leet Code, 11-12-2021Availablehttps://leetcode.com/ [7]. Hacker Earth, 11-12-2021Available https://www.hackerearth.com/ [8]. Topcoder, 11-12-2021Available https://www.topcoder.com/challenges/ [9]. Coder Byte, 11-12-2021Available https://www.coderbyte.com/ [10]. Code wars, 11-12-2021Available https://www.codewars.com/ [11]. Code Signals, 11-12-2021Available https://codesignal.com/ [12].Code Chef, 11-12-2021 Available https://www.codechef.com/

20IT6554 - MINI PROJECT

Course Category:	Project	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-4
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify the problem, define objectives and scope of the project.
	CO2	Analyze the problem from state of the art for arriving at feasible solutions.
	CO3	Prepare an organized report employing elements of technical writing & critical thinking.
	CO4	Summarize and communicate the content to audience in an effective manner.

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

	PO												PSO			PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	BTL	
CO1	2	1					2	3	2		1	1		1	2	
CO2		3	2	2							2	2	2	2	4	
CO3						3	2	3	2	2	2	1	1	2	3	
CO4						1	2	2	3	3		2	1	1	2	

Course Content

Mini Project could be done in group of students; involves working under a faculty member and carrying out a detailed feasibility study, literature survey and preparing a work plan for major project

20MC6107A - INNOVATION, IPR AND ENTREPRENEURSHIP

Course Category:	Mandatory Course	**Credits:**	0
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2-0-0
Prerequisites:	--	**Continuous Evaluation:**	100
		Semester end Evaluation:	
		Total Marks:	100

Upon successful completion of the course, the student will have:

CO1	Learn the innovation concepts related to business organizations.
CO2	Understand the importance of innovation in new start-ups.
CO3	Know fundamental aspects of Intellectual property Rights.
CO4	Learn the basic concepts of entrepreneurship and its benefits.

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

CO	PO												PSO		BTL	PI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1		1						2	2		2				2	
CO2		2						1	2		2				2	
CO3		2						2	3		3				2	
CO4		1						3	2		2				2	

Course Content

UNIT – I Innovation Management: Introduction

Innovation: Definition, Importance – The need to view innovation in an organizational context – Different types of innovation - Innovation and Invention – Popular views of innovation – Innovation as a management process.

UNIT – II Innovation: New Product Development (NPD)

Innovation Management and New Product Development – Considerations when developing as NPD strategy - NPD as a strategy for growth – What is new product? – Classification of new
products – NPD as an industry innovation cycle.

UNIT – III – Intellectual Property Rights (IPR)

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development.

UNIT – IV - Entrepreneurship

Concept and need of entrepreneurship - Characteristics and Types of Entrepreneurship - Entrepreneurship as a career - Entrepreneurship as a style of Management - The changing role of the entrepreneur - Entrepreneurial traits, factors affecting entrepreneurs.

Text Books

[1] Paul Trott, Innovation Management and New Product Development, Pearson Education Limited, UK, 2017.
[2] Nithyananda, K V., Intellectual Property Rights: Protection and Management, Cengage Learning India Private Limited, 2019.
[3] Dr.S S Khanka, Entrepreneurial Development, S Chand, New Delhi, 2020.

Reference Books	[1] Managing innovation: Integrating Technological, Market and Organizational Change, Joe Tidd, John Besant, 2018. [2] Neeraj, P., &Khusdeep, D, Intellectual Property Rights. PHI learning Private Limited, India, 2019. [3] Vasant Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, India, 2022.
E-resources and other digital material	https://edisciplinas.usp.br/pluginfile.php/5553082/mod_folder/content/0/Trott%20-%202017%20-%20%20roz%20Innovation-Management-and-New-Product-Development.pdf?forcedownload=1

SEMESTER - VII

20IT7301-DEEP LEARNING

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT6302-Machine Learning	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes

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

CO1	Analyze the performance of feed forward neural networks with different hyper parameters
CO2	Apply CNN, Autoencoders, Attention mechanisms and GANson image processing applications
CO3	Design a suitable RNN model for time series applications
CO4	Create a suitable intelligent model for the given application

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

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	1	1						1	1			1	1	1
CO2	2	2		2				1	1			1	2	2
CO3	2	2		2				2	2			2	2	2
CO4	3	2	3		3			2	2			3	3	3

Course Content

UNIT I:

The Neural Network: Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neuron, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU, Softmax Output Layers

Training Feed-Forward Neural Network: Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm, Stochastic and Minibatch Gradient Descent, Test Sets, Validation Sets, and Overfitting, Preventing Overfitting in Deep Neural Networks

UNIT II:

Convolutional Neural Networks: Neurons in Human Vision,The Shortcomings of Feature Selection, Filters and Feature Maps, Convolutional Layer, Max Pooling, Full Architectural Description of Convolution Networks

Embedding and Representation Learning: Learning Lower-Dimensional Representations, Principal Component Analysis, Motivating the Autoencoder Architecture, Denoising to Force Robust Representations, Sparsity in Autoencoders, The Word2Vec Framework

UNIT III:

Sequence Modeling: **Recurrent and Recursive nets:** Unfolding Computational Graphs, Recurrent neural networks, Bidirectional RNNS, Encoder-Decoder sequence-to –sequence architectures, Deep Recurrent networks, Recursive neural networks

The Challenge of Long-Term Dependencies: Echo State Networks, Leaky Units & Other strategies for multiple timescales, The Long Short-Term memory and other Gated RNNs, Optimization for Long-Term Dependencies

UNIT IV:

Advanced Topics in Deep Learning: Attention Mechanisms, Recurrent Models of Visual Attention, Attention Mechanisms for Machine Translation, Neural Networks with External

	Memory **Generative Adversarial Networks:** Using GANs for Generating Image Data, Conditional Generative Adversarial Networks, Competitive Learning, Limitations of Neural Networks
	Content Beyond: The Transformer Neural Network
Text books and Reference books	**Text Book(s):** **[1].** Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Media, 2017 **[2].** Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning(Adaptive Computation and Machine Learning series",MIT Press, 2017 **[3].** Charu C. Aggarwal, Neural Networks and Deep Learning, c Springer International Publishing AG, part of Springer Nature 2018, ISBN 978-3-319-94462-3 ISBN 978-3-319-94463-0 (eBook) **Reference Books:** [1]. Li Deng and Dong Yu, "Deep learning Methods and Applications", Now publishers, 2013 [2]. Michael Nielsen,"Neural Networks and Deep Learning", Determination Press 2015 [3]. Vaswani A, Shazeer N, Parmar N, Uszkoreit J, Jones L, Gomez AN, Kaiser Ł, Polosukhin I. Attention is all you need. Advances in neural information processing systems. 2017;30.
E-resources and other digital material	[1]. MiteshKhapra, "Deep Learning", Sep 20, 2018 https://www.youtube.com/watch?v=4TC5s_xNKSs&list=PLH-xYrxjfO2VsvyQXfBvsQsufAzvlqdg9 [2]. AfshineAmidi and ShervineAmidi ,"Deep Learning cheat sheets for Stanford's CS 230", 2018, https://github.com/afshinea/stanford-cs-230-deep-learning [3]. YoshuaBengio, Deep learning: "Theoretical Motivations, Canadian Institute for Advanced Research", 2015 http://videolectures.net/deeplearning2015_bengio_theoretical_motivations/ [4]. Geoffrey Hinton's GoogleTech Talk,"Recent developments on Deep Learning" March 2010, https://www.youtube.com/watch?v=VdIURAu1-aU [5]. Eduardo Muñoz, Attention is all you need: Discovering the Transformer paper, Nov 2020, https://towardsdatascience.com/attention-is-all-you-need-discovering-the-transformer-paper-73e5ff5e0634

20IT7402A - SOFTWARE TESTING AND AUTOMATION

Course Category:	Programme Elective - 3	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites :	20IT5302 : Software Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes

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

CO1	Apply Black Box, White Box, and Selenium testing techniques in commercial environment for improving the quality of software product.
CO2	Choose the techniques and skills for testing software projects using modern software testing tools
CO3	Analyze V&V activities, software testing life cycle and methodologies, test automation life cycle and its frame work.
CO4	Create test cases for manual and automation testing.

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

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

Course Content

UNIT I:

Introduction to Software Testing : Introduction, Evolution of Software Testing, Software Testing – Myths and Facts, Goals of software Testing, Software Testing Definitions, Model for Software Testing, Effective software testing vs Exhaustive Software Testing.

Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle(STLC), Software Testing Methodology

Verification & Validation : Verification and Validation(V & V) Activities, Verification, Verification of Requirements, Verification of High-level Design, Verification of Low-level Design, How to verify code, Validation.

Case study: Design test cases for an enterprise application

UNIT II:

Black Box Testing Techniques: Boundary Value Analysis (BVA), Equivalence Class Testing, State Table based Testing, Decision Table based Testing, Cause -Effect Graphing based Testing.

White Box Testing Techniques: Need of White Box Testing, Logic Coverage Criteria, Basis Path Testing, Graph Matrices, Loop Testing, Data Flow Testing

Case study: Income tax calculator

UNIT III:

Test Automation: Introduction, Test automation life cycle, Test automation

	approach, Test automation framework. **Agile Test Automation:** Agile automation, Agile automation framework..
	UNIT IV: **Selenium:** Getting Started with Selenium IDE, Locators, Overview of Selenium WebDriver, Working with WebDriver **Case study:** Applying Selenium testing for an enterprise application.
Text books and Reference books	**Text Book(s):** [1]. Naresh Chauhan, "Software Testing Principles and Practices, Oxford University Press, 2010. [2]. Rajeev Gupta, "Agile automation and unified functional testing", Pearson 2017. [3]. David Burns, "Selenium 2 Testing Tools Beginner's Guide", Published by Packet Publishing Ltd, 2012. **Reference Books:** [1]. Brian Marick , "The craft of software testing", Pearson Education, 2007 [2]. Edward Kit , "Software Testing in the Real World", Pearson.2002 [3]. Perry, "Effective methods of Software Testing", 3rd Edition, John Wiley,2006 [4]. Meyers, "Art of Software Testing, **3rd** Edition John Wiley. 2015 [5]. Dr.K.V.K.K.Prasad , "Software Testing Tools" , Dreamtech, 2009.
E-resources and other digital material	[1]. Prof. Rajib Mall, IIT Kharagpur, NPTEL SOFWARE Testing video. Available: https://nptel.ac.in/courses/106105150/, 2016 [2]. Software testing MIT. Available: http://ocw.mit.edu/courses/electrical-engineering-and-computer- science/6-912-introduction-to-copyright-law-january- iap-2006/video-lectures/lecture-4-software-licensing/ [3]. Gregory Gay. Associate Professor, Chalmers and the University of Gothenburg.Software Quality and Testing - Spring 2022, https://youtu.be/OLbo92_MgtU [4]. Sanjai Rayadurgam Director, https://www.coursera.org/lecture/introduction-software-testing /welcome-to-the-software-testing-and-automation-myKdt, 2020

20IT7402B- DEVOPS ESSENTIALS

Course Category:	Program Elective-3	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT6301-Cloud computing	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement software delivery models for continuous integration and deployment.
	CO2	Apply Docker file syntax to generate containers automatically.
	CO3	Analyze Kubernetes resources and interaction between Kubernetes components.
	CO4	Create a GIT repository in cloud for monitoring and logging of external resources.

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

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	3		1		2				2	2		2	2	1
CO2	3				1				1	1			2	1
CO3				3							1		3	1
CO4			2		3				1				1	3

Course Content

UNIT I:

Introduction to Devops: Software delivery challenges, Waterfall and physical delivery, Agile and electrical delivery, software delivery on the cloud, continuous Integration, Continuous Delivery, Configuration management, Infrastructure as code, Orchestration

Trend of Microservices: Modular programming, package management, MVC design pattern, Monolithic application, Remote Procedure call, RESTful design, Microservices.

UNIT II:

DevOps with Container: understanding container, Resource isolation, Linux container concept, Containerized delivery, getting started container, Installing Docker for Ubuntu, Installing Docker for CentOS, Installing Docker for macOS. **Container life cycle**: Docker basics, Layer, image, container, and volume, distributing images, connect container

Working with Dockerfile: writing your first Dockerfile, Dockerfile syntax, Organizing a Dockerfile.

UNIT III:

Understanding Kubernetes: Understanding Kubernetes, Kubernetes components, Master components, API server, Controller, Scheduler, Node components, Kubelet, Proxy, Docker, Interaction between kubernets master and nodes.

Getting started with Kubernetes:Preparing the environment, kubectl, kubernetes resources, kubernets objects, Namespace, Name, Label and selector, Annotation, Pods, ReplicaSet(RS) and Replication Controller (RC), Deployments, Services, volumes, Secrets, Control Map, Using ConfigMap via volume, Using ConfigMap via environment variables

UNIT IV:

Monitoring and Logging: Inspecting a container, Kubernetes dashboard, Monitoring in Kubernetes, Application, Host, External resources, container, Kubernetes, Getting monitoring essentials for Kubernetes,

Cluster Administration: Kubernetes namespaces, Default namespaces, Create a new namespace.

Content Beyond Syllabus: Introduction to MLOps

Text books and Reference books	**Text Book(s):** [1]. DevOps with Kubernetes: Accelerating software delivery with container by Hideto Saito, Hui-Chuan Chloe Lee, Cheng-Yang Wu, O' Reilly publications, 2017. **Reference Books:** [1]. Managing Kubernetes:OperatingKubernetes Clusters in the Real Worlds by Brendan Burns, Craig Tracey, O'Reilly publications, 2017. [2]. https://www.arrikto.com/mlops-explained/
E-resources and other digital material	**[1]. Introduction to DevOps Tools, Edureka, April, 2018, https://www.youtube.com/watch?v=lpWjKXa_4Hs** [2]. Hitesh Choudary, What is DevOps? Easy way, Aug 16, 2019 https://www.youtube.com/watch?v=_Gpe1Zn-1fE

20IT7402C –CYBER SECURITY

Course Category:	Program Elective-3	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT5301-Computer Networks	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Categorize various types of attacks in Information Security
	CO2	Apply data leakage prevention, protection and security policies on data
	CO3	Explore log files and backup strategies for securing the data in real time environment
	CO4	Analyze the issues in handling web vulnerabilities

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

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

Course Content

UNIT I:

Information Security and Threats: Introduction – Information Security, Information Assets & Threats - Threats to Information Assets, Types of Attacks, Types of Virus, Types of Worms, Types of Trojans, Network Attacks, Common Vulnerabilities and Exposures (CVE).**Case studies – malware attacks**

Fundamentals of Information Security: Elements of information security – Network Security, Application Security, Communications Security. Principles and concepts – data security – Critical Information Characteristics, Information States, Prevention Vs Detection, Types of controls – Access Control Models

UNIT II:

Data Leakage and Prevention: Introduction to Data Leakage, Organisational Data Classification, Location and Pathways, Content Awareness, Content Analysis Techniques, Data Protection

Network Sniffers and Injectors – Sniffers Overview, Tcpdump, Wireshark, Ettercap, Hping

UNIT III:

Log Correlation and Management: Event Logs - Concepts, Log Management and its need, Log Management Process, IIS Log Files, Log Analysis and Response.

Case study-The Log HERO-Monitor Bots like people in real time in Google Analytics

Data Backup: Data Backup -Overview, Types of Backup, Backup Procedures., Types of Storage

UNIT IV:

Web Application Hacking: Scanning for web vulnerabilities: Nikto, HTTP utilities - Curl, Open SSL, Application Inspection – Zed Attack Proxy, Sqlmap. Password cracking and Brute-force tools, Analysis of Web Application Security Vulnerabilities: A Case Study of Testing Web Applications

Basic forensics: Data Collection, Drive Imaging

	Content Beyond Syllabus: Overview of Cyber Ark tool
Text books and Reference books	**Text Book(s):** [1]. Student Handbook – Security Analyst, NASSCOM, 2015 [2]. Anti-Hacker Tool Kit (Indian Edition) Fourth Edition by Mike Shema, Publication McGraw Hill,2014 **Reference Books:** [1]. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley,2012 [2]. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009. [3]. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005 [4]. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006. [5]. McClure, Stuart, Saumil Shah, and Shreeraj Shah. Web Hacking: attacks and defense. Addison Wesley. 2003.
E-resources and other digital material	[1] Prof.V.Kamakoti ,Professor, Introduction to Information security, IIT Madras Jan 2015, https://nptel.ac.in/courses/106106129 [2] Prof.ChesterRebeiro , Professor ,Secure System Engineering ,IIT Madras, Jan 2023,https://nptel.ac.in/courses/106106199 [3] Sanjay Goel, Associate Professor , Introduction to Cybercrime and Fundamental Issues, sep 2022, https://in.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq [4] https://www.bt.com.au/professional/knowledge-centre/business-resources/business-development/targeted-malware-attacks.html [5] Ravindra Savaram, "CyberArc tutorial" January 2023 https://mindmajix.com/cyberark-tutorial

20IT7403A–BUSINESS INTELLIGENCE

Course Category:	Program Elective -4	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	NIL	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify the objectives and practices for deploying a business intelligence (BI) program
	CO2	Apply processes to transform an organization's data into actionable knowledge.
	CO3	Analyze BI program, from the value of information to the actual use of discovered knowledge.
	CO4	Interpret behavioural model to assess the behaviour of the customer.

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												1	
CO2		1	2										1	1
CO3		2	2			2							2	1
CO4			2	2	3			2					2	1

Course Content

UNITI:

Business Intelligence and Information Exploitation- Improving the Decision Making Process, A Business Intelligence Program, Business Intelligence and Program Success, The Analytics Spectrum, Taming the Information Explosion.

The Value of Business Intelligence- Value Drivers and Information Use**,** Performance Metrics and Key Performance Indicator, Using Actionable Knowledge**,** Horizontal Use Cases for Business Intelligence**,** Vertical Use Cases for Business Intelligence

UNITII:

Planning for Success-Introduction, Organizational Preparedness for Business Intelligence and Analytics ,Initial Steps in Starting a Business Intelligence Program, Bridging the Gaps between Information Technology and the Business Users, Knowing the Different Types of Business Intelligence Users, Business Intelligence Success Factors: A Deeper Dive, Moreon Building Your Team, Strategic Versus Tactical Planning

Developing Your Business Intelligence Roadmap-The Business Intelligence and Analytics Spectrum, The Business Intelligence Roadmap: Example, Planning the Business Intelligence Plan.

Case Study: BI for Finance Department

	UNITIII: **The Business Intelligence Environment**- Aspects of Business Intelligence and Analytics Platform and Strategy, The Organizational Business Intelligence Framework, Services and System Evolution Business Processes and Information Flow-Analytical Information Needs and Information Flows, Information Processing and Information Flow, The Information Flow Model. **Data Requirements Analysis**- Introduction, Business Uses of Information, Metrics: Facts, Qualifiers and Models, Data Requirements Analysis. Case Study: BI for Employee Satisfaction
	UNITIV **Data Profiling**- Establishing Usability of Candidate Data Sources, Data Profiling Activities, Attribute Analysis, Relationship Analysis **Deriving Insight from Collections of Data**- Introduction, Customer Profiles and Customer Behavior, Customer Lifetime Value, Demographics, Psychographics, Geographics, Behavior Analysis. **Case Study** : BI for Health care
TextbooksandReferencebooks	**Text Books:** [1].Business Intelligence: The Savvy Managers Guide, David Loshin, The Morgan Kaufmann Series,2nd edition,2013. **Reference Books:** [1].Business Intelligence Roadmap – The Complete Project Lifecycle of Decision-Support Apps ,Larissa T. Moss &ShakuAtre, ,2015 [2].Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman,1st edition,2018
E-resourcesandotherdigitalmaterial	[1]. NeedforDataWarehouse&BusinessIntelligence,MicrosoftBusinessIntelligence,https://freevideolectures.com/course/3635/microsoft-business-intelligence/11 [2]. BusinessAnalytics&TextMiningModelingUsingPython,Prof.GauravDixit,DepartmentofManagement,IITRoorkee,https://nptel.ac.in/courses/110/107/110107092/ [3]. BusinessAnalytics&Intelligence,IIMBangalore,https://iimb.ac.in/eep/product/259/Business-Analytics-Intelligence

20IT7403B- COMPUTER VISION

Course Category:	Program Elective -4	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20BS1101-Mathematics – I 20ES1103-Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply filters, wavelets and Fourier transforms for image processing applications.
	CO2	Analyse various feature detection and matching techniques to solve the problems such as rectangular detection.
	CO3	Implement the concepts of computer vision techniques for Image Segmentation
	CO4	Demonstrate the knowledge of motion estimation in video processing applications such as video stabilization and de-noising

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

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	2													
CO2		2											1	
CO3	2		1		2				1				2	2
CO4		2	2		2				1				2	2

Course Content

UNIT I:
Introduction: Computer vision, A brief history.
Image formation: Geometric primitives and transformations**,** Photometric image formation
Image processing: Point operators, Linear filtering, More neighbourhood operators, Fourier transforms, Pyramids and wavelets,
Application: Image blending

UNIT II:
Feature detection and matching: Points and patches, **Application:** Performance-driven animation Edges, **Application**: Edge editing and enhancement, Lines, **Application**: Rectangle detection.

UNIT III:
Image Segmentation: Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, **Application:** Medical image segmentation.
Feature-based alignment: Pose estimation
Application: Augmented reality

UNIT IV:
Dense motion estimation: Parametric motion, **Application:** Video stabilization, Optical flow, **Application:** Video de-noising, Layered motion,
Application: Frame interpolation.

Text books and Reference books

Text Book(s):

[1]. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

Reference Books:

[1]. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education,

	2003. [2]. K. Fukunaga: Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990. [3] R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
E-resources and other digital material	[1]. Dr. Mubarak Shah, (04-01-2023). UCF Computer Vision Video Lectures, https://www.youtube.com/watch?v=715uLCHt4jE&list=PLd3hlSJsX_ImKP68wfKZJVIPTd8Ie5u-9 [2]. Stanford University School of Engineering , (04-01-2023), Introduction to Convolutional Neural Networks for Visual Recognition,https://www.youtube.com/watch?v=vT1JzLTH4G4&list=PLf7L7Kg8_FNxHATtLwDceyh72QQL9pvpQ

20IT4703C – REMOTE SENSING AND GIS

Course Category:	**Elective**	**Credits:**	3
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the concepts of remote sensing and GIS
	CO2	Apply image processing, machine learning and deep learning techniques on remote sensing data to solve societal problems
	CO3	Analyze remote sensing image using visual interpretation and digital image processing techniques to solve societal problems
	CO4	Explore the recent trends and tools in GIS and remote sensing

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)

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

Course Content

UNIT I:

Concept of Remote Sensing: Introduction, Definition of Remote Sensing, Data, Remote Sensing Process, Source of Energy, Interaction with Atmosphere, Interaction with Target, Recording of Energy by Sensor, Transmission-Reception and Processing, Interpretation and Analysis

Types of Remote Sensing and Sensor Characteristics:

Introduction, Types of remote sensing, Characteristics of images, Remote Sensing Satellites, Sensor Resolutions, Unmanned Aerial Vehicle based Remote Sensing

UNIT II:

Visual Image Interpretation

Introduction, Image Interpretation, Elements of Visual Image Interpretation, Generation of Thematic maps, Thermal Image Interpretation, Radar Image Interpretation

Case Study: Understanding an image and visual interpretation using SAGA

Digital Image Processing

Introduction, Pre-processing, Image Enhancement, Image Transformation, Image Classification, Applications of Remote Sensing

UNIT III:

Concept of GIS

Introduction, Definition of GIS, Key Components of GIS, GIS-Three Views of Information System, GIS-A Set of Interrelated Subsystems, Functions of GIS, Advantages of GIS

Spatial Data Model

Introduction, Spatial, Thematic and Temporal dimensions of Geographical Data, Spatial Data Model, Raster Data Model, Vector Data Model, Raster Versus Vector, File Formats of Spatial Data

	UNIT IV: **Modern Trends of GIS:** Introduction, Local to Global Concept in GIS, Increase in Dimensions in GIS, Integration of GIS and Remote Sensing, Integration of GIS and Multimedia, 3D GIS, 4D GIS and Real-time GIS, Mobile GIS **Change Detection**: Introduction, Change Detection- Image Overlay, Image Subtraction, Spectral-Temporal Classification, Image Regression, Principal Component Analysis Transformation, Artificial Neural Network, Image Classification and Post Classification Comparison
Text books and Reference books	**Text Book(s):** [4]. Remote sensing and GIS, Bhatta B (2008) , Oxford University Press [2].Remote Sensing and Geographic Information System, Anji Reddy, Third Edition BS Publications. **Reference Books:** [3]. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008. [4]. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015. [5]. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015
E-resources and other digital material	[4]. Prof. Pennan Chinnasamy, Centre for Technology Alternatives for Rural Areas (CTARA) Department,IIT Bombay https://nptel.ac.in/courses/106/105/106105077/ [5]. Don Boyes, Professor, Geography and Planning https://in.coursera.org/specializations/gis-mapping-spatial-analysis#instructors [6]. Indian Geospatial education portal https://dst-iget.in/

20IT7404A–NATURAL LANGUAGE PROCESSING

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply preprocessing techniques on text data.
	CO2	Solve NLP problems using probabilistic language models
	CO3	Analyze linguistic structure in text, using parsing and CFG
	CO4	Construct syntactic and semantics structures for a given sentence

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

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	3				2								1	2
CO2	2	2	2		1								1	2
CO3		3							2				1	2
CO4	3	1	1		2				2				1	2

Course Content

UNIT I:

Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, Words, Corpora, Text Normalization, Word Tokenization, Word Normalization, Lemmatization and Stemming, Minimum Edit Distance, The Minimum Edit Distance Algorithm.

Natural Language Toolkit (NLTK)**:** Introduction to NLTK, Performing Text Analysis Tokenization, Normalization, Stemming, Lemmatization and POS tagging using NLTK.

UNIT II:

N-gram Language Models – N Grams, Evaluating Language Models, Perplexity, Smoothing-Laplace smoothing, Add-k Smoothing, Back off and Interpolation.

Naive Bayes and Sentiment Classification – Naive Bayes Classifiers, Training the Naïve Bayes Classifier, Worked example, Naïve Bayes as a Language Model, NaiveBayes as a language model.

UNIT III:

Sequence Labeling for parts of Speech and Named Entities: English Word Classes, Parts-of-speech-Tagging, Named Entities and Named Entities Tagging, HMM Parts of Speech Tagging.

Machine Translation and Encoder-Decoder Models: Language divergences and Typology, The Encoder-Decoder Model, Encoder-Decoder with RNNs.

Constituency Grammars: Constituency, Context-Free Grammars, Some Grammar Rules for English.

Case Study: Generation of Tags from a given sentences using Penn Treebank tagset.

UNIT IV:

Dependency Parsing: Dependency Relations, Dependency Formalisms, Dependency Tree banks.

Logical Representations of Sentence Meaning: Computational Desiderata for Representations, Model-Theoretic Semantics, First-Order Logic, Variables and Quantifiers, Lambda Notation, Inference, Event and State Representations.

Word Senses and WordNet: Word Senses, Relations Between Senses, WordNet: A

	Database of Lexical Relations, Word Sense Disambiguation. **Case Study:** Sentiment analysis of text data using NLTK
Text books and Reference books	**Text Book(s):** **[1].** Daniel Jurafsky and James H.Martin,"Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics,andSpeechRecognition", (availbale at https://web.stanford.edu/~jurafsky/slp3/),2022.) **[2].** Tom Aarsen, Joel Nothman, Steven Bird, Natural Language Toolkit Documentation, NLTK Project, 2023 **Reference Books:** [1]. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019. [2]. Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018. [3]. Michael Nielsen,"Neural Networks and Deep Learning", Determination Press 2015
E-resources and other digital material	[1]. Dan Jurafsky and Christopher Manning, Natural Language Processig Course,Stanford,26th Jun2019, https://web.stanford.edu/~jurafsky/NLPCourseraSlides.html [2]. Dan Jurafsky and Christopher Manning, Natural Language Processig Course,10th Jun2018, https://www.youtube.com/watch?v=3Dt_yh1mf_U&list=PLQiyVNMpDLKnZYBTUOlSI9mi9wAErFtFm [3]. Prof. DragomirRadev,Ph.D.,Lecture Series on Natural Language Processing, Department of School of Information, University of Michigan,Mar 2016 https://www.youtube.com/playlist?list=PLLssT5z_DsK8BdawOVCCaTCO99Ya58ry [4]. https://www.nltk.org/howto.html

20IT7404 B- WIRELESS NETWORKS

Course Category:	Program Elective -5	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT5301-Computer Networks	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Explore the tremendous changes in wireless systems and their applications
	CO2	Implement routing techniques in adhoc and mobile networks
	CO3	Apply improved data services related to mobility, edge computing in real time applications, based on user preferences
	CO4	Analyse security essentials and its services to mitigate attacks in wireless network

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

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	1											2	1	
CO2		1	1		1								1	
CO3		1										1		1
CO4	1	2			1	1							1	

Course Content

UNIT I:

Introduction to Wireless Networks – Evolution of Wireless Networks, Early Mobile Telephony, Analog Cellular Telephony, Digital Cellular Telephony, Cordless Phones, Wireless Data Systems, Fixed Wireless Links, Satellite Communication Systems,Third Generation Cellular Systems and Beyond.

Wireless Communications Principles and Fundamentals: Multiple Access for Wireless Systems- FDMA, TDMA, CDMA, CSMA.

UNIT II:

Future Trends : 4G Systems and Beyond -Design Goals for 4G and Beyond and Related Research Issues, OFDM,4G Services and Applications, Challenges: Predicting the Future of Wireless Systems: Scenarios: Visions of the Future, Trends for Next-generation Wireless Networks, Scenario 1: Anything Goes, Scenario 2: Big Brother, Scenario 3: Pocket Computing.

Satellite Networks: Applications of Satellite Communications, Satellite Systems: Low Earth Orbit(LEO), Medium Earth Orbit (MEO), Geosynchronous Earth Orbit (GEO)

UNIT III:

Wireless Local Area Networks: Introduction, Benefits of Wireless LANs, Wireless LAN Applications, Wireless LAN Concerns, Wireless LAN Topologies, Wireless LAN Requirements.

Security Issues in Wireless Systems: The Need for Wireless Network Security, Attacks on Wireless Networks, Security Services, Wired Equivalent Privacy (WEP) Protocol.

UNIT IV:

Mobile Network layer-Mobile IP- Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, IPv6, **Mobile ad-hoc networks:** Routing, Destination sequence distance vector (DSDV),Dynamic Source Routing(DSR).

	Introduction (Mobile Edge Computing) : Mobile Cloud Computing (MCC), Overview of Mobile Edge Computing (MEC), Mobile Edge Computing :Hierarchical architecture of Mobile Edge Computing(MEC), Challenges and Future Directions, Mobile Edge Computing for Beyond 5G/6G: Fundamental Characteristics of 6G, The Future of Mobile Edge Computing: MEC in other applications - Pandemics, Industrial IoT (IIoT), Disaster Management
Text books and Reference books	**Text Book(s):** [1]. GeorgiosI. Papadimitriou, AndreasS.Pomportsis, P.Nicopolitidis, Mohammed, S.Obaidat,"Wireless Networks", John Wiley & Sons Ltd, 2003. [2]. Jochen Schiller,"Mobile Communications", Second Edition, Pearson Education,2008. [3]. Zhang, Y, "Mobile Edge Computing", Simula Springer Briefs on Computing, Vol 9. Springer, 2022. **Reference Books:** [1]. William Stallings, "Wireless Communications and Networks", Second Edition, Pearson Education, 2005.
E-resources and other digital material	[1]. AdityaK .Jagannatham, IIT Kanpur, "Bluetooth and Future" [NPTEL] Mod-06 Lec-39, 2015 https://www.youtube.com/watch?v=vjhp0zTXEsc [2]. Satish Kashyap,NITSurat, Multiple Access Techniques; Ana. & Dig, dated on 11th June 2019https://www.youtube.com/watch?v=vtiup1w1c4E [3]. Prof.SSekhar Das, IIT Kharagpur(July,2018).Evolution of wireless Communication, https://www.youtube.com/watch?v=d7zeaz-NjmM

20IT7404C – SOFTWARE PROJECT MANAGEMENT

Course Category:	Program Elective -5	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20IT3502-Software Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify the risk management techniques to quantify the likely effect of risk on project timescales.
	CO2	Apply the estimation techniques and planning process to handle the project.
	CO3	Examine a project to identify the scope of work, provide accurate cost estimates and to plan the various phases like design and development.
	CO4	Analyze project monitoring and control techniques

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

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1		2			2						1	1	2	
CO2		3	1							1	1	2	2	
CO3	1										2	2	2	
CO4		3	3	2							2	2	2	

Course Content

UNIT I:

Risk Management: Concepts of Risks and Risk management, Risk Assessment, Risk Control, Examples

Project Planning Infrastructure: The process database, The process capability baseline, Process assets and the body of knowledge systems

Process planning: The infosys development process, Requirement change management , Process planning for ACIC project

UNIT II:

Effort Estimation & Scheduling :

Estimation and scheduling concepts, Effort Estimation, Scheduling

Quality Planning : Quality concepts, Quantitative Quality Management Planning, Defect Prevention Planning, The Quality Plan for the ACIC Project.

Measurement & Tracking Planning: Concepts in Measurement, Measurements, Project Tracking , The ACIC Measurement and Tracking Plan

UNIT III:

Project management Plan: Team management, Customer Communication and issue resolution, The structure of Project Management Plan, The ACIC Project Plan.

Configuration management: Concepts in Configuration Management, The Configuration Management Process, The ACIC Configuration Management Plan.

UNIT IV:

Reviews: The Review Process, Data Collection, Monitoring & Control

Project Monitoring &Control: Project Tracking, Milestone Analysis, Activity-Level Analysis Using SPC, Defect Analysis & Prevention, Process Monitoring & Audit.

Project Closure: Project Closure Analysis, The ACIC Closure analysis report.

Text books and Reference books	**Text Book(s):** [1]. Pankajjalote, "Software project management in practice" Addison-Wesley First Edition, 2002 **Reference Books:** [1]. Watts Humphrey, "Managing the Software Process", Pearson Education, New Delhi, 2000 [2]. PankajJalote, "Software Project Management in practical", Pearson Education, New Delhi, 2002.
E-resources and other digital material	[1]. Prof. Arun Kanda , IIT Delhi, Project and Production Management, http://www..nptelvideos.in/2012/12/project-and-production-management.html [2]. Prof. Rajib Mall, Prof. Durga Prasad Mohapatra, NOC:Software Project Management, IIT Kharagpur, https://nptel.ac.in/courses/106105218

20IT7607A - USER INTERFACE DESIGN AND IMPLEMENTATION

Course Category:	Skill Advanced Course	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:	20ES3151- Web Programming Lab	**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Implement design-centric approach to user interface and user experience to design static screen-based interface.
	CO2	Apply best practices of UI/UX design to create effective and compelling screen-based experiences for websites or apps.
	CO3	Develop a comprehensive complex website via the strategy, scope of the site, information architecture and overall structure
	CO4	Create user experience to actual user interfaces using wireframes, high-fidelity mock-ups, and clickable prototypes

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

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1					2							1	2	1
CO2			3		2								2	2
CO3			3		3			3					1	1
CO4			3		3			3				2	1	1

Course Content

UNIT I:
Visual Elements of User Interface Design:
Introduction to UI, Relation between UI and UX, Rolls in UI/UX, A Brief Historical Overview of Interface Design, Template vs Content, Aesthetics & Functionality
Formal Elements of Interface Design: Design before Design, Look and Feel, Language as a design tool, Color and Shape, imagery, topography,
Active elements of Interface Design: Static to active, functionality, speed and style, composition structure, Buttons, states and changes
Composing the elements of Interface design: Invisible Complexity: Making a Whole from Many Parts, Hierarchy of Content, Conventions and Expectations, Structure and Grids, Platforms and Screen Sizes

UNIT II:
UX Design Fundamentals: Ideation, Articulation, Development, Planning, Testing, Researching, Mapping. Wireframes and Interfaces, Nielsen's Usability Heuristics, Consistency and Details, Wireframe Map, Visual Direction, Feeling Real, Branching Out, Publish your Prototype

UNIT III:
Web Design: Strategy and Information Architecture
The User Experience Process, Determining Strategy, Outlining Scope, the Sitemap

UNIT IV:
Web Design: Wireframes to Prototypes: Introduction to Wireframes, Example Wireframes: Pasadena Conservatory of Music, Visual mock-up, Design Principles, Survey of Web Technologies, HTML vs. CSS vs. JavaScript, Clickable Prototypes Introduction, Importing

	Assets and Creating Hotspots, Hotspot Templates. **Figma**: Exploring Figma and Transitioning from Other Tools, Structuring Moodboards, Personas, and User Flows within FigJam, Design Environment
	Case Study: UI Inventory, Creation of prototypes
Text books and Reference books	**Text Book(s):** [1]. A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012. [2]. The Elements of User Experience: User-Cantered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011. [3]. Fabio Staiano, Designing and Prototyping Interfaces with Figma, PacktPublishing, 2022 **Reference Book(s):** [1]. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007. [2]. The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012
E-resources and other digital material	[1]. Michael Worthington, UI / UX Design Specialization, 04-01-2023, https://in.coursera.org/specializations/ui-ux-design#course [2]. Daniel Walter Scott,User Experience Design Essentials - Adobe XD UI UX Design,04-01-2023,https://www.udemy.com/course/ui-ux-web-design-using-adobe-xd/ [3]. Robert Miller, User Interface Design And Implementation, 04-01-2023, https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/ [4].User Interface Design Features, Infosys Springboard, 12-01-2023, https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0135015849 5203328011860/overview [5].Mark Newman, Introduction to User Experience Principles and Processes, Infosys Springboard, 12-01-2023, https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0132677032 78886912361/overview

20IT7607 B - FULL STACK DEVELOPMENT

Course Category:	Skill Advanced Course	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:	20ES3151 Web Programming Lab	**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop dynamic web applications using Full Stack MEAN Framework
	CO2	Implement HTTP Services and Express in Node environment
	CO3	Create Front End Applications using Angular framework
	CO4	Design web applications that can interact with a MongoDB database

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

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1			2		2				2			2	2	2
CO2					2									1
CO3			2		3				2			2	2	2
CO4			2		2								2	1

Course Content

UNIT I:

Node JS: Introduction to node to angular stack, understanding and installing node JS, working with node packages, writing data to console. Events, event model, event queue, call back implementations.

Data Handling: Working with JSON, buffer model to buffer data, stream module to stream data

UNIT II:

File System Access: Synchronous and asynchronous file system calls, writing and reading files.

HTTP Services: Processing URLs, understanding Request, Response and Server objects, Implementing HTTP Clients and Servers in Node.js, Implementing HTTPS Servers and Clients.

Express: Implementing Express in Node.js, Configuring Express Settings, Starting the Express Server, Configuring Routes, Using Requests Objects, Using Response Objects

UNIT III:

Angular: Understanding Angular, Separation of Responsibilities, Adding Angular to the Environment, Angular CLI, Creating a Basic Angular Application, Angular Components, Expressions, Bindings, Directives-Structural and Attributes, Events and Change Detection, Using Observables.

UNIT IV:

MongoDB and Node.js: Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Understanding the Objects, Accessing and Manipulating Database. Introducing the Data Set, Understanding Query Objects, Understanding Query Options Objects, Finding Specific Sets of Documents, Counting Documents, Limiting and Sorting Result Sets.

Case Study: Develop angular applications to interact with server and database

Text books and Reference books	**Text Book(s):** [1]. Brad Dayley, Brendan Dayley, Caleb Dayley, Node.js, MongoDB and Angular Web Development, 2nd Edition,Addison-Wesley Professional, 2017 **Reference Book(s):** [1]. EladElrom, Pro MEAN Stack Development, Apress, 1st edition, 2016 [2]. Greg Lim, Beginning MEAN Stack , Apress, 1st edition, 2021 [3]. Amos Q. Haviv Amos Q Haviv, Mean Web Development, Packt publishers, 2nd Edition, 2016
E-resources and other digital material	[1]. EC-Council, Secure Full Stack MEAN Developer, 04-01-2023, Available: https://in.coursera.org/learn/secure-full-stack-mean-developer#syllabus [2]. Maximilian Schwarzmuller, Angular &NodeJS - The MEAN Stack Guide, 04-01-2023, Available:https://www.udemy.com/course/angular-2-and-nodejs-the-practical-guide/ [3]. Angular, Google, 04-01-2023 Available: https://angular.io/docs [4]. Express, IBM, 04-01-2023 Available: https://expressjs.com/ [5]. MongoDB, 04-01-2023 Available: https://www.mongodb.com/ [6]. Full Stack Development with the MEAN Stack Bootcamp, Infosys Springboard, 12-01-2023, https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501555969409024810 1/overview

20IT7607 C - AUGMENTED AND VIRTUAL REALITY

Course Category:	Skill Oriented Course	**Credits:**	2
Course Type:	Theory	**Lecture-Tutorial-Practice:**	1-0-2
Prerequisites:	NIL	**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Illustrate the applications of VR to the conduct of scientific research, training, and industrial design.
	CO2	Analyze virtual environment technology, including 3D rendering software, tracking hardware for capturing user data.
	CO3	Apply advanced and interactive techniques for large scale, real time environments in Virtual Reality
	CO4	Examine various visualization techniques for augmented reality

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

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

Course Content

UNIT I:

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality Primary Features and Present Development on Virtual Reality – MultipleModelsofInputandOutputInterfaceinVirtualReality:Input-Tracker - Sensor - Digital Glove - Movement Capture-Video-based Input - 3D Menus & 3DScannerOutput - Visual/Auditory/Haptic Devices.

UNIT II:

Visual Computation in Virtual Reality: Fundamentals of Computer Graphics –Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

UNIT III:

Interactive Techniques in Virtual Reality: BodyTrack-HandGesture-3D Manus-Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3DStandard;Vega-MultiGen-Virtools.

Application of VR in Digital Entertainment: VR Technology in Film & TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

UNITIV:

Augmented and Mixed Reality: Taxonomy-technologyandfeaturesofaugmentedreality-differencebetweenARand VR - Challenges with AR - AR systems and functionality - Augmented reality methods – visualization techniques for augmented reality-wireless displays in educational augmented reality applications-mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments -evaluating AR systems.

The Metaverse and the Real-World Universe: Background of the Metaverse, Concept and Characteristics of the Metaverse, Main Technologies Involved in the Metaverse, Evolution of

	the Metaverse
Text books and Reference books	**Text Book(s):** [1]. Burdea,G. C.,P.Coffet.,VirtualRealityTechnology,SecondEdition,Wiley-IEEEPress, November 2017. [2]. AlanB.Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann,2013. **Reference Books:** [1]. Steve Aukstakalnis ,Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VRAddison-Wesley Professional, 08-Sept-2016 [2]. Alan Craig, William Sherman, Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design , Morgan Kaufmann, 2009.
E-resources and other digital material	[1]. Brian Hui, Product Designer XR Healthcare: Intro to AR/VR and Its Applications in Healthcare, 17 Jun 2021, https://www.youtube.com/watch?v=Ch4RKOD8uHk **[2].** Prof.SudipMisraIITKharagpur,Industry 4.0: Augmented Reality and Virtual Reality,July 2018**, https://www.youtube.com/watch?v=zLMgdYI82IE** [3]. Prof Steven LaValle, Visiting Professor, IITM, UIUC Virtual Reality. 25 Jan 2016, https://www.youtube.com/watch?v=aNC5YMUTcQ4&list=PLbMVogVj5nJSyt80VRXYC-YrAvQuUb6dh

20IT7551-MINI PROJECT-II

Course Category:	Internship/ Project	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20IT6554- Mini Project-I	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Compile relevant data, interpret and analyse the correlation among the data features.
	CO2	Derive the logical conclusions based on the analysis, interpretation of the data, and propose suitable methodology for the chosen problem.
	CO3	Implement the recommended methodology using appropriate techniques
	CO4	Work as an individual or in a team in development of technical projects.
	CO5	Prepare technical report and communicate the content to audience in an effective manner.

Contribution of Course Outcomes towards achievement of Program Outcomes 1-Low, 2-Medium, 3-High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
	CO1	1	1	2	3	2				2			2	1	2
	CO2	1	1	3	3	3				2		1	2	2	2
	CO3	1	1	3	3	3				2		1	2	3	3
	CO4			1	1					3	2	1	2	1	1
	CO5						1	1	3	3	3	1	2	1	1

20IT7552 –INDUSTRIAL/ RESEARCH INTERNSHIP

Course Category:	**Internship/project**	**Credits:**	1.5
Course Type:		**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply the Technical Knowledge in Real Industrial Situations
	CO2	Assess the Strengths, Weaknesses, Opportunities and Threats of the project
	CO3	Apply Soft skills such as time management, positive attitude and communication skills during internship
	CO4	Implement the Engineer's Responsibilities and Ethics

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3-High)		PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
	CO1	**3**	**3**	**3**	**2**	**2**								1	2
	CO2									**3**	**3**			1	2
	CO3									**3**	**3**	**2**	**2**		
	CO4						**3**		**3**			**3**	**2**		

SEMESTER- VIII

20IT8551-MAJOR PROJECT

Course Category:	Project	**Credits:**	12
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-24
Prerequisites:	Mini Project-II	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design, develop and test the developed model using advanced techniques
	CO2	Compare and analyse the proposed framework results with state-of-the-art techniques.
	CO3	Derive and justify the conclusions from the work done and make recommendations for future improvement.
	CO4	Work as an individual or in a team in the development of technical projects.
	CO5	Create a logically coherent project report and project the work in an effective manner.

Contribution of Course Outcomes towards achievement of Program Outcomes 1-Low, 2-Medium, 3-High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
	CO1	2	2	3	3	2				2		1	2	2	2
	CO2	1	2	3	2	3				2		2	2	2	2
	CO3	1	1	2	3	3				2		1	2	2	2
	CO4			1	1					3	2	1	2	1	1
	CO5						1	1	2	3	3	1	2	1	1