VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(AUTONOMOUS)

(Approved by AICTE, Autonomous, Accredited by NAAC at "A+" Grade & ISO 21001:2018 Certified, Affiliated to JNTUK)

Vijayawada – 520 007

SCHEME OF INSTRUCTION AND SYLLABUS
B.Tech in INFORMATION TECHNOLOGY
VR23 REGULATIONS

w.e.f 2023-2024

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

w.e.f. 2023-24   **VR23**

SCHEME OF INSTRUCTIONS AND SYLLABUS
of
FIRST AND SECOND YEAR B.TECH
in
INFORMATION TECHNOLOGY
w.e.f
2023-2024 (VR23)

Department of Information Technology
(B. Tech. IT Programme Accredited by NBA)

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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

DEPARMENT OF INFORMATION TECHNOLOGY

SCHEME OF INSTRUCTIONS FOR FOUR YEAR UG PROGRAM(VR23)

SEMESTER I

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Basic Sciences and Humanities Course	2	0	0	2
2	BS&H	Basic Sciences and Humanities Course	3	0	0	3
3	BS&H	Basic Sciences and Humanities Course	3	0	0	3
4	ES	EngineeringScience Course	3	0	0	3
5	ES	Introduction to Programming	3	0	0	3
6	BS&H	Basic Sciences and Humanities Course Lab	0	0	2	1
7	BS&H	Basic Sciences and Humanities Course Lab	0	0	2	1
8	ES	Engineering Lab	0	0	3	1.5
9	ES	Engineering Science Lab	0	0	3	1.5
10	BS&H	Health and wellness, Yoga and Sports	-	-	1	0.5
Total			**14**	**00**	**11**	**19.5**

SEMESTER II

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Basic Sciences and Humanities Course	3	0	0	3
2	BS&H	Basic Sciences and Humanities Course	3	0	0	3
3	ES	Engineering Science Course	3	0	0	3
4	PC	Professional Core Course	3	0	0	3
5	ES	Engineering Science Course	1	0	4	3
6	ES	Engineering Science Lab	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	ES	Engineering Science Lab	0	0	3	1.5
9	PC	Professional Core Lab	0	0	3	1.5
10	BS&H	NSS/NCC/Scouts & Guides/ Community Service	-	-	1	0.5
11	BS&H	Introduction to Design Thinking	2	0	0	-
Total			**13**	**00**	**15**	**20.5**

DEPARTMENT OF INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTION FOR FOUR YEAR UG
PROGRAMME [VR23]

SEMESTER III

S.No.	Course Code	Course Category	Title	L	T	P	Credits
1	23HS3101	Humanities & Science	Engineering Economics & Management	2	0	0	2
2	23HS3102	Basic Science & Humanities	Universal Human Values 2 – Understanding Harmony	2	1	0	3
3	23ES3303C	Engineering Science	Digital Logic and Computer Organization	2	1	0	3
4	23IT3304	Professional Core	Advanced Data Structures & Algorithms	2	1	0	3
5	23IT3305	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	23TP3106	Skill Enhancement Course	Logic & Reasoning	0	0	2	1
7	23IT3651	Skill Enhancement Course	Python Programming Lab	0	0	2	1
8	23IT3552	Professional Core	Advanced Data Structures Lab	0	0	3	1.5
9	23IT3553	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
Total				**11**	**3**	**10**	**19**

DEPARTMENT OF INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTION FOR FOUR YEAR UG
PROGRAMME [VR23]

SEMESTER IV

S.No.	Course Code	Category	Title	L	T	P	Credits
1	23BS4101B	Engineering Science	Discrete Mathematical Structures	3	0	0	3
2	23ES4102B	Engineering Science	Probability & Statistics	3	0	0	3
3	23IT4303	Professional Core	Operating Systems	2	1	0	3
4	23IT4304	Professional Core	Database Management Systems	2	1	0	3
5	23IT4305	Professional Core	Software Engineering	3	0	0	3
6	23TP4106	Soft Skills	English for Professionals	0	0	2	1
7	23MC3107	Audit Course	Environmental Science	2	0	0	--
8	23IT4651	Skill Enhancement course	Python with DJango	0	0	2	1
9	23ES4152	Engineering Science	Design Thinking & Innovation	1	0	2	2
10	23IT4353	Professional Core	Operating Systems & Software Engineering Lab	0	0	3	1.5
11	23IT4354	Professional Core	Database Management Systems Lab	0	0	3	1.5
Total				16	2	12	22

**DEPARTMENT OF INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTION FOR FOUR YEAR UG
PROGRAMME [VR23]**

SEMESTER V

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Advanced Java	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Automata Theory & Compiler Design	3	0	0	3
4	Professional Elective-I	1. Object Oriented Analysis and Design 2. Cyber Security 3. Artificial Intelligence 4. Microprocessors & Microcontrollers 5. Data Warehousing & Data Mining	3	0	0	3
5	Open Elective- I		3	0	0	3
6	Professional Core	Advanced Java Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack Development-1	0	1	2	2
9	Engineering Science	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
		Total	15	1	10	23

DEPARTMENT OF INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTION FOR FOUR YEAR UG
PROGRAMME [VR23]

SEMESTER VI

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Cloud Computing	3	0	0	3
2	Professional Core	Cryptography & Network Security	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodologies 2. Augmented Reality & Virtual Reality 3. DevOps 4. Embedded Systems 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Distributed Operating System 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – II		3	0	0	3
7	Professional Core	Cloud Computing Lab	0	0	3	1.5
8	Professional Core	Machine Learning Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills OR IELTS	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
		Total	**20**	**1**	**08**	**23**
		Mandatory Industry Internship of 08 weeks duration during summer vacation				

DEPARTMENT OF INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

SEMESTER VII

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Blockchain Technology	3	0	0	3
2	Management Course-II	Human Resource Management	2	0	0	2
3	Professional Elective-IV	1. Software Architecture & Design Pattern 2. Deep Learning 3. Computer Vision 4. Internet of Things 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile methodologies 2. Metaverse 3. Big Data Analytics 4. Cyber Physical Systems 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	Prompt Engineering	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
		Total	**19**	**1**	**02**	**21**

SEMESTER VIII

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

Note : *Student need to do at least ONE MOOC Course (of 3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations*

Curricular Framework for Minor Program

- Students who are desirous of pursuing their special interest areas other thanthe chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parentdepartment
- A student shall be permitted to register for Minors program at the beginningof 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired ≥ 7.75 CGPA (Cumulative Grade point average) up to the end of 2nd semester without any history of backlogs.
- A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses by the department. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs.

MINOR COURSES OFFERED BY INFORMATION TECHNOLOGY DEPARTMENT

MINOR DEGREE IN INFORMATION TECHNOLOGY (DATA SCIENCE)

S.No	Course code	Course Name	Offered in Semester	L	T	P	Credits
Elective – Opt anyone of the course						
1	20ITM4701A	Fundamentals of Data Science	IV	3	0	2	4
2	20ITM4701B	Data Science With R Software	IV	3	0	2	4
Elective – Opt anyone of the course						
3	20ITM5701A	Data Warehousing and mining	V	3	0	2	4
4	20ITM5701B	Machine Learning	V	3	0	2	4
Elective – Opt anyone of the course						
5	20ITM6701A	Big Data	VI	3	0	2	4
6	20ITM6701B	Cloud Computing	VI	3	0	2	4
Elective – Opt anyone of the course						
7	20ITM7701A	Data Visualization	VII	3	1	0	4
8	20ITM7701B	Business Intelligence	VII	3	1	0	4
9	Self Learning course - 1	-		-	-	-	2
10	Self Learning course - 2	-		-	-	-	2

MINOR DEGREE IN INFORMATION TECHNOLOGY (SOFTWARE ENGINEERING)

S.No	Course code	Course Name	Offered in Semester	L	T	P	Credits
1	20ITM4702	Software Engineering	IV	3	0	2	4
2	20ITM5702	Agile Software Development	V	3	0	2	4
3	20ITM6702	Software Quality and Testing	VI	3	0	2	4
4	20ITM7702	Software Project Management	VII	3	0	2	4
9	Self Learning course - 1	-	-	-	-	-	2
10	Self Learning course - 2	-	-	-	-	-	2

Curricular Framework for Honors Program

- Students of a Department/ Discipline are eligible to opt for Honors Program offered by the same Department/ Discipline.
- A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired ≥ 8 CGPA without backlogs upto end of 2nd semester without any backlogs
- Student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree
- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, of domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

Honors Degree offered by IT Department

Honors in AI & Data Science

S.No	Course code	Course Name	Offered in Semester	L	T	P	Credits
1	20ITH4801A	Data Analytics	IV	4	0	0	4
2	20ITH5801A	Web and Text Mining	V	4	0	0	4
3	20ITH6801A	Social Media Mining	VI	4	0	0	4
4	20ITH7801A	Financial Analytics	VII	4	0	0	4
(MOOCs - Self Learning)							
5	20ITH5811	Advanced Data Science	V	-	-	-	2
6	20ITH7812	Machine Learning Engineering for Production	VII	-	-	-	2

Honors in Cyber Security

S.No	Course Code	Title of the course	Offered in Semester	L	T	P	Credits
1	20ITH4801B	Introduction to Security: Cyberspace, Cybercrime and Cyber Security	IV	4	0	0	4
2	20ITH5801B	Cyber Physical Systems	V	4	0	0	4
3	20ITH6801B	Penetration Testing and Vulnerability Assessment	VI	4	0	0	4
4	20ITH7801B	Cloud Security	VII	4	0	0	4
MOOCs - SELF LEARNING COURSES							
1	20ITH5811B	Information Security and Cyber Forensics	V	-	-	-	2
2	20ITH7812B	Online privacy	VII	-	-	-	2

SEMESTER III

23HS3101- 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 Publications, 2nd 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/

23HS3102 -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-I during induction program desirable.	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 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)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1						1			2					
	CO2			3											
	CO3						2								
	CO4								3				2		

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, Inter-connectedness 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):** [1] A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, New Delhi (2010). [2] A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Asthana and G. P. Bagaria, 2nd revised edition Excel Books Private Limited, New Delhi (2019). **Reference Books:** [1] Jeevan Vidya: Ek Parichaya, A. Nagaraj, Jeevan Vidya Prakashan, 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-Sangh Prakashan, Varanasi (2017). [8] Bharat Mein Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, 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, Maulana Abul Kalam Azad, Orient Blackswan (1988). [12] The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaitha Ashrama, 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] Textbook-1: https://dokumen.pub/a-foundation-course-in-human-values-and-professional-ethics-firstnbsped-9788174467812.html [2] AICTE – SIP Youtube Channel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ [3] AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1

23ES3303C– DIGITAL LOGIC AND COMPUTER ORGANIZATION

Course Category:	Engineering Science						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 digital logic design principles, register transfer operations, CPU & Memory organizations and Computer organization fundamentals.											
	CO2	Design the hardwired and micro-programmed control units.											
	CO3	Demonstrate the Fixed Point Arithmetic Operations and various Addressing Modes.											
	CO4	Analyze different ways of communication with I/O devices and standard I/O interfaces.											

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	3												1
	CO2		1											1	3
	CO3	3												1	3
	CO4		1												1

Course Content	**UNIT I:** **Digital Logic Circuits**: Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits. **Digital Components**: Decoders, Multiplexers, Registers, Shift Registers, Binary Counters **Basic Structure of Computers:** Computer Types, Functional Units, Basic Operational concepts, Software, Performance, Multiprocessors and Multi computers, Computer Generations.
	UNIT II: **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 III: **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 IV: **Computer Arithmetic**: Addition and Subtraction, Multiplication Algorithms, Division Algorithms **Memory Organization**: Memory Hierarchy, Associative Memory, Cache Memory **Input-Output Organization**: Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).
Text books and Reference books	**Text Book(s):** [1].M.Morris Mano, "Computer System Architecture, Revised Third Edition, Pearson publications, 2020. [2].Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Sixth Edition, McGraw Hill Publication, 2002. **Reference Books:** [1].J.P.Hayes, "Computer Architecture and Organization" TMH, International Second Revised Edition, 1998 [2].William Stallings, "Computer Organization and Architecture", Ninth Edition, Pearson/PHI, 2013 [3].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

23IT3304 - ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core		Credits:							3			
Course Type:	Theory		Lecture-Tutorial-Practice:							2-1-0			
Prerequisites:	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 an Algorithm and estimate the asymptotic performance of algorithms											
	CO2	Synthesize design techniques and choose appropriate technique to solve problems.											
	CO3	Analyze algorithm design techniques to provide optimal solution for given problem.											
	CO4	Understand various operations on advanced tree data structures and asymptotic performance of algorithms.											

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	3										2	1
	CO2	1	2	3	2									1	1
	CO3	1	2	3	2									1	3
	CO4		3	2										3	2

Course Content	**UNIT I:** **Introduction:** What is an algorithm, Algorithm Specification: Pseudo code Conventions, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big —oh, Omega, Theta, Little —oh). **Divide and Conquer:** General method, Binary search, Finding the Maximum and Minimum, Merge sort, Quick sort, Strassen's matrix multiplication.
	UNIT II: **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. **Dynamic Programming:** General method, All pairs shortest Path problem, Single-source shortest paths: general weights, String Editing, 0/1 knapsack problem, Travelling salesperson problem.
	UNIT III: **Backtracking:** General method, 8-queens problem, sum of subsets, graph coloring, Hamiltonian cycles. **Branch and Bound:** The General method, 0/1knapsack problem, Travelling Salesperson Problem
	UNIT IV: **Trees:** AVL trees: Creation, insertion and deletion operations and Applications. B-Trees: Creation, insertion and deletion operations and Applications.

	Splay Trees: A simple idea, splaying, Top-Down splay trees. Red-Black trees: Definition and Properties, Searching a Red-Black Tree, Top-Down Insertion, Bottom-Up Insertion, Deletion operations. Heap Trees(Priority queues): Min and Max Heaps, Operations and Applications **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].Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "FUNDAMENTALS OF DATA STRUCTURES in C++", 2nd edition, University Press. [2] Ellis. Horowitz, Sartaj Sahani, Sanguthevar Rajasekharan, "FUNDAMENTALS OF COMPUTER ALGORITHMS", 2nd edition, University Press. **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/ [3] https://www.tutorialpoint.com/advanced _data_structures/index.asp [4] http://peterindia.net/Algorithms.html

23IT3305 - OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category:	Programme Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practice:		3-0-0
Prerequisites:	23ES1103Programming for Problem Solving 23IT3303 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 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)		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	1	2												
	CO2		2	3								2	1	2	
	CO3	1	3	2								3	3	3	
	CO4			2								2	2	3	

Course Content	**UNIT I:** **Introduction:** An 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, Understanding Static and Introducing 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:** A Generic class with two type parameters, the general from of a generic class, Bounded types

	Multithread Programming: The Java thread model, creating a thread, implementing runnable, extending thread, creating multiple threads, thread priorities **Collections Framework:** Collections overview, the Collection interfaces: Collection, List and Set. **Collection Classes:** ArrayList, LinkedList, HashSet,TreeSet
	UNIT IV: **Lambda Expressions:** Lambda Expression fundamentals, function interfaces, some lambda expression examples, Block lambda expressions, Passing lambda expressions as arguments. **Method References:** Method References to static methods, Method References to instance methods, Method References with generics. **Stream API:** Stream Basics: Stream interfaces, how to obtaining a Stream, A simple Stream examples, Reduction Operations, Using Parallel Streams, Mapping, Collecting, Iterators and Stream.
Text books and Reference books	**Text Book:** [1]. Herbert Schildt, "Java The Complete Reference", 12th Edition, McGraw-Hill, New Delhi, 2022. [2].Debasis Samanta, "Joy with JAVA, Fundamentals of Object-Oriented Programming", Monalisa Sarma, Cambridge, 2023. **Reference Books:** [1]. Kathy Sierra & Bert Bates, Head First Java, Second edition, Shroff/O'Reilly, 2009. [2]. Berbert 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	[4] 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 [5] 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 [6] 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-javaprogramming--cs046

23TP3106 - LOGIC & REASONING

Course Category:	Institutional Core		Credits:		1
Course Type:	Learning by Doing		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	Think reason logically in any critical situation
	CO2	Analyze given information to find correct solution
	CO3	To 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)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1						2								
	CO2		2												
	CO3								2						
	CO4									2					
	CO5	2													
	CO6	1													

Course Content	**UNIT I:** [1]. Series Completion, [2]. Coding-Decoding, [3]. Blood Relation, [4]. Puzzles test
	UNIT II: [1]. Direction sense test, [2]. Logical Venn diagrams, [3]. Number test, ranking test, [4]. Mathematical operations
	UNIT III: [1]. Arithmetical Reasoning, [2]. Inserting missing character, [3]. Syllogism. [4]. Binary logic. [5]. Data sufficiency

	UNIT IV: [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, [2]. Reasoning Guru Verbal & Non-Verbal Reasoning by Vikramjeeth, Multilingual Edition-2023. ISBN :978-9358706000 **Reference Books:**
E-resources and other digital material	

23IT3651 – PYTHON PROGRAMMING LAB

Course Category:	Skill Enhancement Course	Credits:	1
Course Type:	Learning by Doing	Lecture-Tutorial-Practice:	0-0-2
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	Develop python programs on control flow statements and strings.												
	CO2	Design solutions to a variety of problems using python built-in Data Structures.												
	CO3	Apply object-oriented concepts, error handing mechanisms in python.												
	CO4	Analyze and visualize using NumPy, Pandas and Matplotlib in python.												

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

Course Content	**UNIT I:** **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. **Strings:** Concatenating, appending and multiplying strings, immutability, String formatting operator, built-in string methods and function, slice operation.
	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. **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. **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.
	UNIT III: **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, operator overloading. **Inheritance:** Introduction, inheriting classes in python, types of inheritance, composition/containership/complex objects, abstract classes and interfaces, Meta class. **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.
	UNIT IV: **NumPy Basics:** Introduction to numpy, The NumPy ndarray: A Multidimensional Array Object, Universal Functions: Fast Element-wise Array Functions. **Getting Started with pandas:** Introduction to Pandas Data Structures, Essential Functionalities, Summarizing and computing descriptive statistics. **Plotting and Visualization:** A brief Matplotlib API Primer, Plotting with Pandas and seaborn.
Text books and Reference books	**Text Book(s):** [1]. ReemaThareja,"Python Programming Using Problem Solving Approach", Oxford University Press, 2019. [2]. Wes McKinney, "Python for Data Analysis", Oreilly, Second Edition, 2017. **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. [5]. Vamsi Kurama, "Python Programming, A modern approach", Pearson, 2018.
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), [3]. Available:https://nptel.ac.in/courses/106/106/106106182/# [4]. Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM],(05-01-2021),Available: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview. [5]. Corey Schafer,Python OOP Tutorials - Working with Classes, (05-01- 2021), Available: Python OOP Tutorials - Working with Classes – YouTube [6]. Prof. Ragunathan Rengasamy, IIT Madras, Python for Data Science [NPTEL], Available: https://onlinecourses.nptel.ac.in/noc22_cs32/preview

23IT3352 - ADVANCED DATA STRUCTURES AND ALGORITHMS LAB

Course Category:	Program core						Credits:					1.5	
Course Type:	Lab						Lecture-Tutorial-Practice:					0-0-3	
Prerequisites:	23PC2104 - Data Structures Programming language						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 divide and conquer technique with time complexity											
	CO2	Demonstrate the divide and conquer technique with time complexity analysis											
	CO3	Design the algorithms for optimization problems using greedy or dynamic programming											
	CO4	Demonstrate backtracking technique											
	CO5	Perform operations on balanced data structures - AVL and B-trees											
	CO6	Solve scenario based problems using appropriate data structure and design technique											

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3-High)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	2	2	1										3	
	CO2	2	2	1										1	2
	CO3	2	1	1										2	2
	CO4	2	2	2										3	1
	CO5	2	1	1										1	2
	CO6	2	3	3									2	2	2

Course Content	**Week 1: Programs on Time complexity Analysis techniques**
	     a. Design an algorithm for the given problem and analyze the time complexity of the algorithm.
	     b. Design an algorithm for the given problem and analyze the time complexity of the algorithm.
	
	 Week 2&3: Programs on Divide And Conquer Technique
	     a. Sorting techniques: Merge Sort and Quick Sort
	     b. Find the minimum and maximum in a given array of elements
	     c. Design experiment using Divide and Conquer Technique
	
	 Week 4&5: Programs on Greedy Method
	     a. Implement fractional Knapsack problem

	b. Find minimum cost spanning tree using Prims and Kruskals Algorithms
	    c. Implement Single Source Shortest Path problem
	    d. Implement job sequencing with deadlines problem
	Week 6: Programs on Dynamic Programming
	    a. Implementation of all Pairs shortest path problem.
	    b. Implementation of travelling salesperson Problem.
	    c. Implementation of 0/1 Knapsack Problem
	Week 7&8: Programs on Backtracking
	    a. Implement N-Queens Problem
	    b. Implement sum of subsets problem
	    c. Implement Graph coloring problem
	    d. Implement Hamiltonian cycle problem
	Week 9: AVL tree and applications
	    a. Implementation of AVL tree operations.
	    b. Design experiment using AVL-Tree
	Week 10:B- tree and applications
	    a. Insert and delete operations on B-tree
	    b. Design experiment using B-Tree
	Week 11: Design experiments/scenario based problem solving using Advanced Data structures
	Week 12: Design experiments/scenario based problem solving using Algorithm Design Strategies

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

23IT3353- OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Category:	Programme Core		Credits:	1.5
Course Type:	Lab		Lecture-Tutorial-Practice:	0-0-3
Prerequisites:	23ES1103-Programming for Problem Solving 23IT2104 - 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		
	CO3	Develop java applications to make use of collections frameworks and Stream API to solve real world problems		
	CO4	Design graphical user interface applications using Java Swings		

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

Course Content	**Week 1:**
	1. Create a class Hello which can contains all the primitive datatypes: byte, int,short, long, float, double, char, a. print all the default values b. set the values to them and print those values 2. Create a class Vehicle which contains the data members vno, vname, company, typefuel member functions insertDetails() getDetails() 3. Create a class employee with the data members int eno, String ename, float esal Member Functions: setEmployee() - to set the values to the employee displayEmployee()- to display the values 4. Write a class called Bank with the data members acno, actype, name, bal, Member functions

Insert CustomerDetails()- method to insert the values to the variables
Deposit Amount()-ask the user to enter the amount to deposit and add the amount enteredto the bal
Withdraw Amount() - ask the user to enter the amount to withdraw and update the amount entered to the b.

Week 2:

1. Write a program to implement method overloading to compute area of Rectangle, square and triangle
2. Write a program to implement function overloading to read the employee details like eno, esal, eaddress and display the information.
3. Write a program to implement constructor overloading to compute area of Rectangle, square and triangle.
4. Define a class to represent a bank account. Include the following Data Member
   a. Name of the depositor
   b. Account Number
   C. Type of Account
   Member Functions
   e. To assign Initial value using constructor overloading
   f To deposit an amount
   g. To withdraw amount after checking the balance
   h. To display name and balance.

Week 3:

1. A travel agent book tickets in rail to Mumbai to its customers. Create a class Railway with the variables pass_name, age,no_of_tickets, price, total amount. The Manager of the travel agent wants to know how many tickets and how many customers the agent has booked.
2. Write a java program for For MOVIE TICKET RESERVATION assuming that movie is A rated movie and it shouldn't allow the children below 18 and identify the current status of the seats available and should also display when the house is full.
3. Write a java program for movie ticket reservation. Assuming that the number of tickets available are 10. use the codisplay(), to display the availability of tickets. The datamembers are name , movie name, numberof ticket needed, cofull display house full.
4. Write a java program to count the number of object created using static.

Week 4:

1. Create a program that reads the string "object-oriented programming using Java". Find the number of words/tokens in the string. Also print all the tokens that presents in the string.
2. Create a program that reads a string "It sometimes, happens that, while using, Microsoft Word you, hicave to transfer, copied table, to normal line – you need, to have your words, in one line separated, by let's say commas. While this procedure, would require, lot of clicking, and manual deleting, Microsoft Word possesses, a function that allows, you to do this

automatically, disregarding how, many words you, need to transform".

3. Create a program that asks the user to enter the two string with different lengths and check whether the two strings are equal or not. Also check the last index and first index of the strings.

4. Write a Java program to check if two strings are anagrams of each other or not.

Week 5:

1. Create a class person with the filed firstname, lastname. Use parameterized method to set the values to the variables at runtime. Create sub class Employee with the variable eno, edept, esal. Create parameterized method for setting the data and default method for display the information.

2. Create a class named Employee with the following details Data members:
(a) name (b) address (c) age (d) gender
Methods:
(a) Display() to show the employee details
Create another class FullTimeEmployee that inherits the Employee class:
a. Data members : Salary Designation
Method:
Display() to show the salary and designation along with other employee details.

3. Write a java program for the bank which provides different interest rates for different time periods for the costumers. If the time limit is <2 years the interest is 5% per annum. If the time limit is between 2 and 4 years the interest rate is 8% per annum. If the time limit is >4years the interest rate is 10%per annum. Identify the inheritance and also use method over riding for display method and a parameterized constructor.

4. Create a Abstract class called shaped use this class to store two double data type values that could be used to compute the area of figures. Drive two specific class called triangle and rectangle from the base class shape.

Week 6:

1. Write a program to access the methods of one package methods in another packages: Create a bank class and implement the methods of deposit() and withdraw(). Access these in another package.

2. Create an interface called Vehicle with the methods set Vehicle(int, String, String, double), display(). Create a subclass Veh with the members vehno, vehname, vehprice. Implement the interface to the class. Create three objects to the class.

3. Create an interface A with the methods sum(int, int), mul(double, double, double). Create a subclass B which implements only sum(int, int). Create a subclass C which implements mul (double, double, double). Display the sum and multiplication values.

4. Write a java program having an interface called figure in the abstract method area. Design a class called diagram with 3 data members length, breadth and height. Write a program to calculate the perimeter and volume of the figure using the interface. Derive a class dimensions that implements interface figure and class diagram and display the area,

perimeter and volume using Multiple Inheritance concept.
5. Create a class Bank with deposit and withdrawal method. Derive two class hdfc bank and sbi bank and override the methods using dynamic method dispatcher.

Week 7:
1. Create a class that reads an array of integers to holds the marks of student in five subjects. Display the values of array upto the array index 6.
2. Create a class that can raise ArithmeticException and ArraylndexOutOfBoundsException. Use try, catch; try,catch use try and multiple catch use nested try(try-try-catch)catch.
3. Create a class that reads sno, sname, javamarks, totalmarks. Compute the % of marks obtained by the user. Raise the exception in case of total marks is 0. Print the sname character by character. Raise an exception by printing the character at index which is not there.
4. Create a class Emp with eno, ename,esal. If esal is <1000 then raise an exception that" he will not eligible for promotion". Otherwise print the employee details.

Week 8:
1. Implement generic class which will take list of numbers or names and sort them.
2. Create multiple threads Hello and Welcome which prints "Hello Java" and "Hello Dotnet" using Runnable interface for 10 and 20 times.
3. Create a thread using Thread class to print "java programming Lab" for every 1 Second. Check the Status of the thread before and after.
4. Write a program to access the methods of one package methods in another packages:
   a. Create two classes IT and CSE which extends Thread class each. Inside each of the class, print Hello IT and Hello CSE for 5 and 10 times.
   b. Create multiple threads that display welcome to it and welcome to seca for every 5 and 10 seconds. Also write a for loop to print welcome to vrsec forevery 15 secs

Week 9:
1. Write a java program to push the elements from back into a Linked List and sort them in ascending order
2. Write a java program clone an ArrayList to another ArrayList in Java?
3. Write a java program to perform various operations on Deques.
4. Write a program that creates a LinkedList object of 10 characters, then creates a second LinkedList object containing a copy of the first list, but in reverse order.

	Week 10: 1. Develop a program using label (swing) to display the message "GFG WEB Site Click" 2. Write a program to create three buttons with caption OK, SUBMIT, CANCEL. 3. Program to create a translucent frame and control its translucency with the help of a JSlider. 4. Write a program to create JComboBox and Swing Menus. **Week 11:** 1. Write a program to Check if a String Contains Only Alphabets in Java Using Lambda Expression 2. Write a program to Converting ArrayList to HashMap in Java 8 using a Lambda Expression 3. Write a program to Perform area of Rectangle using Lambda expressions 4. Write a program to Perform Linear search using Lambda expressions **Week 12:** 1. Write a program demonstrates a static method reference. 2. Write a program demonstrate string operations using a method reference to an instance method 3. Write a java program to print the Fibonacci values upto the given integer using streams. 4. Write a program that generates an infinite stream of random numbers between 0 and 100, limits the stream to 10 numbers, and prints them. **Case Studies:** 1. Simulate the bank, college, library applications using java 2. Develop GUI based application using handle events raised by the application 3. Develop GUI based application using java swings to various applications bank, college, library.
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

SEMESTER IV

23ES3102- DISCRETE MATHEMATICAL STRUCTURES

Course Category:	Engineering Science		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Set theory, functions		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 on recurrence relations and generating functions		
	CO3	Infer abstract algebra and evaluate the algebraic structures		
	CO4	Analyze the properties, types and applications of graphs.		

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

Course Content	**UNIT I:** **The Foundations: Logic and Proofs**-Propositional Logic, Propositional equivalences, Predicates and Quantifiers, Rules of inference, Introductions to proofs. Normal forms(PDNF, PCNF). **Counting Techniques:** Basics of counting, Pigeonhole principle, Generalized permutations and combinations.
	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.
	UNIT IV: **Graph Theory:** Basic concepts, 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

23ES4102B – PROBABILITY & STATISTICS

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	Examine Probability distributions with random variables.
	CO2	Apply random phenomena of sample to test the Hypothesis concerning means.
	CO3	Infer the Hypothesis concerning variance and proportions.
	CO4	Examine the Quality improvement, control charts and reliability to improve Statistical skills.

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

Course Content	UNIT I
	Probability Distributions: Random Variables (discrete and continuous) , Expectation, Variance and Standard deviation of discrete random variable, Binomial distribution, Poisson distribution. Expectations, Variance and standard deviation of continuous random variables, Normal distribution, Normal approximation to the Binomial distribution.
	Joint distribution: Joint distributions-Discrete and Continuous**.**
	UNIT II
	Sampling Distributions: Introduction, Populations and Samples
	Inferences Concerning Mean: Point Estimation- Interval Estimation
	Test of Hypothesis – Null Hypothesis and Tests of Hypothesis – Hypothesis concerning one mean – Relation between tests and Confidence intervals –Operating characteristic curves - Inferences concerning two means.
	UNIT III:
	Inferences Concerning Variances: Estimation of variances- Hypothesis concerning one variance- Hypothesis concerning two variances.
	Inference Concerning Proportions: Estimation of Proportions- Hypothesis concerning one Proportion- Hypothesis concerning several Proportions – The Analysis of r x c Tables- Goodness of fit.
	UNIT IV:
	The Statistical Content of Quality Improvement Programs: Quality Control- Control Charts for Measurements - Control Charts for Attributes.
	Applications to Reliability and Life Testing: Reliability - Failure – Time

	Distributions – The Exponential Model in Reliability.
Text books and Reference books	**Text Book(s):** [1]. Probability and Statistics for Engineers Eighth edition by Richard A. Johnson Prentice Hall of India. **Reference Books:** [1]. Probability & Statistics for Engineers & Scientist by R.E. Walpole, R.H.Myers&S.L.Myers, Sixth Edition, Prentice Hall of India / Pearson Education. [2]. Probability and Statistics, Purna Chandra Biswal, Pearson Education Prentice Hall of India 2007. [3]. Probability and Statistics by T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganatham, M.V.S.S.N.PrasadS.Chand.
E-resources and other digital material	[1]. probweb.berkeley.edu/teaching.html [2]. statsci.org/teaching.html [3]. video lectures.nptel.iitm.ac.in

23IT4303– OPERATING SYSTEMS

Course Category:	Programme Core							Credits:			3			
Course Type:	Theory							Lecture-Tutorial-Practice:			2-1-0			
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	Outline the concepts of operating system services, Process, Multithreading, file, directory and RAID structures.												
	CO2	Apply Page Replacement, CPU scheduling algorithms and Disk Scheduling algorithms												
	CO3	Develop appropriate solutions to solve problems related to primary , secondary memory management, Inter process communication and deadlocks												
	CO4	Identify suitable file allocation, free space management and security measures for a given scenario												

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	2											2	1
	CO3	1	3											2	1
	CO4	2	2											1	1

Course Content	**UNIT I** **Introduction:** Operating System – User View, System View, Operating System Operations, Operating-System Structure, Operating-System Services, 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. **Implementing File Systems:** Allocation Methods, Free-Space Management.

	Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Scheduling, RAID Structure. **Security**- Protection Goals, Access Matrix, Access Control, Revocation of Access rights.
Text books and Reference books	**Text Book(s):** [2]. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts", 9[th]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", 8[th]ed, Prentice Hall ,2014. [3]. Andrew S. Tanenbaum, "Modern Operating Systems", 4th ed, Pearson , 2016.
E-resources and other digital material	[1]. Prof. Chester Rebeiro Department of CSE,IITM "Introduction to Operating Systems" [NPTEL] dated 08[th]Sep 2016 https://nptel.ac.in/courses/106/106/106106144/ [2]. Mythili Vutukuru,Dept of CSE ,IITB "Lectures on Operating Systems" dated 14[th]Mar 2018 https://www.cse.iitb.ac.in/~mythili/os/ [3]. Prof. P.K. Biswas,Dept of EEC,IITK "Operating Systems" dated 06[th]Apr 2013 http://www.satishkashyap.com/2013/02/video-lectures-on-operating-systems-by.html

23IT4304– DATA BASE MANAGEMENT SYSTEMS

Course Category:	Professional Core		Credits:	3
Course Type:	**Theory**		**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	23PC2104 - 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	Develop schemas using data models for a given application requirement.
	CO2	Construct queries using SQL and Relational algebra on a given database
	CO3	Design normalized databases for a given application by incorporating various constraints and normal forms.
	CO4	Analyze different forms of transactions and concurrency control mechanisms to maintain data consistency in a multi user environment.

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3- High)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	2	2	1		2	1							1	
	CO2		2			2									2
	CO3			2								2		2	
	CO4												1	2	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. **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-Codd Normal 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]. Prof Richard Holowczak, Professor, Baruch College, The Normalization, Feb 2023 https://www.youtube.com/watch?v=GvxBqzWeGz0 [2]. Prof PP Das,IIIKharagpur, DBMS. Dec 7, 2017 https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh [3]. Jennifer widom,(09,05,2018). Introduction to Databases https://www.youtube.com/watch?v=ShjrtAQmIVg [4]. P. B. Mahanty,(09,05,2015). DBMS and RDBMS. http://nptel.iitm.ac.in/video.php?courseId=1128&v=7952RsbAx2w8

23IT4305 - SOFTWARE ENGINEERING

Course Category:	Professional Core	Credits:	3
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	23PC2104 - 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 basic fundamentals of the software development life cycle.
	CO2	Apply process models and testing techniques to real time applications.
	CO3	Analyze requirements, specifications to build software design architecture.
	CO4	Analyze the processes for identifying, assessing, and mitigating risks associated with software maintenance and evolution.

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

Course Content	**UNIT I:** **Introduction:** Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering. Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model. **Agility:** Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process.
	UNIT II: **Software Project Management:** Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management. **Requirements Analysis And Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL. **Software Design:** Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design
	UNIT III: **User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology. **Coding And Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

	Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma..
	UNIT IV: **Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.
	Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.
	Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.
Text books and Reference books	**Text books:** [1]. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI,2018. [2]. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, Mc-Graw Hill International Edition. **References:** [1]. Software Engineering, Ian Sommerville,10th Edition, Pearson. [2]. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
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 [2]. https://www.nptelvideos.com/lecture.php?id=7041 [3]. 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 **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

23TP3206 : ENGLISH FOR PROFESSIONALS

Course Category:	Soft Skills – 2		Credits:	1
Course Type:	Practical		Lecture – Tutorial – Practice:	0-0-2
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing.		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 how to listen, reflect, and speak while communicating with others.
	CO2	Recall the fundamentals of language in terms of grammar and vocabulary in communication.
	CO3	Apply English language skills in various speaking contexts to present ideas with clarity and accuracy.
	CO4	Analyze the different parts in Versant Test and answer them.

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

Course Content	**1. Conversation Starters** roduction – Seeking Permissions – Asking for Directions – Making Requests – Offering Help – Expressing Thanks – Conveying Apologies – Starting a Conversation with a Stranger – Practice. **2. Functional Conversations** roducing Self – Introducing Others – Starting a Group Introduction – Icebreaker Introduction – Introducing a Formal Setting – Practice Exercises. **3. Grammar** Verbs – Tenses – Sentence Structures – Spotting the Errors. **4. Just A Minute** roduction – Significance – Fluency – Coherence – Avoiding Errors – Communication Skills – Confidence – Practice. **5. Vocabulary** Idioms – Phrases – Significance – Meanings – Usage – Practice. **6. Elocution** finition – Importance – Key Components – Voice Modulation – Articulation – Posture and Gestures – Practice. **7. Extempore** roduction – Significance – Developing Quick Thinking – Communication Skills – Confidence – Practice.

	8. Debate
	...roduction – Understanding the Structure – Purpose of a Debate – Developing Basic Debating skills – Do's and Don'ts – Practice.
	9. Versant Test
	...erview of the Versant Test – Purpose and Importance – Format of the Test – Types of Questions – Practice.
	10. Story Telling
	Know Your Audience – Choose a Story – Set the Scene – Introduce the Characters – Build Suspense – Describe the Conflict – Show the Resolution – Share the moral/message – Use Vivid Language – Practice Delivery – Invite Reflection/Discussion – Follow Up.
Text books and Reference books	**Text Book(s):** [1] English for Professionals Lab Manual **Reference Books** [1] Wren & Martin. *English Grammar and Composition.* S.Chand & Company, 2023. [2] Dale Carnegie. *The Quick and Easy way to Effective Speaking.* Rupa Publications, 2016. [3] Richard A. Spears. *McGraw-Hill's Dictionary of American Idioms and Phrasal Verbs.* McGraw Hill, 2005. [4] Kamalesh Sadanand. *A Spoken English.* VOL 1&2, Orient BlackSwan, Second Edition, 2014.
E-resources and other digital material	[1] https://www.pearson.com/languages/hr-professionals/versant.htmlSoftx [2] https://www.ted.com/talks [3] https://shortstoryproject.com/

23MC3107 – ENVIRONMENTAL SCIENCE

Course Category:	Audit Course						Credits:				-
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	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)		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	1							1					1	
	CO2		1	1							1			1	
	CO3				1	1							1	1	
	CO4						1	1	1					1	

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.

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.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.

23IT4651– **PYTHON WITH DJANGO**

Course Category:	Skill Enhancement Course	Credits:	2
Course Type:	Learning by doing	Lecture-Tutorial-Practice:	0-1-2
Prerequisites:	23IT3651: Python Programming Lab	Continuous Evaluation:	-
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop python programs on control flow statements and strings.
	CO2	Design solutions to a variety of problems using python built-in Data Structures.
	CO3	Apply object-oriented concepts, error handing mechanisms in python.
	CO4	Analyze and visualize using NumPy, Pandas and Matplotlib in python.

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	2			2	2				1	1	2			
	CO2	2	1			2				1	1	2			
	CO3	2	2		1	2				1	1	2			
	CO4	3	3		3	3				3	2	2	3		

Course Content	**UNIT I:** **Python libraries for web development :** Collections-Container datatypes, Tkinter-GUI applications, Requests-HTTP requests, BeautifulSoup4-web scraping, Scrapy, Zappa, Dash, CherryPy, Turbo Gears, Flask, Web2Py, Bottle, Falcon, Cubic Web, Quixote, Pyramid.
	UNIT II: **Introduction to Django Framework** Understanding Django environment, Features of Django and Django architecture, MVC and MTV, Urls and Views, Mapping the views to URLs, Django Template, Template inheritance Django Models, Creating model for site, Converting the model into a table, Fields in Models, Integrating Bootstrap into Django, Creating tables, Creating grids, Creating carousels.
	UNIT III: **Integrating Accounts & Authentication on Django** Introduction to Django Authentication System, Security Problem & Solution with Django Creating Registration Form using Django, Adding Email Field in Forms, Configuring email settings, Sending emails with Django, Adding Grid Layout On Registration Page, Adding Page Restrictions, Login Functionality Test and Logout. **Connecting SQLite with Django** Database Migrations, Fetch Data From Database, Displaying Data On Templates, Adding Condition On Data,Sending data from url to view, Sending data from view to template
	UNIT IV: Saving objects into database, Sorting objects, Filtering objects, Deleting objects, Difference between session and cookie, Creating sessions and cookies in Django. **Deploying Django Web Application on Cloud** Creating a functional website in

	Django, Four Important Pillars to Deploy, registering on Heroku and GitHub, Push project from Local System to GitHub, working with Django Heroku,Working with Static Root, Handling WSGI with gunicorn, setting up Database & adding users.
Text books and Reference books	**Text Book(s):** [1].Martin C.Brown, "Python: The Complete Reference Paper back", 4th Edition 2018, McGraw Hill Education. [2].Reema Thareja, "Python Programming: Using Problem Solving Approach", 3rd Edition 2017,Oxford. [3].Daniel Rubio, Apress, "Beginning Django Web Application Development and Deployment with Python", 2nd Edition 2017, Apress. **Reference Books:** [1].Tom Aratyn, "Building Django 2.0 Web Applications: Create enterprise-grade, scalable Python web applications easily with Django 2.0", 2nd Edition 2018, Packt Publishing. [2].Harry Percival, "Test-Driven Development with Python: Obey the Testing Goat: Using Django, Selenium and JavaScript",2nd Edition 2019, Kindle Edition.
E-resources and other digital material	[1].https://www.browserstack.com/guide/top-python-web-development-frameworks [2].https://developer.mozilla.org/en-us/docs/learn/server-side/django/introduction [3].https://www.classcentral.com/course/youtube-django-authentication-user-management-full-tutorial-117030 [4].https://www.youtube.com/watch?v=uipsnre6uwe

23ES4152-DESIGN THINKING & INNOVATION

Course Category:	Engineering Science	Credits:	2
Course Type:	Learning by doing	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	Describe the fundamental concepts of Design Thinking and Innovation.
	CO2	Apply the design thinking techniques for solving problems in various sectors.
	CO3	Analyze the concepts of design thinking to work in a multidisciplinary environment.
	CO4	Evaluate the value of creativity with design thinking concepts.

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

Course Content	**UNIT I:** **Introduction to Design Thinking** Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry. **UNIT II:** **Design Thinking Process** Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development **Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development. **UNIT III:** **Innovation** Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. **Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation

	UNIT IV: Product Design Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. **Activity:** Importance of modeling, how to set specifications, Explaining their own product design. **Design Thinking in Business Processes** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. **Activity:** How to market our own product, about maintenance, Reliability and plan for startup.
Text books and Reference books	**Text Book(s):** 1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009. 2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014. **Reference Books:** 1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018. 2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018. 3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010. 4. Chesbrough.H, The era of open innovation, 2003
E-resources and other digital material	• https://nptel.ac.in/courses/110/106/110106124/ • https://nptel.ac.in/courses/109/104/109104109/ • https://swayam.gov.in/nd1_noc19_mg60/preview • https://onlinecourses.nptel.ac.in/noc22_de16/preview

23IT4353 - OPERATING SYSTEMS & SOFTWARE ENGINEERING LAB

Course Category:	Professional core	Credits:	1.5
Course Type:	Lab	Lecture-Tutorial-Practice:	0-0-3
Prerequisites:	Data Structures Programming language	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	Practice Unix Commands for creating and operating data in files and directories
	CO2	Illustrate semaphore based solution to Synchronization problems
	CO3	Implement Memory management methods
	CO4	Demonstrate different CPU Scheduling and Page Replacement algorithms for a given reference string
	CO5	Apply Object Oriented Analysis and Design concepts and various UML diagrams to real time applications.
	CO6	Generate UML diagrams illustrating both the static and dynamic components of software, and utilize these diagrams to develop projects.

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	1	1											1	1
	CO2	1	3											2	1
	CO3	1	3											2	1
	CO4	3	2											2	1
	CO5														
	CO6														

Course Content	**OPERATING SYSTEMS**
	Week 1: Practicing of Basic UNIX Commands. Write programs using the following UNIX operating system calls
	    fork, exec, getpid, exit, wait, close, stat
	Week 2: Simulate UNIX commands like opendir and readdir cp, ls, grep, etc.,
	Week 3: Simulate the following CPU scheduling algorithms
	    a) FCFS b) SJF c) Priority d) Round Robin
	
	.
	Week 4: Write a program to solve producer-consumer problem
	    using Semaphores.
	Week 5: Implement the following memory allocation methods for
	    fixed partition a) First fit b) Worst fit c) Best fit
	Week 6: Simulate the following page replacement algorithms
	    a) FIFO b) LRU c) LFU
	
	SOFTWARE ENGINEERING

	Week 7: Demonstrate fundamentals of DFD and building blocks of UML.
	Week 8: Develop Structural diagrams for modeling complex systems.
	Week 9: Develop Behavioural diagrams for modeling complex systems.
	Week 10: Describe SRS and test cases for any real time application.
	      a) Online Library Management System
	      b) Online Banking System, etc…
	Week 11: Implement white box and black box testing methods for real-time applications.

Text books and Reference books	**Text Book(s):** [1]. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts", 9thed, John Wiley &Sons (Asia) Pvt. Ltd, 2018. [2]. Yashavant Kanetkar, "Unix Shell Programming", 1st ed, BPB Publications, 2003. [3]. I. Somerville "Software Engineering" 6 edition:Pearson Education. [4]. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language user guide", Tenth Edition, Pearson, 2011. **Reference Books:** [1]. RajibMall,"Fundamentals of Software Engineering",Second Edition PHI.
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]. Software engineering NPTEL. Available: http://nptel.iitm.ac.in/video.php?courseId=1076

23IT4354– DATABASE MANAGEMENT SYSTEMS LAB

Course Category:	Laboratory		Credits:		1.5
Course Type:	Program Core		Lecture-Tutorial-Practice:		0-0-3
Prerequisites:	Data Structures 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	Execute advanced queries such as relational constraints, operators, joins, set operations, aggregate functions, views in SQL. Apply SQL commands to create relational databases and extract information to satisfy business reporting requests
	CO2	Design, create and implement relational database systems for real time applications
	CO3	Use various software's to design and build ER diagrams for related database systems.
	CO4	Develop application programs using PL/SQL

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

Course Content	**Week 1:**
	   a. Introduction to SQL, RDBMS.
	   b. Compare various RDBMS softwares
	   c. Different data types and its implementation
	   d. Implement Data Definition language
	   e. Apply Integrity Constraints , aliasing on relations
	
	Week 2:
	   a. Implement Data Manipulation Language on Relational Model.
	   b. Implement queries using : Relational Operators, Logical Operators and Comparison operators
	.
	Week 3:
	Implement queries using SQL functions :
	   a. Aggregate functions
	   b. String functions
	   c. Date/time functions
	   d. Mathematical functions
	   e. Sorting

	Week 4:
	Implement Nested Queries using operators
	    a. Set comparison operators
	    b. Correlated sub queries
	    c. Set operators
	
	Week 5:
	Combining tables and execution of queries :
	    a. Implement advanced queries using joins and grouping (Group by, Having)
	    b. Views creation and updation
	
	Week 6:
	    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 7:
	Implementation of security by assigning privileges to database users :
	DCL : Understand the implementation of Grant, Revoke and views
	TCL : Understand the implementation of Commit, Rollback and Savepoint
	
	Week 8:
	PL /SQL programming: Blocks, Operators and Control structures,cursors
	
	Week 9:
	PL /SQL programming: Triggers, Functions and Procedures
	
	Week 10:
	Case Study on a given application: Refine the schemas up to 4th normal form. (Mini Project).
	
	Week 11:
	Installing , Configuring and Execution of MongoDB NoSQL
	
	Week 12:
	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)

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	[1]. Prof Richard Holowczak, Professor, Baruch College, The Normalization, Feb 2023 https://www.youtube.com/watch?v=GvxBqzWeGz0

digital material	[2]. Prof PP Das,IIIKharagpur, DBMS. Dec 7, 2017
	       https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm
	       1VRJROX4vP2YMIf4Ebh
	[3]. Jennifer widom,(09,05,2018). Introduction to Databases
	       https://www.youtube.com/watch?v=ShjrtAQmIVg
	[4]. P. B. Mahanty,(09,05,2015). DBMS and RDBMS.
	       http://nptel.iitm.ac.in/video.php?courseId=1128&v=7952RsbAx2w8