Progressive Education Society's

Modern College Of Engineering, Pune-05

1186A, Shivaji Nagar, Pune- 411 005.

DEPARTMENT OF INFORMATION TECHNOLOGY

E- Curriculum Booklet

YEAR: 2020-21 **SEMESTER: I**

CLASS: SE **DIV: A & B**

VISION AND MISSION OF THE INSTITUTE

Vision Statement:

To create a collaborative academic environment to foster professional excellence and ethical values

Mission Statement:

1. To develop outstanding professionals with high ethical standards capable of creating and managing global enterprises
2. To foster innovation and research by providing a stimulating learning environment
3. To ensure equitable development of students of all ability levels and backgrounds
4. To be responsive to changes in technology, socio-economic and environmental conditions
5. To foster and maintain mutually beneficial partnerships with alumni and industry

VISION AND MISSION OF THE DEPARTMENT

Vision Statement:

To develop proficient IT engineers for the Industry and Society.

Mission Statement:

1. To achieve academic excellence.
2. To develop students for being competent in dynamic IT environment.
3. To encourage research and innovation.
4. To inculcate moral and professional ethics.

PEO's OF THE DEPARTMENT

1. Demonstrate sustained learning by building the profound foundation of math's, science and engineering principles and make the students erudite self-reliant and adaptable to diverse culture of multidisciplinary environment.
2. Prepare graduate with strong knowledge and skills in the field of Information Technology to develop solutions of complex engineering problems.
3. To bring leadership skill with teamwork in continuous learning environment to bear with professional challenges.
4. To inculcate ethics towards issues of professional and social relevance.

PSO's OF THE DEPARTMENT

1. Graduate exhibits skills to analyze, design and develop software.
2. Graduate demonstrate technical competency and leadership qualities to work in multidisciplinary environment.

PROGRAM OUTCOMES

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

LONG TERM GOALS

1. To Improve Industry Collaboration.
2. Promote Faculty for Research.
3. To Introduce Post Graduates Programme and Research Center.
4. To Enhance Infrastructure and lab development.

SHORT TERM GOALS

1. To enhance teaching learning process with effective utilization of e-resources
   - Moodle
   - Kahoot.
   - Activity Based Teaching.
   - Online Courses. (NPTEL/Spoken Tutorials)
   - G-Suite
   - Microsoft-Team
2. To organize national level conference / workshop.
3. Focused Interaction with Alumni.
   - Forum for Career Guidance
   - Guidelines for Training and Placements
   - Expert /Webinar/Seminar
   - Suggestions on Programme Improvisation.

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These are tentative dates, subject to change.

** Exam form submission, SE Online Examination, TE, BE In-Semester Examination, Theory Examination will be scheduled as per Savitribai Phule Pune University notification.

HOD

Department of Information Technology

STUDENT ACADEMIC CALENDAR

STUDENT CO CURRICULER ACTIVITY CALENDAR

Sr No.	Date	Name of activity	Duration	Mapping with PO's and PSO's	Guest speaker with Designation and Organization	Beneficiaries	Faculty In charge
ITSA: Ms. Poonam Rakibe							
1	5/07/2021	TE ,BE Orientation Programme	1 Hr	--	All Internal faculties	TE, BE	Ms.Supriya Jagtap
2	24/8/2021	SE Orientation Programme	1 Hr	--	All Internal faculties	SE	Ms.Supriya Jagtap
3	01/09/2021	Tech-Aarambha, Day # 1 : IT Industry - Changes Due to Covid	1 Hr	PO8, 12, PSO2	Mr. Nagesh Rajopadhye, Accenture, Pune	SE	Mrs. Sampada Kulkarni
4	02/09/2021	Tech-Aarambha, Day # 2 : Soft Skills - Offline/Online	1 Hr	PO10, 12, PSO2	Mrs. Vaidehi Banergee, Asst. Prof., I2IT, Pune	SE	Mrs. Sampada Kulkarni
5	03/09/2021	Tech-Aarambha, Day # 3 : Python : The Application Oriented Approach	1 Hr	PO5,12, PSO1,2	Mr. Tushar Kute, MiTu Technologies, Pune	SE	Mrs. Sampada Kulkarni
6	04/09/2021	Tech-Aarambha, Day # 4 : Sky is the Limit with Mindset of Programming	1 Hr	PO8,12, PSO 2	Mr. Yash Gandhi, SE at Persistent Systems Limited, Pune	SE	Mrs. Sampada Kulkarni
7	5/09/2021	Teachers Day	1 Hr	--	All Internal faculties	Internal Faculties	Ms.Poonam Rakibe
8	15/09/2021	Engineers Day	1 Hr	PO6	All Internal faculties	FE,SE,TE,BE	Ms.Poonam Rakibe
App Club: Mr. Deepak Tamhane							

9	28/8/2021	Session on "app development using python"	2 Hrs	PO 1,2,3,4, 10,11,12	Mr. Sachin Magdum. Cybage pvt ltd Pune	TE, BE	Deepak Tamhane
10	11/9/2021	Session in AngularJS	2 Hrs	PO 1,2,3,4, 10,11,12	Sakshi Kshatriya, Alumni	TE BE	Deepak Tamhane
GraphiX Club: Ms. Poonam Rakibe / Mrs.Ketki Gawali							
11	28/08/2021	Session on" Introduction to Game Engines"	2 Hrs	PO5,10,12,PSO1,2	Mr.Ganesh Mune,BMW,Pune	FE,SE,TE,BE	Ms.Poonam Rakibe
PixInsight Club: Mrs. Suhasini Bhat							
12	04/09/2021	Collage Exhibition:Nature at its best	1 Hr	PO 7,9,10	Prof.Dr.Mrs.S.D. Deshpande	FE,SE,TE,BE	Ms.Suhasini Bhat
Audit Course: Mrs. Ketki Gawali							
13	14/08/2021	Japanese Module-I	12 Hrs	PO 9,10,12, PSO-2	Mrs.Amita Godse Director at Sun and Sands Advisers Co. Ltd. Pune	SE	Mrs.Ketki M Gawali
14	12,13/08/2021	Udyojak :Session on Entrepreneurship Development,	2 Hrs	PO6,9,12, PSO1,2	Mr.Rajesh Namase Owner Produer, Pune Prakash Manage Virtuethink, Pune	TE, BE	Mr.Digvijay Patil
15	1/8/2021	Japanese Module-III	12 Hrs	PO 9,10,12, PSO-2	Mrs.Amita Godse Director at Sun and Sands Advisers Co. Ltd.Pune	TE	Mrs.Ashwini Bhamre

16	1/9/2021	Aptitude Session	2 Hrs	PO 1,2,3,6,12 PSO 1 2	Internal Faculties	SE	Mr.Deepak Tamhane
17	26/8/2021	Session on "Green Computing"	3 Hrs	PO 6,7	Mr.Ashok Pattar, IT Trainer, Pune	BE	Mr.Rohit Tate
CSI: Mrs. Vandana Dixit/ Ms. Asmita Pawar							
18	17/8/2021 24/8/2021 28/8/2021	Webinar Series on " Artificial Intelligence-Machine Learning"	6 Hrs Series	PO 1,2,4,5, 12, PSO1,2	Ms. Asawari Kakne Sprinker ltd, Gurgaon Mr. Tushar Kute MiTu Skillogies, Pune Mr. Vivek Deshpande AI Adventures , Pune	TE, BE, Hon our	Ms. A. L. Devkar, Mrs. Ketki Gawali, Ms. Mukta Jamage, Mrs. V. G. Dixit
19	4/9/2021 11/9/2021 18/9/2021	Webinar Series on "Cyber Security"	6 Hrs Series	PO6,7,12, PSO1,2	Mr. Uday Mathapati, TCL, Pune Mr. Mahesh Patil Semantic Pune Mr. Ashok Pattar IT Trainer, Pune	TE, BE, Hon our	Mrs. V. G. Dixit Mr. Deepak Tamhane
20	18/9/2021	Guest lecture on Business Intelligence tools and Applications	1Hr	PO5, 12 PSO-1,2	Mr.Sangram Nawale, Bitwise Solutions Pune	BE	Ms.Yogita Fatangare
ACM: Mrs. Ashwini Bhamre/ Ms. Asmita Pawar							
21	21/8/2021	Session on Data Visualisation tool	2 Hrs	PO1,5,7,12P SO1,2	Mr.Aniket Sawhney, Earnst and Young	TE, BE	Ms.Asmita Pawar, Mrs.Ashwini Bhamre
ISR/NSS: Mr.Deepak Tamhane/ Mrs. Tanmayee Kute							

22	22/08/2021	IT awareness	1 Hr	PO 6,7,9	Mr.Deepak Tamhane/ Mrs. Tanmayee Kute	School Students	Mr.Deepak Tamhane/ Mrs. Tanmayee Kute
Project Activities: Mrs. Vanadana Dixit							
23	14,21,22,28,29/08/2021	Project Review - 1	5 Days	PO1,2,3,5,9,10	Mr. Mahesh Deshpande, Cognizant, Pune Mr. Mahesh Gawali AVOMA Technologies	BE	Mrs. V. G. Dixit Ms. Anita Devkar
24	11.12,18,19,25,26/9/21	Project Review-2	6 Days	PO 2,3,4,5,8,9	Mr. Mahesh Deshpande, Cognizant, Pune Mr. Mahesh Gawali AVOMA Technologies	BE	Mrs. V. G. Dixit Ms. Anita Devkar
25	28/8/2021	TE Seminar Activities	2 Days	PO 1,2,9,12	Internal Faculties	TE	Ms.Yogita Fatangare Ms. Deepali Bhanage Naik
Soft Skill Training and Placement (T&P): Mrs. Ketki Gawali							
26	29/6/2021 to 24/7/2021	MCOE-Pre Placement Training session-by campus credential	2 Hrs +40Hrs training	PO12	Mr.Vinay Raikar ,Campus Credential	BE	Mrs.Ketki MGawali
27	23/7/2021	Pre Placement Talk by Persistent Company	1 Hr	-	-	BE	Mrs.Ketki Gawali
ED Activities:Mr. Digvijay Patil							
28	12,13/08/2021	Udyojak :Session on Entrepreneurship Development,	2 Hrs	PO6,9,12, PSO1,2	Mr.Rajesh Namase Owner Produer, Pune Prakash Manage	TE, BE	Mr.Digvijay Patil

					Virtuethink, Pune		
Career Guidance/Competitive Examinations: Mrs. Ketki Gawali							
29	9/10/2021	How to apply/prepare for Higher studies	1 Hr	PO12	Mr.Sumit Achaye,The Gate Academy	TE, BE	Mrs.Ketki Gawali
III: Mrs.V.G.Dixit							
30	21/8/2021	Workshop on "Website development"	1 Day	PO1,3,5, 12 PSO 1,2	Mr. Viraj Shelar, KingSprout Pune	Faculties & Students	Mrs. V. G. Dixit
31	25/9/21	Session on Python & PHP	2 Hrs	PO3,4,5,12 PSO 1,2	Mr. Viresh Chapate Persistent Pune	BE	Mrs. V. G. Dixit, Ms. Mukta Jamage
Industrial Visit: Mr.Deepak Tamhane							
NIL							
FDP: Ms. Yogita Fatangare							
32	23,24, &25/9/2021	Workshop on Art of Technical Writing	3 Days	PO 8,9,12 PSO 2	Dr.Mr.Parikshit Mahalle,SKN CoE Pune Dr. Mrs.K.R.Joshi, PES's MCOE Dr.Mrs.Ambika Pawar, Symbiosis Institute of Technology, Pune	Faculties and Students	Ms.Deepali Bhanage Naik
33	4/10/2021 to 9/10/2021	FDP on " Data Science"	5 Days	PO 1,2,3,4,5,12 PSO 1,2	Mr. Tushar Kute, Mr. Vivek Patil MiTu Skillologies, Pune Mr. Yogesh Murumkar,	Faculties	Mrs. Swapna Bhavsar Ms.Anita Devkar

					Bharat Soft Solutions Dr. Mahesh Sanghavi, Principal at SNJB COE, Chandwad		
Alumni Contribution: Mrs. Tanmayee Kute/ Mrs.Vishnu Kamble							
34	9/7/2021	Guest session on " Importance of Internship and Job opportunities through internship"	1 Hr	PO 9,10,12 PSO 2	Mr. Yash Gandhi, Persistent Pvt Ltd, Pune	BE	Mrs. Tanmayee Kute Mr. Vishnu Kamble
35	10/7/2021	Importance of Elective Subjects in IT industry	1 Hr.	PO11,12 PSO2	Mr. Ajay Pawar, Atos Pvt Ltd, Pune	BE	
36	17/7/2021	Guest session on " Explore JavaScript"	1 Hr.	PO 1,2,3,11,12 PSO 1,2	Ms. Shivani Jamdade, Michelin Pune	SE,TE,BE	

HOD
Department of Information Technology

TIME TABLE SE A

DAY \ TIME	10.00 to 10.45	10.45 to 11.30	11.30 to 12.15	12.15 to 1.00	1.00 to 1.45	1.45 to 2.30	2.30 to 3.15
MON	DSAL 'A' (SAK) DSAL 'B' (KMG) OOPL 'C' (RS) OOPL 'D' (SP)		OOPL 'A' (SP) LDCOL 'B' (MJ) DSAL 'C' (SAK) SSL 'D' (SB)			BCN (JJ)	DM (SP)
TUE	OOPL 'C' (RS) OOPL 'D' (SP)		DSA (SAK)	LDCO (TK)		BCN (JJ)	
WED	SSL 'A' (SB) OOPL 'B' (SP) DSAL 'C' (SAK) LDCOL 'D' (TK)		OOP (SP)	LDCO (TK)	RECESS	BCN (JJ)	DM (SP)
THU	OOPL 'A' (SP) SSL 'B' (SB) LDCOL 'C' (TK) DSAL 'D' (SAK)		DSA (SAK)	OOP (SP)		DSAL 'A' (SAK) DSAL 'B' (KMG)	
FRI	DSA (SAK)	OOP (SP)	LDCO (TK)	DM (SP)		LDCOL 'A' (MJ) OOPL 'B' (SP) SSL 'C' (SB) DSAL 'D' (SAK)	
DAY \ TIME	**10.00 to 10.45**	**10.45 to 11.30**	**11.30 to 12.15**	**12.15 to 1.00**			
SAT	Audit Course - Japanese Language						

GFM : - Ms. Tanmayee Kute

Name of the Subject	Teaching Staff & Seating Arrangement
DM : Discrete Mathematics	SP : Mr. Shantanu Pawar
LDCO : Logic Design & Computer Organization	TK : Ms. Tanmayee Kute
DSA : Data Structures and Algorithms	SAK : Mrs. Sampada Kulkarni
OOP : Object Oriented Programming	SP : Mr. Shantanu Pawar

BCN : Basics of Computer Network	JJ : Ms. Jyoti Jadhav
SSL : Soft Skills Lab	SB : Ms. Suhasini Bhat
LDCOL : Logic Design and Computer Organization Lab	TK : Ms. Tanmayee Kute MJ : Mrs. Mukta Jamage
DSAL : Data Structures and Algorithms Lab	SAK : Mrs. Sampada Kulkarni KMG : Mrs. Ketki Gawali
OOPL : Object Oriented and Programming Lab	RS : Ms. Rajashri Sadafule SP : Mr. Shantanu Pawar

DAY \ TIME	10.00 to 10.45	10.45 to 11.30	11.30 to 12.15	12.15 to 1.00	1.00 to 1.45	1.45 to 2.30	2.30 to 3.15
MON	DSAL 'A' (SJ) SSL 'B' (AAB) SSL 'C' (PR) DSAL 'D' (JJ)		DM (VGD)	DSA (SJ)		OOP (AAB)	LDCO (PR)
TUE	DSAL 'A' (SJ) DSAL 'B' (JJ) OOPL 'C' (AAB) SSL 'D' (PR)		BCN (JJ)	LDCO (PR)		DSA (SJ)	DM (VGD)
WED	OOPL 'A' (AAB) LDCOL 'B' (PR) DSAL 'C' (JJ) OOPL 'D' (DP)		BCN (JJ)	LDCO (PR)	RECESS	OOP (AAB)	DM (VGD)
THU	OOPL 'A' (AAB) DSAL 'B' (JJ) LDCOL 'C' (PR) OOPL 'D' (DP)		BCN (JJ)	OOP (AAB)		DSA (SJ)	
FRI	LDCOL 'A' (PR) OOPL 'B' (SSB) OOPL 'C' (AAB) DSAL 'D' (JJ)		SSL 'A' (AAB) OOPL 'B' (SSB) DSAL 'C' (JJ) LDCOL 'D' (PR)				

DAY \ TIME	10.00 to 10.45	10.45 to 11.30	11.30 to 12.15	12.15 to 1.00
SAT	Audit Course - Japanese Language			

GFM : - Ms. Supriya Jagtap

Name of the Subject	Teaching Staff & Seating Arrangement
DM : Discrete Mathematics	VGD : Mrs. Vandana Dixit
LDCO : Logic Design & Computer Organization	PR : Ms. Poonam Rakibe
DSA : Data Structures and Algorithms	SJ : Ms. Supriya Jagtap
OOP : Object Oriented Programming	AAB : Mrs. Ashwini Bhamre
BCN : Basics of Computer Network	JJ : Ms. Jyoti Jadhav

SSL : Soft Skills Lab	AAB : Mrs. Ashwini Bhamre , PR : Ms. Poonam Rakibe
LDCOL : Logic Design and Computer Organization Lab	PR : Ms. Poonam Rakibe
DSAL : Data Structures and Algorithms Lab	SJ : Ms. Supriya Jagtap, JJ : Ms. Jyoti Jadhav
OOPL : Object Oriented and Programming Lab	AAB : Mrs. Ashwini Bhamre SSB : Mrs. Swapna Bhavsar DP : Mr. Digvijay Patil

COURSE STRUCTURE

Savitribai Phule Pune University
Second Year of Information Technology Engineering(2019 Course)
(With effect from Academic Year 2020-21)
Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
214441	Discrete Mathematics	03	-	01	30	70	25	-	-	125	03	--	01	04
214442	Logic Design and Computer Organization	03	-	-	30	70	-	-	-	100	03	-	-	03
214443	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
214444	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
214445	Basics of Computer Network	03	-	-	30	70	-	-	-	100	03	-	-	03
214446	Logic Design Computer Organization Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214447	Data Structures and Algorithms Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214448	Object Oriented Programming Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214449	Soft Skill Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
214450	Mandatory Audit Course 3	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	--	700	15	06	01	22

Abbreviations:
TH: Theory TW: Term Work PR: Practical
OR: Oral TUT: Tutorial

Note: Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 3:
214450A- Ethics and values in IT
214450B - Quantitative Aptitude and Logical Reasoning
214450C- Language Study- Japanese- Module
214450D-Cyber Security and Law

IMPORTANT INSTRUCTIONS

1. It is essential that the student attends all classes in time from the first day to the last day of each term.
2. Minimum of 75% attendance for lectures and practical sessions is mandatory for all students.
3. In case the attendance falls below 75% , term will not be granted and the student will not be allowed to appear for the University examination
4. Student should complete term work such as Journals, Files as per schedule. If the student fails to complete the term work to the entire satisfaction of the Head of the Department his/her term will not be granted and he/she will not be allowed to appear for the University examination.
5. Attendance to all class tests or internals exams is compulsory.
6. Students are always required to carry Identity card (duly signed by Authority) everyday to college and shall show the same on demand by any faculty/official of the Institute in the campus.
7. Students are advised to maintain good rapport with classmates and staff.
8. Institute uniform is compulsory on specified days, during University examinations, for internal tests and special functions decently dressed on the other days of the week.

TERM WORK EVALUATION CRITERIA

Final term work will be given based on throughout performance of the student. 100 marks are distributed in (60 for continuous assessment + 15 for internal test result + 5 for general behavior + 20 for attendance of student)

- 60 marks shall be awarded to the students, based on their journal work, which includes experiment's write up, program print out. Each assignment should be evaluated for 10 marks.
    - Distribution of 10 marks for each assignment is as follows:

Sr. No.	Head	Marks
i.	Coding standards, proper indentation, Comments, Documentation	2 Marks
ii.	Timely submission	3 Marks
iii.	Test cases / originality / Understanding of Assignment	5 Marks

- 15 marks shall be allotted based on the marks of Class test/ Assessment test per unit/ mock exam.
- 5 marks for General Behavior.
- 20 Marks as per the college policy for Term Work, marks are to be awarded for attendance as per the below, based on the percentage of attendance per subject, combining lectures and practical's together, wherever applicable.

Sr .No.	%of attendee=total(Lectures + Practical's attended)	Marks
1	90 to 100	20
2	85to<90	16
3	80to<85	12
4	75 to <80	10

EXAM EVALUATION CRITERIA

University Examination

Phase I Online examination of 25 marks, 30 minutes duration, containing objective- multiple choice questions (MCQ) and fill in blanks; based on unit I and unit II of the subject

Phase II Online examination of 25 marks, 30 minutes duration, containing objective- multiple choice questions (MCQ)) and fill in blanks; based on unit III and unit IV of the subject

University Practical Examination of 50 marks oral/ practical duration 3 hr, contain problem statement based on assignment submitted as term work during lab hours Each chit will have 3 problem statements

- Every student will pick up one chit randomly and will perform one assignment/experiment out of three written on his/her chit.
- Practical examination will be based on the term work.
- Oral examination (if applicable i.e. in case of Oral as a separate passing head) will be based on journal and theory syllabus
- Questions will be asked during the practical examination to judge the understanding of the practical performed in the examination

Note: student will be allowed for university practical examination only when, all types of assignments given by respective staff and Satisfying attendance criteria

Phase III Written examination of 50 marks, 2 hours duration; based on all the six units, shall be conducted at the end of semester, as per the schedule of the university.

Internal Examination

MCQ Test 1

Test of 25 marks, 30 minutes duration, containing objective- multiple choice questions (MCQ) and fill in blanks; based on unit I and unit II of the subject.

MCQ Test 1

Test of 25 marks, 30 minutes duration, containing objective- multiple choice questions (MCQ) and fill in blanks; based on unit I and unit II of the subject

214441

Discrete Mathematics

SYLLABUS

214441 : Discrete Mathematics		
Teaching Scheme: **TH:03Hours/Week** **TUT:01Hours/Week**	**Credits: 04**	**In-Semester : 30 Marks** **End-Semester: 70Marks** **Term Work: 25 Marks**

Prerequisite:

1. if any: Basic Mathematics

Course Objectives:

1. To gain sound knowledge to formulate and solve problems with sets and propositions.
2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
3. To understand Graph and Tree terminologies and models to be applied in real life problems.
4. To recognize types of relation, formulate and solve problems with relations and functions.
5. To understand basics of number theory and its applications.
6. To understand the various types' algebraic structures and its applications.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.

CO2: Analyze and evaluate the combinatorial problems by using probability theory.

CO3: Apply the concepts of graph theory to devise mathematical models.

CO4: Analyze types of relations and functions to provide solution to computational problems.

CO5: Identify techniques of number theory and its application.

CO6: Identify fundamental algebraic structures.

UNIT – I Sets And Propositions (06 hrs + 2 hrs Tut)

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.

Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms. Applications of Sets and Propositions

Mapping of Course Outcomes for Unit I- (CO1)

UNIT – II Combinatorics And Discrete Probability (06 hrs + 2 hrs Tut)

Combinatorics: Rules of Sum and Product, Permutations, Combinations.

Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Information and Mutual Information, Applications of Combinatorics and Discrete Probability.

Mapping of Course Outcomes for Unit II- (CO2)

UNIT – III	Graph Theory	(06 hrs + 2 hrs Tut)
Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring. **Trees**: Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network). Applications of Graph Theory. **Mapping of Course Outcomes for Unit III- (CO3)**		
UNIT – IV	**Relations And Functions**	**(06 hrs + 2 hrs Tut)**
Relations: Properties of Binary Relations, Closure of Relations, Warshall'sAlgorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices, Chains and Anti Chains. **Functions**: Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete Numeric Functions. Recurrence Relations: Recurrence Relation, Linear Recurrence Relations with Constant Coefficients, Total Solutions, Applications of Relations and Functions. **Mapping of Course Outcomes for Unit IV- (CO4)**		
UNIT – V	**Introduction To Number Theory**	**(06 hrs + 2 hrs Tut)**
Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem. **Mapping of Course Outcomes for Unit V- (CO5)**		
UNIT - VI	**Algebraic Structures**	**(06 hrs + 2 hrs Tut)**
Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Cosets, Normal Subgroup, Codes and Group Codes, Ring, Integral Domain, Field. Applications of Algebraic Structures. **Mapping of Course Outcomes for Unit VI- (CO6)**		
Text Books		

1. C. L. Liu and D. P. Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, McGraw-Hill
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, & 7th edition, McGraw-Hill

Reference Books

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, “Discrete mathematical structures”, 6th edition, Prentice Hall of India
2. Edgar G. Goodaire, Michael M. Parmenter, “Discrete Mathematics with Graph Theory”, 3rd Edition, Pearson Education
3. Tremblay J. S., “Discrete mathematical structures with application”, 3rdEdition, Tata McGraw Hill 4. Lipschutz Seymour, “Discrete mathematics”, 4th Edition, Tata McGraw
5. Johnsonbaugh Richard, “Discrete Mathematics”, 7th edition, Pearson
6. Biggs Norman L, “Discrete mathematics”, 6th edition, Oxford
7. David M. Burton, “Elementary Number Theory”, &7th Edition, McGraw-Hill

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit	Assessment Technique	Blooms Taxonomy Category
CO214441.1	Formulate and apply formal proof techniques and solve the problems with logical reasoning.	I	UNIT TEST - I	L1-Remembering,
CO214441.2	Analyze and evaluate the combinatorial problems by using probability theory.	II	UNIT TEST – I	L5- Evaluating
CO214441.3	Apply the concepts of graph theory to devise mathematical models.	III	UNIT TEST – I	L3- Applying
CO214441.4	Analyze types of relations and functions to provide solution to computational problems.	IV	UNIT TEST – II	L4- Analyzing
CO214441.5	Identify techniques of number theory and its application.	V	UNIT TEST – II	L3- Applying
CO214441.6	Identify fundamental algebraic structures.	VI	UNIT TEST - II	L3- Applying

PREREQUISITES

Sr. No.	Unit Number	Prerequisite subject name
1.	I	Basic Mathematics
2.	II	Basic Mathematics
3.	III	Basic Mathematics
4.	IV	Basic Mathematics
5.	V	Basic Mathematics
6.	VI	Basic Mathematics

TEACHING PLAN

Teaching Plan Short

Academic Year:-2021-22 Semester :-I w. e. f. :- 05/07/2021

Class : - SE Division: A &B

Subject :- Discrete Structure Subject Code :- 214441

Faculty In charge :- Mr. Shantanu S Pawar/Ms. Vandana G Dixit No. of Lectures/ weeks: 4

- **Lecture Plan**

Sr. No.	Unit No.	Unit/ Topic Name	Start week	End week
1.	I	Sets and Propositions	2nd Week August	5th week August
2.	II	Permutations, Combinations and Discrete Probability	1st Week September	3rd Week September
3.	IV	Relations and Functions	4th week September	1st week October
4.	III	Graph Theory	2nd week October	4th week October
5.	V	Introduction To Number Theory	5th week October	2nd week November
6.	VI	Algebraic Structures	3rd week November	1st week December

Detail Teaching Plan

LectNo	Unit No.	Main Topic to be Covered	Sub Topics to be Covered	Chap. No. & Reference Books	CO to Attain	Measurable to attain CO	Mode of Delivery
1	I	**Sets and Propositions**	Sets, Combination of sets	C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics" & Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill	CO1	Unit Test	Chalk and Talk
2			Venn Diagrams				
3			Finite and Infinite sets, Un-countably infinite sets				
4			Principle of inclusion and exclusion, multisets.				
5			Propositions, Conditional Propositions				
6			Logical Connectivity, Propositional calculus				
7			Universal and Existential Quantifiers, Normal forms,				
8			methods of proofs				
9			Mathematical Induction				

10	II	**Combinatorics And Discrete Probability**	Combinatorics: Rules of Sum and Permutations	R. Johnsonbaugh, "Discrete Mathematics", 5th Edition, Pearson Education & Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill	CO2	Unit Test	Chalk and Talk
11			Combinations				
12			Discrete Probability: Discrete Probability,				
13			Conditional Probability				
14			Bayes Theorem				
15			Information and Mutual Information				
16			Applications of Combinatorics				
17			Discrete Probability				
18	III	**Graph Theory**	Graphs: Basic Terminologies, Multi-Graphs	R. Johnsonbaugh, "Discrete Mathematics", 5th Edition, Pearson Education & Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th	CO3	Unit Test	Chalk and Talk
19			Weighted Graphs, Sub Graphs				
20			Isomorphic graphs, Complete Graphs, Regular Graphs				

21			Bipartite Graphs, Operations on Graphs	edition, McGraw-Hill			
22			Paths, Circuits, Hamiltonian and Eulerian graphs				
23			Travelling Salesman Problem, Factors of Graphs				
24			Planar Graphs, Graph Colouring.				
25			Trees: Tree Terminologies, Rooted Trees				
26			Path Length in Rooted Trees, Prefix Codes				
27			Spanning Trees, Fundamental Cut Sets and Circuits				
28			Max flow –Min Cut Theorem (Transport Network). Applications of Graph Theory.				

29	IV	**Relations And Functions**	Relations: Properties of Binary Relations	C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics" & Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill	CO 4	Unit Test	Chalk and Talk
30			Closure of Relations, Warshall's Algorithm				
31			Equivalence Relations, Partitions,				
32			Partial Ordering Relations, Lattices, Chains and Anti Chains.				
33			Functions: Functions, Composition of Functions				
34			Invertible Functions, Pigeonhole Principle				
35			Discrete Numeric Functions.				
36			Recurrence Relation, Linear Recurrence Relations with Constant Coefficients				
37			Total Solutions, Applications of Relations and Functions				

38	V	**Introduction To Number Theory**	Divisibility of Integers: Properties of Divisibility	R. Johnsonbaugh, "Discrete Mathematics", 5th Edition, Pearson Education & Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill	CO 5	Unit Test	Chalk and Talk
39			Division Algorithm, Greatest Common Divisor GCD and its Properties				
40			Euclidean Algorithm, Extended Euclidean Algorithm				
41			Prime Factorization Theorem, Congruence Relation,				
42			Modular Arithmetic, Euler Phi Function, Euler's Theorem				
43			Fermat's Little Theorem, Additive and Multiplicative Inverses				
44			Chinese Remainder Theorem.				
45	VI	**Algebraic Structures**	Algebraic Structures: Introduction Semigroup	B. Kolman, R. Busby and S. Ross, "Discrete Mathematical Structures", 4th Edition,Pearson Education & Kenneth H. Rosen, "Discrete	CO 6	Unit Test	Chalk and Talk
46			Monoid, Group				
47			Abelian Group,				
48			Permutation Groups				

49			Cosets, Normal Subgroup	Mathematics and its Applications", & 7th edition, McGraw-Hill			
50			Codes and Group Codes, Ring				
51			Integral Domain, Field				
52			Applications of Algebraic Structures.				

UNIT WISE QUESTION BANK

Unit 1

12	Question	CO	Marks	University Year
1	During a survey of the ice cream preferences of students, it was found that 22 like mango, 25 like custard apple, 39 like grape, 9 like custard apple and mango, 17 like mango and grape, 20 like custard apple and grape, 6 like all flavors and 4 like none. Then how many students were surveyed ? How many students like exactly one flavor, how many students like exactly two flavors?	CO1	6	2014
2	State the principle of Mathematical Induction, using mathematical induction prove the following proposition $P(n)= 1 + 4 + 7 + ----+(3n – 2)= \frac{n (3n – 1)}{2}$	CO1	6	2014
3	Show that each of these conditional statements is a tautology by using truth tables : (i) $(p \wedge q) \rightarrow p$ (ii) $p \rightarrow (p \vee q)$.	CO1	6	2018
4	Prove the statement is true using mathematical induction : $n^3 + 2n$ is divisible by 3 for all $n >= 1$	CO1	6	2016
5	There are 2504 computer science students at a school. Of these, 1876 have taken a course in Java, 999 have taken a course in Linux, and 345 have taken a course in C. Further, 876 have taken courses in both Java and Linux, 231 have taken courses in both Linux and C, and 290 have taken courses in both Java and C. If 189 of these students have taken courses in Linux, Java, and C, how many of these 2504 students have not taken a course in any of these three programming languages ?	CO1	6	2018
6	Prove the statement is true using mathematical induction $n^3 + 2n$ is divisible by 3 for all $n >= 1$	CO1	6	2015
7	Show that (A-B)-C= A – (BUC) Using Venn diagram	CO1	3	2015
8	Obtain CNF for following $\sim(p \vee q) \leftrightarrow (p \wedge q)$	CO1	3	2015

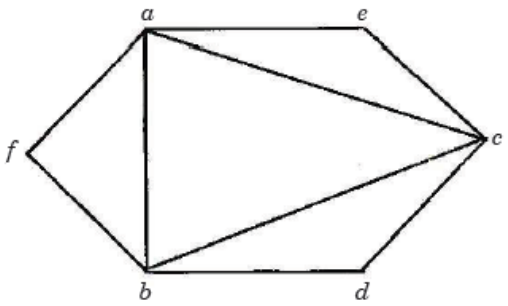
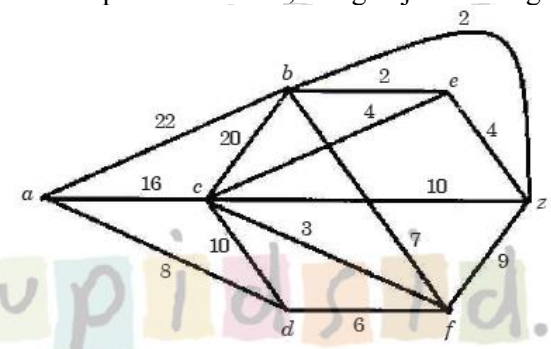
Unit 2

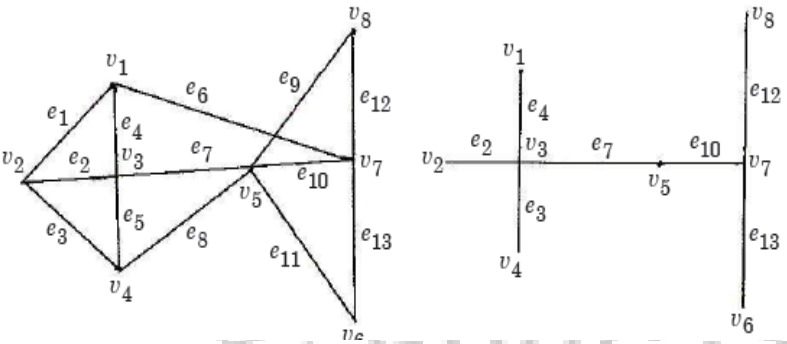
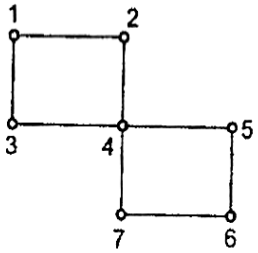
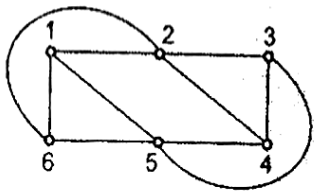
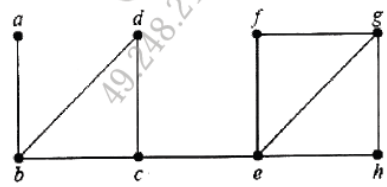
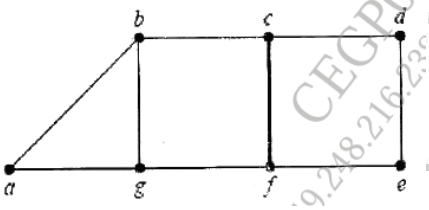
Q.No	Question	CO	Marks	University Year
1	Prove by induction that the sum of cubes of three consecutive integers is divisible by 9.	CO2	6	2017
2	Two cards are drawn together from a pack of 52 cards. Determine the probability that one is spade and one is a heart.	CO2	4	2017
3	In a certain college town, 25% of the students failed in mathematics,15% failed in chemistry, and 10% failed both in mathematics and chemistry. A student is selected at random : (i) If he failed in chemistry, what is the probability that he failed in mathematics ?	CO2	7	2014

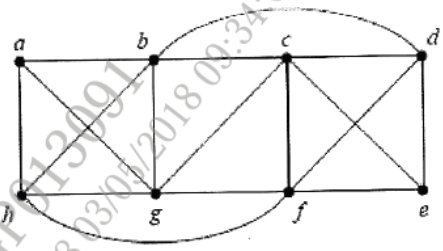
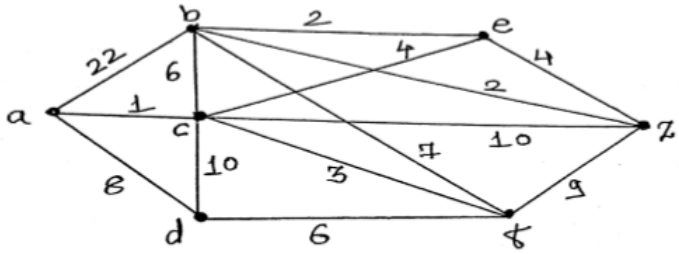
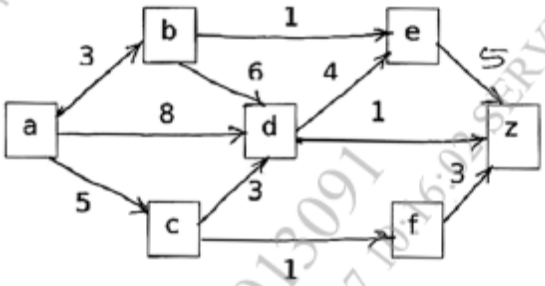
	(ii) If he failed in mathematics, what is the probability that he failed in chemistry ? (iii) What is the probability that he failed in mathematics or chemistry ? (iv) What is the probability that he failed neither in mathematics nor in chemistry ?			
4	12 persons are made sit around a table. Find the number of ways they can sit such that 2 specific persons are not together.	CO2	6	2014
5	Find the smallest number of people you need to choose at random so that the probability that at least two of them were both born on April 1 exceeds ½. Assume number of days in year as 366 days.	CO2	6	2018
6	A club has 25 members : (i) How many ways are there to choose four members of the club to serve on an executive committee? (ii) How many ways are there to choose a president, vice president, secretary, and treasurer of the club, where no person can hold more than one office ?	CO2	6	2018
7	Out of a total 130 students,60 are wearing hats,51 are wearing scarves,and 30 are wearing both hats and scarves.Out of 54 students who are wearing sweaters , 26 are wearing hats, 21 are wearing scarves,and 12 are wearing both hats and scarves.Everyone wearing neither a hat nor a scarf is wearing gloves: (a) How many students are wearing gloves? (b) How many students not wearing a sweater are wearing hats but not scarves? (c) How many students not wearing a sweater are wearing neither hat nor scarf?	CO2	6	2017
8	Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?	CO2	3	2017
9	In a box, there are 8 red, 7 blue, 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?	CO2	3	2017
10	Three unbiased coins are tossed. What is the probability of getting at most two heads?	CO2	2	2017
11	A survey of 70 high school students revealed that 35 like folk music, 15 like classical music , and 5 like both. How many of the students surveyed do not like either folk or classical music?	CO2	6	2015
12	A Die is rolled and a coin is tossed find the probability that the die shows an odd number and the coin shows a head	CO2	4	2015

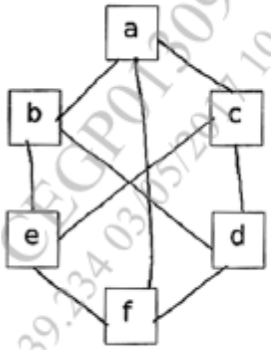
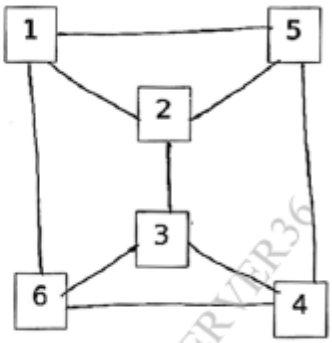
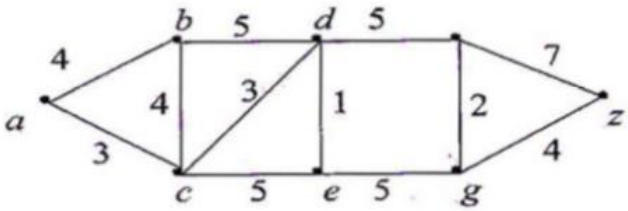
13	In how many ways can 6 men and 5 women be seated in a line so that no two women sit together?	CO2	3	2016
14	A single card is drawn from an ordinary deck S of 52 cards. Find the probability p that : (i) The card is a king. (ii) The card is a face card (jack, queen or king). (iii) The card is a heart. (iv) The card is a face.	CO2	6	2014
15	Find number of arrangement that can be made out of letters : (i) ASSASSINATION (ii) GANESHPURI.	CO2	7	2014

Unit 3

Q.No	Question	CO	Marks	University Year
1	What do you understand by factors of a graph ? Find allpossible k-Factors of the following graph : 	CO3	6	2014
2	Find the shortest path from a to z, using Dijkstra's Algorithm. 	CO3	6	2014
3	Find fundamental system of cut set for the graph G shown below with respect to the spanning tree T.	CO3	6	2014

				
4	State the theorems for presence of Euler path and circuit in a graph. Justify whether the graphs contain the following properties. If yes, write the path and circuit : (i) Euler path (ii) Euler circuit (iii) Hamiltonian path (iv) Hamiltonian Circuit  G_1  G_2	CO3	6	2018
5	Find minimum cut set and value of vertex connectivity of the following graphs (i)  (ii) 	CO3	6	2018

	(iii) 			
6	Use Dijkstra's algorithm to find the shortest path from a to z : 	CO3	6	2016
7	Solve the following recurrence relations. $a_r - 7a_{r-1} + 10a_{r-2} = 2^r$ $a_1 = 3,\ a_2 = 21.$	CO3	6	2017
8	Find the shortest path between vertex a to z 	CO3	6	2017
9	Functions f,g,h are defined on sets x={1,2,3} as $f = \{(1, 3), (2, 1), (3, 2)\};$ $g = \{(1, 2), (2, 3), (3, 1)\};$ $h = \{(1, 2), (2, 1), (3, 3)\}$ (1)Find fog and gof. are they equal (2)find fogoh and fohog	CO3	6	2017
10	Define Isomorphic graph.Show following graphs ar Isomorphic.	CO3	6	2017

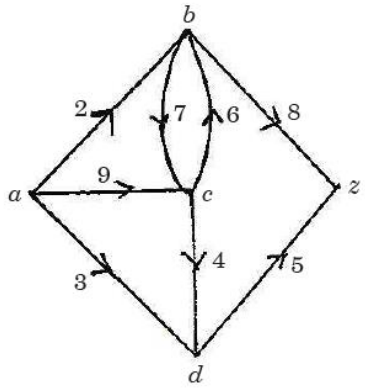
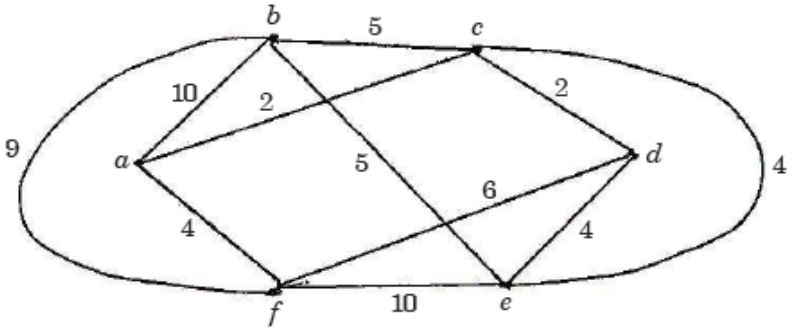
	 G1  G2			
11	Find the shortest path using Dijkstra's algorithm for the graphs. 	CO3	6	2015

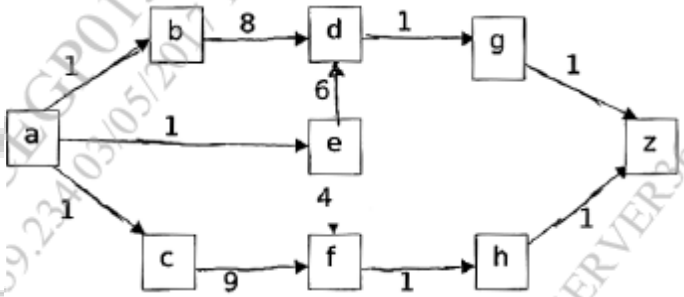
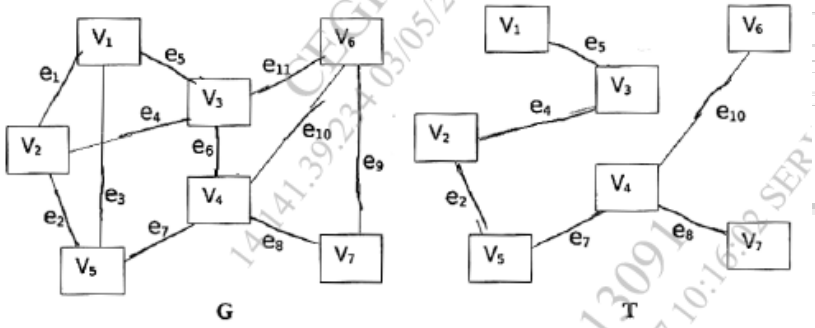
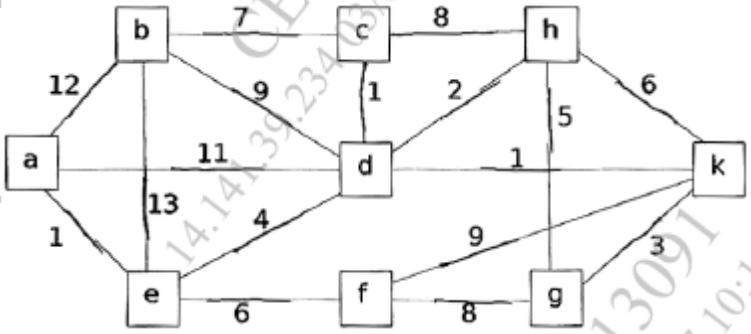
Unit 4

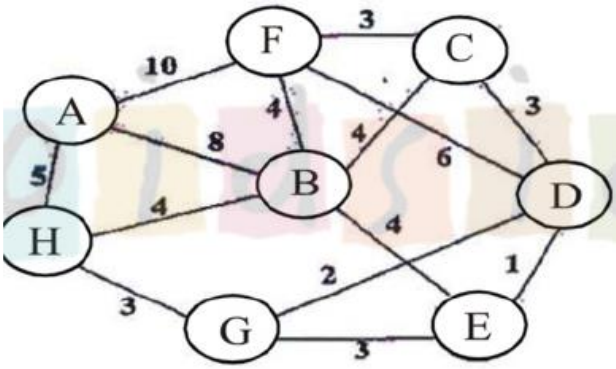
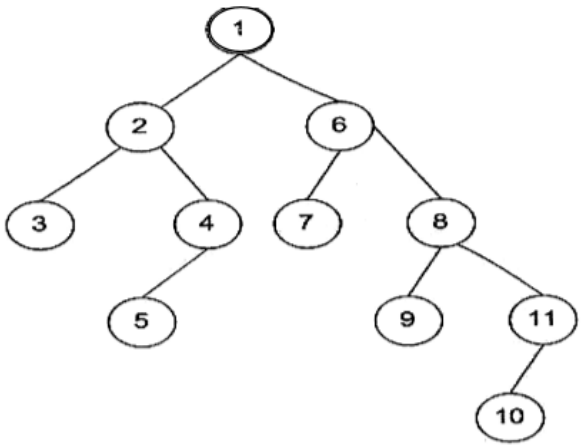
Q.No	Question	CO	Marks	University Year
1	Draw Hasse Diagram on relation R on A. Let A = {1,2,3,4,5} and R={(1,1), (2,1)	CO4		2016
2	What is recurrence relation ? Solve the following recurrence relation : ar – 7ar – 1 + 10ar – 2 = 0 given that a0 = 0 and a1 = 3.	CO4	6	2014
3	Let A = {1, 2, 3, 4} and let R = {(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)}. Find Transitive closure of R using Warshall's Algorithm.	CO4	6	2014
4	Draw the graph and its equivalent Hasse diagram for divisibility on the set : {1, 2, 3, 6, 12, 24, 36, 48}.	CO4	6	2018
5	Use Warshall's algorithm to find transitive closure of the following relation on the set {1, 2, 3, 4}, R = {(1, 2), (1, 3), (1, 4,), (2, 3), (2, 4), (3, 4)}	CO4	6	2018
6	define optimal tree for following set of weights,construct optimal binary prefix code. For each weight in the set give corresponding prefix code: 1,4,8,9,15,25,31,37	CO4	6	2017

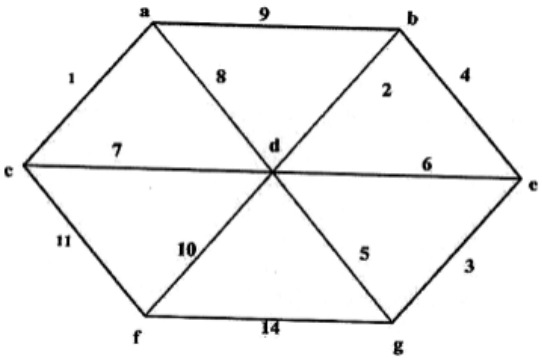
7	Solve the following recurrence relation : $a_n - 7a_{n-1} + 10a_{n-2} = 0,\ a_0 = 0,\ a_1 = 3$	CO4	6	2015
8	Find the transaction closure by using Warshall's algorithm for the given relation as R = {(1, 1), (1, 4), (2, 1), (2, 2), (3, 3), (4, 4).	CO4	6	2015
9	Find the transitive closure of R by Warshall's algorithm where A = {1, 2, 3, 4, 5, 6} and R = {(x, y)| |x − y | = 2} and draw it digraph.	CO4	6	2016
10	What is recurrence relation ? Solve the following recurrence relation : $a_r - 4a_{r-1} + 4a_{r-2} = 0$ given that $a_0 = 1$ and $a_1 = 6$	CO4	6	2016

Unit 5

Q.No	Question	CO	Marks	University Year
1	Determine the maximum flow in the following transport Network. 	CO5	7	2014
2	Define optimal tree. For the following set of weights, construct optimal binary prefix code. For each weight in the set, give corresponding code words — 8, 9, 12, 14, 16, 19.	CO5	7	2014
3	Use the Kruskal's algorithm to find the minimum spanning tree for the graph shown in the figure. 	CO5	6	2014

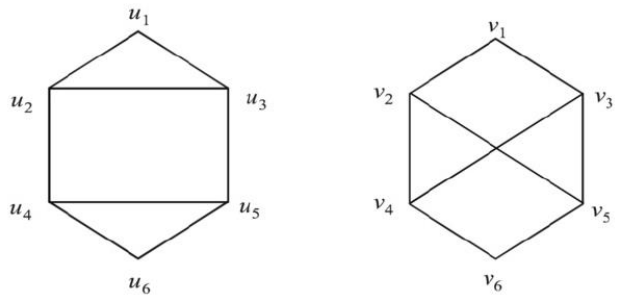
4	How many edges does a full binary tree with 1000 internal vertices have ?	CO5	6	2018
5	Represent the expression (x + xy) + (x/y) and x + ((xy + x)/y) using binary trees. Write these expressions in : (i) prefix notation (ii) postfix notation (iii) infix notation.	CO5	7	2018
6	Use Huffman coding to encode these symbols with given frequencies a : 0.20, b : 0.10, c : 0.15, d : 0.25, e : 0.30. What is the average number of bits required to encode a character ?	CO5	6	2018
7	Find the maximum flow for following transport network. 	CO5	6	2017
8	Find the fundamental of cut set for the graph G shown below with respect to the spanning tree T. 	CO5	6	2017
9	Find the minimum Spanning tree and weight of it for given graph using kruskals algorithms. 	CO5	7	2017

10	Find minimum spanning tree and its minimum weight Prim's algorithm.  	CO5	6	2015
11	Determine the preorder, postorder and inorder traversal of the following binary tree shown in Fig. 3 :  Fig. 3	CO5	6	2016
12	What is hamming distance ? Find hamming distance between code words of : c = {(0 0 0 0), (0 1 0 1), (1 0 1 1), (0 1 1 1)} Rewrite the message by adding even parity check bit.	CO5	6	2016

13	Find minimum spanning tree for the graph given below using Prim's algorithm.  	CO5	6	2016

Unit 6

Q.No	Question	CO	Marks	University Year
1	Consider an algebraic system (G, *), where G is the set of all non-zero real number and * is a binary operation defined by a * b = ab/4. Show that (G, *) is an abelian group.	CO6	6	2014
2	What is abelian group ? Show that (Z6, +) is an Abelian Group ?	CO6	7	2018
3	Find the hamming distance between code words of : C = {(0000), (0101), (1011), (0111)} Rewrite the message by adding even parity check bit and odd parity check bit.	CO6	6	2018
4	Let R = {0º, 60º, 120º, 180º, 240º, 300º} and * = binary operation, so that for a and b in R, a * b is overall angular rotation corresponding to successive rotations by a and then by b. Show that (R, *) is a Group.	CO6	7	2018
5	Let G = {even, odd} and binary operation _ be defined as : ⊕ | even | odd even | even | odd odd | odd | even Show that (G, _) is a group	CO6	6	2018

6	Let Q1 be the set of all rational numbers other than 1.Show that with operation * defined on the set Q1 by (a*b=a+b-ab) is an Abelian group.	CO6	7	2017
7	Let I be the set of all integers. For each of the following determine wheather * is an associative operation or not (1) a * b = max(a, b) (2) a * b = min(x + 2, b) (3) a * b = a − 2b (4) a * b = max(2a − b, 2b − a).	CO6	6	2017
8	Let Z_n be the set of integers {0, 1, 2, ..., n − 1}. $\oplus$ be a binary operation on Z_n such that : $a \oplus b = \begin{cases} a + b \text{ if } a + b < n \\ a + b - n \text{ if } a + b \geq n \end{cases}$ Let $\odot$ be a binary operation on Z_n such that : $a \odot b$ = the remainder of ab divided by n.	CO6	7	2017
9	Consider the (2, 7) encoding function e. $e(00)$ = 0000000 $e(01)$ = 1010101 $e(10)$ = 0111110 $e(11)$ = 0110110 (a) Find the minimum distance of e. (b) How many errors will e detect ?	CO6	6	2017
10	Determine the following sets together with binary operation represent a group. If so, determine if it is abelian or not ,specify the identity & inverse.(1) set of odd integers, binary operation: multiplication (2) set of all rational numbers binary operation:addition	CO6	6	2015
11	Determine graph G and H shown in figure are isomorphic or not?  	CO6	6	2015

12	Let Z be the set of integers : (*i*) Show that the operation * on Z defined by $a * b = a + b + 1$ for all $a, b \in Z$ satisfies the closure property, associative law and the commutative law. (*ii*) Find the identity element (*iii*) Define inverse. What is the inverse of an integer a ?	CO6	6	2016
13	A secondary storage media contains information of files with different formats. The frequency of different types of files is as follows : Exe(20), bin(75), bat(20), jpeg(85), dat(51), doc(32), sys(26), c(19), cpp(25), bmp(30), avi(24), prj(29), lst(35), zip(37). Using Huffman algorithm, find optimal tree and its prefix codes.	CO6	7	2016
14	Define each of the following : (*i*) Homomorphism of group (*ii*) Isomorphism of group (*iii*) Semigroup (*iv*) Abelian group	CO6	6	2016

Home Assignment

UNIT NO. 1

Q. No.	Question	CO	Marks
1	A box contains 2 white, 3 black and 5 red balls. In how many ways can three balls be drawn from the box if at least one black ball is to be included in the draw?	CO1	6
2	In how many ways can the letters of the word ENCYCLOPAEDIA be arranged such that vowels only occupy the even positions?	CO1	6

UNIT NO. 2

Q. No.	Question	CO	Marks
1	It was found that inn first year of computer science of 80 students, 50 know COBOL, 55 know C language and 46 know Pascal. It was also known that 37 know C and COBOL, 28 know C and Pascal, and 25 know Pascal and COBOL. 7 students however know none of the language. Find: (i) How many know all the three languages? (ii) How many know exactly two languages? (iii) How many know exactly one language?	CO2	6
2	In a class of 55 students, the number of students studying different subjects are as follows: Maths – 23, Physics – 24, Chemistry – 19, Maths + Physics – 12, Maths + Chemistry – 9, Physics + Chemistry – 9, Physics + Chemistry – 7, all three subjects – 4. Find the numbers of students who have taken: (i) At least one subject, (ii) Exactly one subject ,	CO2	6

UNIT NO. 3

Q. No.	Question	CO	Marks
1	Let A be the product set {1, 2, 3} X {a, b}. How many relations are there on A?	CO2	6
2	Let A be a set of lines in a plane. Define the following relation on A: I_1 A I_2iff I_1 is perpendicular to I_2.determine whether the properties of a relation are satisfied by R.diagram.	CO2	6

UNIT NO. 4

Q. No.	Question	CO	Marks
1	Determine the number of edges in a graph with 6 nodes,2 of degree 4 and 4 of degree 2. Draw two such graphs	CO4	6
2	How many nodes are necessary to construct a graph with exactly 6 edges in which edge node is of degree 2	CO4	6

UNIT NO. 5

Q. No.	Question	CO	Marks

1	Determine the number of edges in a graph with 6 nodes,2 of degree 4 and 4 of degree 2. Draw two such graphs	CO4	6
2	What is the union of (i) two null graphs N3 and N4 (ii) two complete graph K2 and K3	CO4	7

UNIT NO. 6

Q. No.	Question	CO	Marks
1	Consider the binary operation table defined on the set A = {a, b, c, d} Then a * (b * c) =	CO5	6
2	Let(A,*)be an algrbric system where * is a binary operation such that for any a,b, belongs to A a*b=a i)show that * is an associative operation and can *ever be a commutative operation	CO5	6

*	a	b	c	d
a	b	c	a	d
b	c	b	a	d
c	a	b	c	d
d	d	a	b	C

Additional Resources:-

NIL

214442
Logic Design & Computer Organization

SYLLABUS

214442: Logic Design & Computer Organization

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	In-Semester: 30Marks End-Semester: 70Marks

Unit 1	Introduction To Digital Electronics	06 hrs

Digital Logic families: Digital IC Characteristics; TTL: Standard TTL characteristics, Operation of TTL NAND gate; CMOS: Standard CMOS characteristics, operation of CMOS NAND gate; Comparison of TTL & CMOS.

Signed Binary number representation and Arithmetic: Sign Magnitude, 1's complement & 2's complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement; IEEE Standard 754 Floating point number representations.

Codes: Binary , BCD, octal , hexadecimal , Excess-3 , Gray code & their conversions

Logic minimization: Representation of logic functions: logic statement, truth table, SOP form, POS form; Simplification of logical functions using K-Maps up to 4 variables.

Unit 2	Combinational Logic Design	06 hrs

Design using SSI chips: Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder.

Introduction to MSI chips: Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74238) Encoder (IC 74147), Binary adder (IC 7483)

Design using MSI chips: BCD adder & Subtractor using IC 7483, Implementation of logic functions using IC 74153 & 74138.

Unit 3	Sequential Logic Design	06 hrs

Introduction to sequential circuits: Difference between combinational circuits and sequential circuits; Memory element-latch & Flip-Flop.

Flip- Flops: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from one FF to another , Study of flip flops with regard to asynchronous and synchronous, Preset & Clear, Master Slave configuration ; Study of 7474, 7476 flip flop ICs.

Application of flip-flops: Counters- asynchronous, synchronous and modulo n counters, study of 7490 modulus n counter ICs & their applications to implement mod counters; Registers- shift register types (SISO, SIPO, PISO &PIPO)& applications.

Unit 4	Computer Organization &Processor	06 hrs

Computer organization & computer architecture, organization, functions & types of computer units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control , Typical control lines, Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle

Processor: Single bus organization of CPU; ALU(ALU signals, functions & types); Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR)& control unit (control signals & typical organization of hard wired &micro programmed CU).

Micro Operations (fetch, indirect, execute, interrupt) and control signals for these micro operations.

Case Study : 8086 processor , PCI bus

Unit 5	Processor Instructions &Processor	06 hrs

	Enhancements	
Instruction : elements of machine instruction ; instruction representation (Opcode& mnemonics, Assembly language elements) ; Instruction Format & 0-1-2-3 address formats, Types of operands Addressing modes; Instruction types based on operations (functions& examples of each); key characteristics of RISC& CISC; Interrupt: its purpose, types , classes & interrupt handling (ISR , multiple interrupts), exceptions; instruction pipelining(operation & speed up) Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages 0f multicores), typical features of multicore intel core i7. Case Study : 8086 Assembly language programming		
Unit 6	**Memory &Input / Output Systems**	**06 hrs**
Memory Systems: Characteristics of Memory Systems, Memory Hierarchy, signals to connect memory to processor, memory read & write cycle, characteristics of semiconductor memory: SRAM, DRAM &ROM, Cache Memory – Principle of Locality, Organization, Mapping functions, write policies, Replacement policies, Multilevel Caches, Cache Coherence, Input / Output Systems: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA). Case Study : USB flash drive		

Text Books:

1. "Modern Digital Electronics", R.P. Jain, Tata McGraw-Hill, Third Edition
2. "Computer organization and architecture, designing for performance" by William Stallings , Prentice Hall ,Eighth edition

Reference Books:

1. "Digital Design", M Morris Mano, Prentice Hall, Third Edition
2. "Computer organization" , Hamacher and Zaky, Fifth Edition
3. "Computer Organization and Design: The Hardware Software Interface" D. Patterson, J. Hennessy, Fourth Edition, Morgan Kaufmann
4. "Microprocessors and interfacing-programming and hardware" Douglas V. Hall and SSSP Rao, McGraw-Hill ,Third Edition

COURSE OUTCOME

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Blooms Taxonomy Category
214442.1	To Perform basic binary arithmetic & simplify logic expressions.	Unit I	Unit Test, Pre In sem Exam	Applying
214442.2	To Grasp the operations of logic ICs and Implement combinational logic functions using ICs.	Unit II	Unit Test, Pre In sem Exam	Applying
214442.3	To Comprehend the operations of basic memory cell types and Implement sequential logic functions using ICs.	Unit III	Unit Test, Pre In sem Exam	Applying
214442.4	To Elucidate the functions & organization of various blocks of CPU.	Unit IV	Unit Test, Pre End Sem Exam	Understanding
214442.5	To Understand CPU instruction characteristics, enhancement features of CPU	Unit V	Unit Test, Pre End Sem Exam	Understanding
214442.6	To Describe an assortment of memory types (with their characteristics) used in computer systems and basic principle of interfacing input, output devices.	Unit VI	Unit Test, Pre End Sem Exam	Understanding

PREREQUISITES

Sr. No.	Unit Number	Prerequisite subject name
1.	I	Basic Electronics Engineering, Basic Mathematics
2.	II	Basic Electronics Engineering, Basic Mathematics
3.	III	Basic Electronics Engineering, Basic Mathematics
4.	IV	Basic Electronics Engineering, Basic Mathematics
5.	V	Basic Electronics Engineering, Basic Mathematics, C Programming
6.	VI	Basic Electronics Engineering, Basic Mathematics, C Programming

TEACHING PLAN

Teaching Plan Short

Academic Year:-2020-21 Semester:-I w. e. f. :- 20/08/2021

Class :-SE Division: A/B

Subject :-Logic Design & Computer Organization Subject Code :- 214442

Faculty In charge :-Mrs. Tanmayee Kute & Ms.Poonam Rakibe No. of Lectures/ weeks:3

- **Lecture Plan**

Sr. No.	Unit No.	Unit/ Topic Name	Start week	End week
1.	I	Introduction To Digital Electronics	August 3rd week	August 4th week
2.	II	Combinational Logic Design	September 1st week	September 2nd week
3.	III	Sequential Logic Design	September 3rd week	September 5th week
4.	IV	Computer Organization &Processor	October 1st week	October 2nd week
5.	V	Processor Instructions &Processor Enhancements	October 2nd week	October 4th week
6.	VI	Memory &Input / Output Systems	November 1st week	November 3rdweek

Detail Teaching Plan

Lect. No	Unit No.	Main Topic to be Covered	Sub Topics to be Covered	Reference Books	CO to Attain	Measurable to attain CO	Mode of Delivery
1	I	**Digital Logic families**	Digital IC Characteristics; TTL: Standard TTL characteristics	R1 ,T1	1	Unit Test, Pre In Sem Exam	Online lecture and PPT
2			CMOS: Standard CMOS characteristics				Online lecture and PPT
3			TTL NAND gate, operation of CMOS NAND gate, Comparison of TTL & CMOS.				Online lecture and PPT
4		**Signed Binary number representation and Arithmetic**	Sign Magnitude, 1's complement & 2's complement representation,	R1 ,T1			Online lecture and PPT
5			unsigned Binary arithmetic (addition, subtraction, multiplication, and division)				Online lecture and PPT
6			subtraction using 2's complement				Online lecture and PPT
7			IEEE Standard 754 Floating point number representations.	R1 ,T1			Online lecture and PPT
8		**Codes**	Binary , BCD, octal , hexadecimal , Excess-3 , Gray code	T1			Online lecture and PPT
9			their conversions				Online lecture and PPT
10		**Logic minimization**	Representation of logic functions: logic statement, truth table, SOP form, POS form	T1			Online lecture and PPT
11			Conversion into canonical forms				Online lecture and PPT
12			Simplification of logical functions using K-Maps up to 4 variables				Online lecture and PPT

13	**II**	**Design using SSI chips**	Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder.	R1 ,T1	2	Unit Test, Pre In Sem Exam	Online lecture and PPT
14			Code converters	T1			Online lecture and PPT
15		**Introduction to MSI chips**	Multiplexer (IC 74153), Demultiplexer (IC 74138	R1 ,T1			Online lecture and PPT
16			Decoder (74238) Encoder (IC 74147)				Online lecture and PPT
17			Binary adder (IC 7483)	R1 ,T1			Online lecture and PPT
18		**Design using MSI chips**	BCD adder & Subtractor using IC 7483				Online lecture and PPT
19			Implementation of logic functions using IC 74153 & 74138.				Online lecture and PPT
20	**III**	**Introduction to sequential circuits**	Difference between combinational circuits and sequential circuits; Memory element-latch & Flip-Flop.	T1	3	Unit Test, Pre In Sem Exam	Online lecture and PPT
21		**Flip- Flops**	Logic diagram, truth table & excitation table of SR, JK, D, T flip flops				Online lecture and PPT
22			Conversion from one FF to another	T1			Online lecture and PPT
23			Study of flip flops with regard to asynchronous and synchronous	T1			Online lecture and PPT
24			Preset & Clear, Master Slave configuration	T1			Online lecture and PPT
25			Study of 7474, 7476 flip flop IC				Online lecture and PPT
26		**Application of flip-flops**	Counters- asynchronous, synchronous and modulo n counters	T1			Online lecture and PPT
27			study of 7490 modulus n counter ICs & their applications to implement mod counters	T1			Online lecture and PPT
28			Registers- shift register types (SISO, SIPO, PISO &PIPO)& applications.	T1			Online lecture and PPT

29			organization, functions & types of computer units	T1			Online lecture and PPT
30		**Computer organization & computer architecture**	CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control	R2	4	Unit Test, Pre End Sem Exam	Online lecture and PPT
31			Typical control lines, Multiple-Bus Hierarchies				Online lecture and PPT
32			Von Neumann & Harvard architecture				Online lecture and PPT
33	**IV**		Instruction cycle				Online lecture and PPT
34		**Processor**	Single bus organization of CPU; ALU(ALU signals, functions & types);	R2			Online lecture and PPT
35			Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR)&				Online lecture and PPT
36			control unit (control signals & typical organization of hard wired & micro programmed CU).				Online lecture and PPT
37		**Micro Operations**	(fetch, indirect, execute, interrupt) and control signals for these micro operations.	R2			Online lecture and PPT
38		**Instruction**	elements of machine instruction ; instruction representation (Opcode& mnemonics, Assembly language elements	R2	5	Unit Test, Pre End Sem Exam	Online lecture and PPT
39			Instruction Format & 0-1-2-3 address formats, Types of operands				Online lecture and PPT
40			Addressing modes; Instruction types based on operations (functions & examples of each				Online lecture and PPT
41	**V**		key characteristics of RISC& CISC; Interrupt: its purpose, types , classes & interrupt handling (ISR , multiple interrupts	R2			Online lecture and PPT
42			exceptions; instruction pipelining(operation & speed up)				Online lecture and PPT
43		**Multiprocessor systems**	Taxonomy of Parallel Processor Architectures	T2			Online lecture and PPT

44			two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages 0f multicores	T2			Online lecture and PPT
45			typical features of multicore intel core i7	T2			Online lecture and PPT
46	**VI**	**Memory Systems**	Characteristics of Memory Systems, Memory Hierarchy, signals to connect memory to processor, memory read & write cycle	T2	6	Unit Test, Pre End Sem Exam	Online lecture and PPT
47			characteristics of semiconductor memory: SRAM, DRAM &ROM	T2			Online lecture and PPT
48		**Cache Memory**	Principle of Locality, Organization, Mapping functions, write policies	T2			Online lecture and PPT
49			Replacement policies, Multilevel Caches, Cache Coherence,	T2			Online lecture and PPT
50		**Input / Output Systems**	I/O Module, Programmed I/O, Interrupt Driven I/O,	T2			Online lecture and PPT
51			Direct Memory Access (DMA).	T2			Online lecture and PPT

Books referred:

1. R1: “Digital Design”, M Morris Mano, Prentice Hall, Third Edition
2. T1: “Modern Digital Electronics”, R.P. Jain, Tata McGraw-Hill, Third Edition
3. R2: “Computer organization” , Hamacher and Zaky, Fifth Edition
4. T2: “Computer organization and architecture, designing for performance” by William Stallings , Prentice Hall ,Eighth edition

UNIT WISE QUESTION BANK

Unit I: Introduction To Digital Electronics

Sr. No.	Question	CO No.	Marks	University Year
1	Do the required conversions for the following numbers? $(BF8)_{16}$ = ( ) 10 $(1000)_{10}$= ( ) 8 $(377)_8$= ( ) 16 $(1010.11)_{10}$= ( ) 2 $(11100011101)_2$= ( ) 10 $(85.7)_{16}$= ( ) 8	CO1	6	
2	Define the following terms related to logic family: Propagation delay Fan out VIL, VIH Noise margin		4	
3	Convert given numbers in binary form & use 2's complement method to perform following operation 1)(-48)-(+23) 2) –(48)-(-23)		6	May 2019
4	Explain with diagram CMOS to TTL interface		6	May 2019
5	Use K map technique to realize following expression using minimum number of gates Y=∑m (1,2,9,10,11,14,15)		6	May 2019
6	Obtain excess-3 code for (25)10		2	May 18
7	Convert the following numbers in Binary form: (i) (125.12)10 = (?)2 (ii) (337.025)8 = (?)2 (iii) (5DB.FA)16 = (?)2		6	Oct 2018
8	Minimize the given Boolean expression using K maps method F (A, B, C, D) = ∑m (0, 1, 3, 7, 8, 9, 11, 15).		6	Oct 2018
9	Draw and Explain TTL NAND gate?		2	MAY 2016
10	Convert decimal 27 into following: 1)Binary 2)Excess-3 3)Gray 4)HEX		6	May 2016

11	Convert decimal 27 into following: 1)Binary 2)Excess-3 3)Gray 4)HEX		6	May 2016
12	Convert (110101.101010)2 to octal.		2	Dec 2015
13	Explain following TTL characteristics: 1)Noise immunity 2)High level input voltage 3)Figure of merit		6	Dec2015
14	Convert the following number into its equivalent hexadecimal, decimal and binary number1. (357.2)8 2. (453.54)8		6	May201 4
15	Explain TTL characteristics: Speed of operation and Fan out		2	Dec2014
16	Compare TTL and CMOS logic family		4	DEC 2014

Unit II: Combinational Logic Design

Sr. No.	Question	CO No.	Marks	University Year
1	Explain working of 16:1 multiplexer	CO2	6	
2	Draw and explain 4-bit BCD adder using IC 7483?		6	
3	Design 12: 1 MUX using 4: 1 MUX		4	
4	Implement the following Boolean function using 4:1 MUX F (A, B, C, D) = A+ABD+ABC+AB+D		6	
5	Design &Implement 8: 1 MUX using 4:1 MUX F (X, Y, Z)=∑m(1,3,4,7)		6	May 2019
6	With the help of circuit diagram explain half Subtractor		8	Dec 2018
7	Implement the following Boolean function using single 8:1 multiplexer F (A, B, C, D)=∑m(1,4,6,9,13)		6	May 17
8	Design using single 8:1 multiplexer and logic gates: F (A, B, C, D)=∑(0,2,5,8,10,15)		6	May 2016
9	Design Full Subtractor using Decoder IC 74138		6	Nov.15
10	Design Full Adder using 4:1 MUX		4	Dec.1 4
11	Draw and explain the look ahead carry generator		6	May.14
12	Design full adder using suitable decoder?		6	Dec 2013
13	Implement the following Boolean function using 1:8 DEMUX F (A, B, C, D) = A+ABD+AB+A		2	
14	Design 16:1 multiplexer using 8:1 multiplexer		6	
15	Define half Subtractor& full Subtractor		8	

16	Explain the circuit diagram of full Subtractor		8	
17	Draw and explain the block diagram and working of 4-bit parallel adder		8	
18	Design 4 bit binary to BCD converter		8	
19	Design logic circuit to convert BCD to gray code		8	

Unit III: Sequential Logic Design

Sr. No.	Question	CO No.	Marks	University Year
1	What is race around condition? How it can be avoided? Convert T flip flop into D flip flop	CO3	6	
2	Explain applications of T ff		2	May 2016
3	Design MOD-11 up counter using IC 74191		6	Nov2015
4	What is race around condition? Explain with the help of timing diagram. how it is removed in basic flip flop circuit		8	May 2015
5	What do you mean by MSJK FF? Explain advantage of this FF. Draw circuit diagram & timing diagram		10	May 2014
6	Design JK flipflop using SR flipflop		6	Dec2014
7	Convert JK FF to SR FF		3	Dec2013
8	Explain difference between sequential and combinational circuits? Design SR flip flop using JK flip flop?		6	Dec 2013
9	Draw and explain 3-bit asynchronous UP counter. Also draw the necessary timing diagram. Compare between synchronous counter and asynchronous counter?		4	
10	Design the following using IC7490: (i) MOD 97counter (ii) MOD 45counter.		6	
11	What is MOD counter? Draw the internal structure of IC 7490. Design MOD 56 counter using IC 7490 & necessary logic gates		6	
12	Draw and explain the working of master slave JK flip flop. Draw excitation table of JK flip flop		6	
13	What is SR-flip-flop? Convert the basic SR-flip-flop (SR-FF) into: (i) JK-FF (ii) T-FF (iii) D-FF.		6	
14	What is the difference between synchronous counter and asynchronous counter? Design 3-bit synchronous up-counter using MS JK-flip-flop		4	
15	Convert SR FF to JK FF		3	May 2012
11	Discuss method to avoid race around condition in JK flip flop		4	

12	What is SR FF? Explain working of clocked SR flip flop. What is edge triggering?		10	May 2011
13	Explain application of D flip flop		2	
14	Derive excitation tables for SR, D, JK, T flipflops		8	
15	Convert SR FF to D FF		3	
16	Convert SR FF to T FF		3	
17	Design a divide by 96 counters using 7490		6	
18	Design MOD 8 counter using IC 7490		6	
19	Design a MOD 25 counter using IC 7490		6	
20	Design MOD 78 counter using IC 7490		6	

Unit IV: Computer Organization &Processor

Sr. No.	Question	CO No.	Marks	University Year
1	Draw and explain single bus processor organization.		6	May June 2019
2	Draw and explain processor organization		6	May June 2018
3	Explain control unit and its function along with block diagram?		6	May-June 2018
4	What are the functions of control unit? Explain control unit with block diagram.		6	May-June 2017 /Nov-Dec2017
5	Draw diagram of single bus processor organization and explain		7	May June 2017/NovDec2017
6	What is micro-operation?		4	
7	What are the different types of memory?		4	
8	What is difference between Von Neumann & Harvard architecture?		6	
9	Draw diagram of instruction cycle states of a processor and explain.	CO4	6	May June 2017/NovDec2017
10	Write a short note on Registers?		4	
11	Write a short note on flag Registers?		4	
12	Explain micro-programmed control unit along with block diagram		7	May June 2017
13	Draw and explain hardwired control unit.		6	May Jun 2016
14	Explain different control signals used for micro operation?		4	
15	Explain Von Neumann architecture in detail?		6	
16	Explain Harvard architecture in detail?		6	
17	Write short note on PCI bus?		4	
18	Explain architecture of 8086 processor?		6	

Unit V: Processor Instructions &Processor Enhancements

Sr. No.	Question	CO No.	Marks	University Year
1	Differences between RISC and CISC Architecture.	CO5	6	May-June 2019
2	Explain three addressing mode suitable examples.		6	May June 2019
3	What instruction pipelining? How it improves performance of computer?		6	May June 2018
4	Describe in brief any one pipeline hazard and its solution.		6	May June 2018
5	List different Addressing modes and explain any two with suitable diagram and example		6	May-June 2017/ Nov- Dec 2017
6	Explain Instruction cycle states with suitable diagram		6	Nov-Dec 2016 7
7	Draw diagram of instruction cycle states of a processor and explain.		6	May-June 2017/Nov-Dec2017
8	What are different stages in 5 stage pipelines.		6	May June 2017/NovDec2017
9	What is cluster computing? What are the types of clustering?		6	May June 2017
10	Write note on Multi core Architecture		7	May June 2017/ Nov Dec 2017
11	Explain any four addressing modes with suitable diagram		6	Nov-Dec 2016
12	Which are the basic performance issues in pipelining?		6	Nov Dec 2017,NovDec2016
13	Explain instruction format in detail?		4	
14	What are the different types of operands?		6	
15	What is difference between interrupt and exception?		6	
16	How processor handles interrupt?		4	
17	Write short note on features of Intel core i7		4	
18	Write short note on 8086 ALP?		4	

Unit VI : Memory &Input / Output Systems

Sr. No.	Question	CO No.	Marks	University Year
1	What are the different Characteristics of Memory Systems?	CO6	4	
2	Explain memory read cycle?		6	
3	Explain memory write cycle?		6	
4	Explain characteristics of semiconductor memory?		4	
5	Write short note on SRAM and DRAM?		4	
6	Explain ROM in details?		4	
7	List and explain cache replacement policy		6	May June 2019
8	Explain need of cache memory		6	Nov Dec 2016
9	What is cache coherence?		4	
10	Write short note on DMA?		4	
11	List and explain write policies used in cache memory?		4	May 12
12	Write short note on USB flash drive?		6	

HOME ASSIGNMENT

Unit I: Introduction To Digital Electronics

Sr. No.	Question	CO No.	Marks	University Year
1	Convert given numbers in binary form & use 2's complement method to perform following operation 1)(-48) - (+23) 2) – (48) - (-23)	CO1	6	
2	Convert the following numbers in Binary form: (i) (125.12)10 = (?)2 (ii) (337.025)8 = (?)2 (iii) (5DB.FA)16 = (?)2		4	
3	Explain following TTL characteristics: 1)Noise immunity 2)High level input voltage 3)Figure of merit		6	May 2019
4	Convert the following number into its equivalent hexadecimal, decimal and binary number 1. (357.2)8 2. (453.54)8		4	
5	Convert decimal 27 into following: 1)Binary 2)Excess-3 3)Gray 4)HEX		4	DEC 2014

Unit II: Combinational Logic Design

Sr. No.	Question	CO No.	Marks	University Year
1	Implement the following Boolean function using single 8:1 multiplexer F (A, B, C, D)=∑m(1,4,6,9,13)	CO2	6	
2	Implement the following Boolean function using 1:8 DEMUX F (A, B, C, D) = A+ABD+AB+A		4	
3	Design logic circuit to convert BCD to gray code		6	
4	Draw and explain the block diagram and working of 4-bit parallel adder		6	May 2019
5	Draw and explain the look ahead carry generator		8	

Unit III: Sequential Logic Design

Sr. No.	Question	CO No.	Marks	University Year
1	Draw and explain 3-bit asynchronous UP counter. Also draw the necessary timing diagram	CO3	6	
2	What is MOD counter? Draw the internal structure of IC 7490.		6	
3	Convert JK FF to SR FF		6	
4	Design a MOD 25 counter using IC 7490		4	
5	Derive excitation tables for SR, D, JK, T flipflops		2	May 2016

Unit IV: Computer Organization &Processor

Sr. No.	Question	CO No.	Marks	University Year
1	What is micro-operation?	CO4	6	May-June 2018
2	Write a short note on flag Registers?		7	May June 2017/NovDec2017
3	Explain different control signals used for micro-operation?		4	
4	Write a short note on flag Registers?		6	
5	Explain Harvard architecture in detail?		4	

Unit V: Processor Instructions &Processor Enhancements

Sr. No.	Question	CO No.	Marks	University Year
1	Write note on Multi core Architecture	CO6	6	May-June 2019
2	Which are the basic performance issues in pipelining?		6	May-June 2017/ Nov- Dec 2017
3	Write short note on features of Intel core i7		4	
4	What is difference between interrupt and exception?		4	
5	Explain any four addressing modes with suitable diagram		4	

Unit VI: Memory &Input / Output Systems

Sr. No.	Question	CO No.	Marks	University Year
1	Write short note on USB flash drive?	CO6	6	
2	Explain need of cache memory		6	

3	Write short note on SRAM and DRAM?		4	
4	What is cache coherence?		4	
5	Explain memory write cycle?		6	

ADDITIONAL RESOURCES

- **NPTEL Online Course - Computer Organization &Architecture**

214443

Data Structures and Algorithms

SYLLABUS

Unit I - Introduction

Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT
Analysis of algorithm: Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm Big 'O', 'Ω' and 'Θ' notations, **Sequential Organization:** Single and multidimensional array and address calculation. **Linked Organization:** Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).
Case Study : Set Operation, String Operation

Unit II - Searching and Sorting
Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.
Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods. Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.
Case Study : Study and Analyze Selection sort, bucket sort,radix sort.

Unit III - Stack & Queue
Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form.
Queue: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.
Case Study : Reversing a string, balanced parentheses in algebraic expressions, Towers of Hanoi problem, double ended queue as Stack and Queue.

Unit IV - Trees
Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, , Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display)

Threaded binary tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees.

Case Study : Construction of BST from pre and postorder traversal, Expression Tree construction.

Unit V - Graph and Symbol Table

Graph - Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting.

Symbol Table - Notion of Symbol Table, OBST, AVL Trees Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap

Case Study : Consider a network of computers connected to each other. The connection has various parameters associated with it as distance, propagation delay, bandwidth (capacity of carrying data), etc. Based on these parameters, decide which path should be chosen to send data from one computer to every other on the network. In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for execution immediately. If there is a job in execution, the newly submitted job is added to a queue. The jobs are assigned a number, which indicates the priority of the jobs. The system must execute the high priority jobs first for execution. Implement the above said system using heap data structure.

Unit VI - Hashing and File Organization

Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement.

File: Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.

Case Study : What are the advantages of binary tree and binary search in file handling? Study Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)

Text Books:

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928

2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9

Reference Books:

1. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
2. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
3. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
4. M. Welss, “Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN81-7808-670-0

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Bloom's Taxonomy Category
C214443.1	Perform basic analysis of algorithms with respect to time and space complexity	ALL	Unit Test	L : III Apply
C214443.2	Select appropriate searching and/or sorting techniques in the application development.	II, IV, V	Unit Test	L : III Apply
C214443.3	Implement abstract data type (ADT) and data structures for given application	I, III, IV, V, VI	Unit Test	L : III Apply
C214443.4	Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc	II, III, V	Unit Test	L : III Apply
C214443.5	Apply knowledge to implement learned algorithm design techniques and data structures to solve problems.	ALL	Unit Test	L : III Apply
C214443.6	Design different hashing functions and use files organizations.	VI	Unit Test	L : III Apply

PREREQUISITES

Sr. No.	Unit Number	Prerequisite Subject name
1	I	Fundamental knowledge of programming language and basics of algorithms
2	II	
3	III	
4	IV	Discrete Mathematics, Fundamental knowledge of programming language and basics of algorithms
5	V	
6	VI	Fundamental knowledge of programming language and basics of algorithms

TEACHING PLAN

Teaching Plan Short

Academic Year:- 2021-22 Semester :- I w. e. f. :- 5-7-2021
Class : - SE Division: A/B
Subject :- Data Structures and Algorithms Subject Code :- 214443
Faculty In charge :-Mrs. S.A.Kulkarni,Ms. Supriya Jagtap No. of Lectures/ weeks: 4

- **Lecture Plan**

Sr. No.	Unit No.	Unit Name/ Topic Name	Start Week	End Week
1	I	Introduction	August 3rd Week	August 5th Week
2	II	Searching and Sorting	September 1st Week	September 2nd Week
3	III	Stack & Queue	September 3rd Week	September 4th Week
4	IV	Trees	September 5th Week	October 1st Week
5	V	Graph and Symbol Table	October 2nd Week	October 3rd Week
6	VI	Hashing and File Organization	October 4th Week	November 2nd Week

Detail Teaching Plan

Lect No.	Unit No.	Main topic to be covered	Sub topics to be covered	Chapter no. & Reference Book	CO to Attain	Measurable to attain CO	Mode of Delivery
1	I	Introduction to Data Structures	Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT	T1 : Chapter 1, 2	CO1, CO2, CO3	Unit Test 1	PPT
2		Analysis of algorithm	Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm Big 'O', 'Ω' and 'Θ' notations	T1 : Chapter 1			PPT
3		Sequential Organization	Single and multidimensional array and address calculation.	T1 : Chapter 1, 2			PPT
4		Linked Organization	Concept of linked organization, Singly Linked List, (Operations: Create, Display, Search, Insert, Delete)	T1 : Chapter 5, T3 : Chapter 3			PPT
5			Doubly Linked List (Operations: Create, Display, Search, Insert, Delete)				PPT

6			Circular Linked List (Operations: Create, Display, Search, Insert, Delete)				PPT
7	II	Searching and sorting	Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.	T1 : Chapter 13	CO1, CO2, CO4, CO5	Unit Test 2	PPT
8		Sorting methods	Bubble Sort, insertion Sort	T1 : Chapter 1, 2 T3 : Chapter 7			PPT
9			Quick Sort				PPT
10			Merge Sort				PPT
11			Shell Sort				PPT
12			comparison of all sorting methods, Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.				PPT
13	III	Stack	Concept of stack, Concept of implicit and explicit stack, Applications of stack: recursion	T1 : Chapter 3, T3 : Chapter 3	CO1, CO3, CO4, CO5	Unit Test 3	PPT
14			stack as an ADT using sequential and linked organization				PPT

15			converting expressions from infix to postfix				PPT
16			Converting expressions from infix to prefix form				PPT
17			Evaluating postfix or prefix form.				PPT
18		Queue	Concept of queues as ADT, Implementation of queue using array and linked organization	T1 : Chapter 4, T3 : Chapter 3,6			PPT
19			Concept of circular queue				PPT
20			Double ended queue				PPT
21			Applications of queue: priority queue.				PPT
22	IV	Tree	Trees and binary trees-concept and terminology, Expression tree, Binary search tree	T2 : Chapter 5	CO1, CO2, CO3, CO5	Unit Test 4	PPT
23			Binary tree as an ADT, Recursive algorithms for binary tree traversals				PPT
24			Non recursive algorithms for binary tree traversals				PPT
25			Binary search tree as				PPT

			ADT(Insert Search Delete, level wise Display)				
26		Threaded binary tree	Concept of threaded binary tree (inorder, preorder and postorder). , Applications of trees.				Video
27			Preorder traversals of in-order threaded binary tree				PPT
28			In-order traversals of in-order threaded binary tree				PPT
29	V	Graph	Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list	T2 : Chapter 6	CO1, CO2, CO3, CO4, CO5	Unit Test 5	PPT
30			Breadth First Search traversal, Depth First Search traversal				PPT
31			Prim's and Kruskal's algorithms for minimum spanning tree				PPT
32			Shortest path using Dijkstra's algorithm, topological sorting.				PPT
33		Symbol Table	Notion of Symbol Table, OBST	T1 : Chapter 9			PPT + Video
34			OBST				PPT + Video

35			AVL Trees				PPT + Video
36			AVL Trees				PPT + Video
37		Heap	Heap data structure, Min and Max Heap	T2 : Chapter 9			PPT + Video
38			Heap sort, applications of heap				PPT + Video
39	VI	Hashing	Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function	T1 : Chapter 9	CO1, CO3, CO5, CO6	Unit Test 6	PPT + Video
40			Different key-to-address transformations techniques, synonyms or collision				PPT + Video
41			collision resolution techniques- linear probing, quadratic probing, rehashing				PPT + Video
42			Chaining with replacement				PPT + Video
43			Chaining without replacement				PPT + Video

44		File	Concept of File, File types and file organization (sequential, index sequential and Direct Access)	R1			PPT + Video
45			Comparison of different file organizations				PPT + Video

UNIT WISE QUESTION BANK

Unit I

Sr. No.	Question	CO No.	Marks	University Year
1	Discuss in detail the different asymptotic notations used to represent time complexity of an algorithm.	C214443.1	6	May 2019
2	What is the time complexity of an algorithm? Explain its importance with suitable example.	C214443.1	3	May 2018
3	Explain linear and non-linear data structure with suitable examples	C214443.5	3	May 2018
4	W.r.t. the Algorithm analysis, explain following terms: i. Big Oh notation ii. Omega notation	C214443.1	6	May 2018
5	Define: i. Data and data object ii. Abstract Data Types	C214443.3	6	Dec 2017
6	Differentiate between the following: i. Primitive and non-primitive data structures. ii. Linear and non-linear data structures	C214443.5	6	Dec 2017
7	Define: i. Data and data object ii. Data Structure iii. Abstract Data Types	C214443.5	6	May 2017
8	W.r.t. the Algorithm analysis, explain following terms: i. Big Oh notation ii. Theta notation.	C214443.1	6	May 2017
9	Define: i. Data and data object ii. Data Structure	C214443.3	6	Dec 2016
10	Differentiate between the following:		6	Dec 2016

	i. Primitive and non-primitive data structures. ii. Linear and non-linear data structures iii. Static and Dynamic Data Structures			
11	Explain row major and column major representation of arrays.	C214443.5	5	May 2018
12	What is sequential memory organization? List advantages and dis-advantages of sequential memory organization.	C214443.5	5	May 2018
13	Explain the address calculation of elements in arrays in row major and column major representation.	C214443.5	5	May 2018
14	Explain the concept of row major and column major representation of a matrix with example.	C214443.5	6	Dec 2017
15	Explain 2D array in detail with row and column major representation and address calculation in both the cases.	C214443.5	6	May 2017
16	Explain sequential memory organization with example	C214443.5	6	Dec 2016
17	Explain 2D array in detail with row and column major representation and address calculation in both the cases.	C214443.5	7	Dec 2016
18	What is ADT? Explain singly linked list as ADT.	C214443.3	6	May 2019
19	Explain with example.Doubly Linked List 1. Circular Linked List	C214443.5	6	May 2019
20	Write C function for inserting and deleting a node of SLL	C214443.5	**6**	May 2019

21	Compare linked list with arrays with reference to the following aspects: i. Accessing any element randomly. ii. Insertion and deletion of an element. iii. Utilization of memory.	C214443.5	6	May 2018
22	Write a pseudo code to delete a node from SLL.	C214443.5	7	May 2018
23	Write a pseudo code to insert a node at start and at end in DLL.	C214443.5	7	May 2018
24	Write short notes on i. CLL ii. DLL iii. SLL iv. Skip List	C214443.5	8	Dec 2017
25	Write a 'C' function to reverse a singly linked list using three pointers.	C214443.5	4	Dec 2017
26	Differentiate between sequential and linked organization	C214443.5	4	Dec 2017
27	Write C function to insert a node and delete a node in DLL.	C214443.5	7	May 2017
28	Explain with suitable example: i. CLL ii. Linked list as an ADT.	C214443.5	6	May 2017
29	Write C pseudo algorithm for merging of two sorted Linked lists into the third one.	C214443.5	7	May 2017
30	What are advantages of Linked list over array. Describe different types of linked lists.	C214443.5	7	Dec 2016

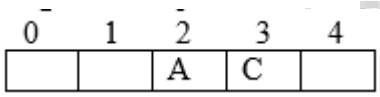
Unit II

Sr. No.	Question	CO No.	Marks	University Year
1	With example discuss the criteria for choosing a sorting algorithm based on the input size and time complexity [Bubble, Insertion, Quick]	C214443.2	6	May 2019
2	For the following set of numbers, perform stepwise demonstration of merge sort algorithm : 91 23 48 13 97 63 27 36 57	C214443.2	6	May 2019
3	Show the output of each pass using insertion sort to arrange the following numbers in ascending order. 150 350 100 250 200 50 300	C214443.2	6	May 2018
4	Explain the importance of searching and sorting in computer science field. What is sort stability?	C214443.2	4	May 2018
5	With example discuss the criteria for choosing a sorting algorithm based on the input size and time complexity [Bubble, Insertion, Quick]	C214443.2	6	May 2019
6	For the following set of numbers, perform stepwise demonstration of merge sort algorithm : 91 23 48 13 97 63 27 36 57	C214443.2	6	May 2019
7	Show the output of each pass using insertion sort to arrange the following numbers in ascending order. 150 350 100 250 200 50 300	C214443.2	6	May 2018
8	Explain the importance of searching and sorting in computer	C214443.2	4	May 2018

	science field. What is sort stability?			
9	What is importance of pivot element in quick sort?	C214443.2	2	May 2018
10	Write an algorithm to sort a list of integers using bubble sort. Show output of each pass for the following lsit : 10 5 4 18 17 1 2.	C214443.2	6	Dec 2017
11	Differentiate between the following: i. Internal sorting and External sorting ii. Linear and binary searching	C214443.2	6	Dec 2017
12	Write pseudo C Algorithm for i. Linear Search ii. Binary Search	C214443.2	7	May 2017
13	Explain the selection sort with given example by showing all passes. Also analyze the time complexity. Numbers are : 17 35 24 13 26 14	C214443.2	7	May 2017
14	Sort the following and show the status of every pass using Selection sort: 34 9 78 65 12 -5	C214443.2	6	Dec 2016
15	Sort following data to ascending order using Quick sort. Show all passes with pivot. 17 8 -9 2 0 -5 7 20 11 15	C214443.2	6	Dec 2016

Unit III

Sr. No.	Question	CO No.	Marks	University Year
1	Write a C++ function to-convert infix expression to postfix expression.	C214443.5	6	May-2018

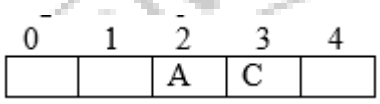
2	Clearly indicate the content-of stack for evaluating the following postfix expression Assume A = 10, B.= 2, C = 13 i) AB+C-SA-CH+ - ii) ABC + *CBA - + *	C214443.5	6	May-2017, May 2016
3	Clearly indicate the contents of stack during conversion of given infix expression to prefix: A+(B*((D-E%F) / H)	C214443.5	6	May-2017
4	Imagine the content of queue Q1 & Q2 are as shown. What would be the content of Q3 after after the following code is executed? Show pictorial representation of both Q1 Q2 with value of front & rear. The queue contents are shown front(left) to rear (right) Q1: 42 30 41 30 19 20 25 14 10 11 12 15 Q2: 3 5 7 4 13 1. Q3 = createQueue() 2. Count = 0 3. Loop (not empty Q1 and not empty Q2) count = count +1 dqueue(Q1,x) dequeue(Q2,y) if (y equal count) enqueue(Q3,x) 4. end loop	C214443.5	6	May 2018, December 2017
5	Consider the following circular queue of character and size 5.  Front point index 1 and Rear point to index 3 For addition, first increment the corresponding index by 1 and then add the new element at the index	C214443.5	6	May-2016

	location for deletion, first increment the corresponding index by 1 and then delete the element at the index location. Show the queue contents as per the following operations at every step: i) F is added to the queue ii) Two letters are deleted iii) K,L,M are added to the queue iv) Two letters are deleted v) R is added to the queue vi) Two letters are deleted=			
6	Clearly indicate the contents of stack for evaluating following POSTFIX EXPRESSION Assum: A=10, B=2, C=13 i) AB+C – BA – C + - ii) ABC + *CBA - + *	C214443.5	6	May 2016
7	Clearly indicate the contents of stack during conversion of given infix expression to prefix. Consider ^ as a exponent operator. A*(B-C)/E^F + G	C214443.5	6	December 2016
8	Explain the concept of multi queue, Double ended queue and Priority queue	C214443.5	6	December 2016
9	Implement stack as ADT using sequential organization	C214443.3	6	December 2016
10	Change the following infix to postfix using stack. Clearly indicate the content of stack:	C214443.5	6	May 2015

	i) (A+B) * C - D * F + C ii) (A-2) *(B+C-D*E) * F			
11	Explain the implementation of circular queue using sequential organization	C214443.5	6	May 2015
12	Implement stack as ADT using linked organization	C214443.3	6	May 2015
13	Define Multiqueues	C214443.5	2	May 2015

Unit IV

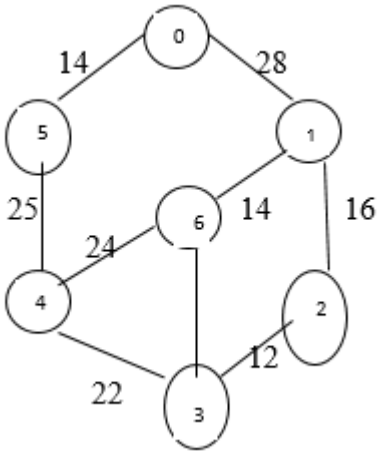
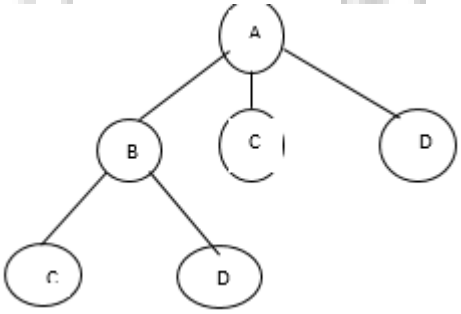
Sr. No.	Question	CO No.	Marks	University Year
1	Construct a binary tree from the given traversal i) Preorder =>* +a-be/-de-+fgh Inorder : a+ b-c*d-—-e/f+g-h ii) Inorder : H, D, I, B, E, A, J, F, A,J,F,K,C,G Postorder : H, I, D, E, B, J, K,F, G,C, A	C214443.5	6	May 2018
2	Write non-recursive algorithm to find the post order traversal of a binary tree	C214443.5	6	Dec 2017
3	Clearly indicate the contents of stack during conversion of given infix expression to prefix: A+(B*((D-E%F) / H)	C214443.5	6	May-2017
4	Imagine the content of queue Q1 & Q2 are as shown. What would be the content of Q3 after after the following code is executed? Show pictorial representation of both Q1 Q2 with value of front & rear. The queue contents are shown front(left) to rear (right) Q1: 42 30 41 30 19 20 25 14 10 11 12 15 Q2: 3 5 7 4 13 1. Q3 = createQueue()	C214443.5	6	May 2018, December 2017

	2. Count = 0 3. Loop (not empty Q1 and not empty Q2) count = count +1 dqueue(Q1,x) dequeue(Q2,y) if (y equal count) enqueue(Q3,x) 4. end loop			
5	Consider the following circular queue of character and size 5.  Front point index 1 and Rear point to index 3 For addition, first increment the corresponding index by 1 and then add the new element at the index location for deletion, first increment the corresponding index by 1 and then delete the element at the index location. Show the queue contents as per the following operations at every step: i) F is added to the queue ii) Two letters are deleted iii) K,L,M are added to the queue iv) Two letters are deleted v) R is added to the queue vi) Two letters are deleted=	C214443.5	6	May-2016
6	Clearly indicate the contents of stack for evaluating following POSTFIX EXPRESSION Assum: A=10, B=2, C=13 i) AB+C – BA – C + -	C214443.5	6	May 2016

	ii) ABC + *CBA - + *			
7	Clearly indicate the contents of stack during conversion of given infix expression to prefix. Consider ^ as a exponent operator. A*(B-C)/E^F + G	C214443.5	6	December 2016
8	Explain the concept of multi queue, Double ended queue and Priority queue	C214443.5	6	December 2016
9	Implement stack as ADT using sequential organization	C214443.3	6	December 2016
10	Change the following infix to postfix using stack. Clearly indicate the content of stack: i) (A+B) * C - D * F + C ii) (A-2) *(B+C-D*E) * F	C214443.5	6	May 2015
11	Explain the implementation of circular queue using sequential organization	C214443.5	6	May 2015
12	Implement stack as ADT using linked organization	C214443.3	6	May 2015
13	Define Multiqueues	C214443.5	2	May 2015

Unit V

Sr. No.	Question	CO No.	Marks	University Year
1.	Write the pseudo code for Kruskal's Algorithm	C214443.4	6	May 2017
2	Write a Kruskal's Algorithm and find minimum spanning tree for the following graph:	C214443.5	6	May 2018

				
3	For the following graph find the DFS and BFS using suitable data structure 	C214443.5	4	May 2017
4	Write Short note on Topological Sorting	C214443.4	4	Nov 2016
5	Define graph. Draw graph from given adjacency matrix and then draw adjacency list with adjacent nodes for given vertices	C214443.5	8	May 2015
6	Represent any one Graph using Adjancy List.	C214443.5	4	-
7	Compare DFS and BFS with example.	C214443.5	8	-
8	Write a code for DFS and BFS using C++ Concept	C214443.5	8	-
9	What is Symbol Table? Give Symbol Table ADT.	C214443.5	4	May 2018

10	Show stepwise construction of maxheap for data: 40,50,10,60,20,30,70	C214443.5	8	May 2018
11	Construct AVL for the following data : NAR, MAY NOV, AUG, APR, JAN, DEC, JUN, FEB, JUL, OCT, SEP. Show the balance factor of each node and type of rotation.	C214443.5	10	May 2018
12	Obtain an AVL tree by inserting one data element at a time in the following sequence: 50,55,60,1510,40,20,45,30,70,80 Lable the rotation at each stage appropriately.	C214443.5	8	May 2017
13	Explain the properties of AVL tree.	C214443.5	4	

Unit VI

Sr. No.	Question	CO No.	Marks	University Year
1	What are the characteristics of good hash function ? List out different techniques to resolve collision in hash table. Explain linear probing with and without replacement with suitable example	C214443.6	6	May 2017
2	What do you mean by hash table.	C214443.6		
3	What is the different collision resolution technique for hash table.	C214443.6	6	May 2015
4	What are the different hashing function explain with example.	C214443.6		
5	Write a C++ program to read character from the keyboard and write in text file	C214443.6	4	May 2018
6	Explain various operations on sequential file in detail	C214443.6	8	May 2018
7	What is File? Explain different File opening mode in C++.	C214443.6	6	May 2018
8	Explain various file opening mode in C++ with respect to text and binary files.	C214443.6	6	May 2017

9	What are the primitive operation on sequential files? Explain with example.	C214443.6	6	May 2017
10	Compare the features of sequential files, index sequential files and direct access file	C214443.6	6	May 2017
11	Write C++ program to perform following operations on direct access file: i) Create and display record ii) Insert record	C214443.6	6	May 2017
12	Explain how record are logically deleted from a file	C214443.6	6	May 2016
13	Explain the following C++ file function with syntax and example i) Create file ii) Read (data and record from file) iii) Delete file	C214443.6	6	May 2016

Unit Wise Home Assignment
Unit I

Unit II

Unit III

Unit IV

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Unit V

Unit VI

QUESTION BANK (MCQ)

Sr. No.	Question	Marks	CO No.	Complexity Level
	Unit I			
1.	Stack is A) Ephemeral DS B) Persistent DS C) Primary DS D) d. None of the above	1	C214443.1	I
2.	The worst case occurs in linear search algorithm when ..... A) Item is not in the array at all B) Item is somewhere in the middle of the array C) Item is the last element in the array D) Item is the last element in the array or item is not there at all	1	C214443.1	I
3.	The correctness and appropriateness of _____solution can be checked very easily. A) algorithmic solution B) heuristic solution C) random solution D) none of these	1	C214443.1	I
4.	The main measure for efficiency algorithm are- A) Processor and Memory B) Complexity and Capacity C) Data and Space D) Time and space	1	C214443.1	I
5.	The complexity of the bubble sort algorithm is ….. A) O(n) B) O(logn) C) O(n2) D) D. O(n logn)	1	C214443.1	I
6.	In doubly linked lists A) a pointer is maintained to store both next and previous nodes. B) two pointers are maintained to store next and previous nodes. C) a pointer to self is maintained for each node. D) none of the above.	1	C214443.5	I
7.	What are the advantages of arrays? A) Objects of mixed data types can be stored B) Elements in an array cannot be sorted C) Index of first element of an array is 1 D) Easier to store elements of same data type	1	C214443.5	I

8.	What differentiates a circular linked list from a normal linked list? A) You cannot have the 'next' pointer point to null in a circular linked list B) It is faster to traverse the circular linked list C) You may or may not have the 'next' pointer point to null in a circular linked list D) All of the mentioned	1	C21444 3.5	I
9.	Which of the following case does not exist in complexity theory? A) Average Case B) NULL Case C) Best Case D) Worst Case	1	C21444 3.1	I
10.	The time factor when determining the efficiency of algorithm is measured by: A) Counting microseconds B) Counting the number of statements C) Counting the number of key operations D) Counting the kilobytes of algorithm operations	1	C21444 3.1	I
11.	The time complexity of a quick sort algorithm which makes use of median, found by an O(n) algorithm, as pivot element is A) O(n log logn) B) O(nlogn) C) $O(n^2)$ D) O(n)	1	C21444 3.1	II
12.	In total, how many times inner for loop will get executed? #include<stdio.h> void main() { int i,j; clrscr(); for(i=0;i<3;i++) { for(j=0;j<3;j++) if(i==0&&j==0) break; printf(" i = %d",i); } printf(" i = %d",i); getch(); } A) 9 B) 12 C) 3 D) 4	1	C21444 3.1	II

13.	Complexity of linear search algorithm is ..... A) O(n) B) O(logn) C) O(n2) D) O(n logn)	1	C21444 3.1	II
14.	Linked lists are not suitable for the implementation of? A) Insertion sort B) Radix sort C) Polynomial manipulation D) Binary search	1	C21444 3.2	II
15.	Linked list data structure offers considerable saving in _____ A) Computational Time B) Space Utilization C) Space Utilization and Computational Time D) Speed Utilization	1	C21444 3.1	II
16.	What is the functionality of the following code? **void** function(Node node) { **if**(size == 0) head = node; **else** { Node temp,cur; **for**(cur = head; (temp = cur.getNext())!=**null**; cur = temp); cur.setNext(node); } size++; } A) Inserting a node at the beginning of the list B) Deleting a node at the beginning of the list C) Inserting a node at the end of the list D) Deleting a node at the end of the list	1	C21444 3.5	II
17.	What is the time complexity of searching for an element in a circular linked list? A) O(n) B) O(nlogn) C) O(1) D) O(n2)	1	C21444 3.1	II
18.	Which of the following applications makes use of a circular linked list? A) Undo operations in text editor B) Recursive function calls C) Allocating CPU to resources D) All of these	1	C21444 3.5	II

19.	Which of the following is false about a circular linked list? A.) Every node has a successor B.) Time complexity of inserting a new node at the head of the list is O(1) C.) Time complexity for deleting the last node is O(n) D.) None of these	1	C21444 3.5	II
20.	Consider an implementation of an unsorted doubly linked list. Suppose it has its representation with a head pointer and tail pointer. Given the representation, which of the following operation can be implemented in O(1) time? i) Insertion at the front of the linked list ii) Insertion at the end of the linked list iii) Deletion of the front node of the linked list iv) Deletion of the end node of the linked list A) I and II B) I and III C) I,II and III D) I,II,III and IV	1	C21444 3.5	II
21.	Calculate time complexity required for following code: for(i=0;i<n;i++) for(j=0;j<n-1;j++) for(k=0;k<n-2;k++) if(a[j]<a[k]) printf("\n DONE…."); A) O(n) B) O(n2) C) O(n3) D) O(n+n(n-1)+n(n-1)(n-2))	2	C21444 3.1	III
22.	What does the following function do for a given Linked List with the first node as head? void fun1(struct node* head) { if(head == NULL) return; fun1(head->next); printf("%d ", head->data); } A) Prints all nodes of linked lists B) Prints all nodes of linked list in reverse order C) Prints alternate nodes of Linked List D) Prints alternate nodes in reverse order	2	C21444 3.5	III
23.	The following function reverse() is supposed to reverse a singly linked list. There is one line missing at the end of the function. */* Link list node */* struct node	2	C21444 3.5	III

	{ int data; struct node* next; }; */* head_ref is a double pointer which points to head (or start) pointer of linked list */* static void reverse(struct node** head_ref) { struct node* prev = NULL; struct node* current = *head_ref; struct node* next; while (current != NULL) { next = current->next; current->next = prev; prev = current; current = next; } */*ADD A STATEMENT HERE*/* } What should be added in place of "/*ADD A STATEMENT HERE*/", so that the function correctly reverses a linked list. A) *head_ref = prev; B) *head_ref = current; C) *head_ref = next; D) *head_ref = NULL;			
24.	Which of the following piece of code has the functionality of counting the number of elements in the list? A) **int** length(Node head) { **int** size = 0; Node cur = head; **while**(cur!=**null**) { size++; cur = cur.getNext(); } **return** size; } B) **int** length(Node head) { **int** size = 0; Node cur = head;	2	C21444 3.5	III

```
        while(cur!=null)
        {
            cur = cur.getNext();
            size++;
        }
        return size;
    }
```

C)
```
    int length(Node head)
    {
        int size = 0;
        Node cur = head;
        while(cur!=null)
        {
            size++;
            cur = cur.getNext();
        }
    }
```

D)
```
    int length(Node head)
    {
        int size = 0;
        Node cur = head;
        while(cur!=null)
        {
            size++;
            cur = cur.getNext().getNext();
        }
        return size;
    }
```

25.	What is the functionality of the following piece of code? `public int function(int data)` `{` `  Node temp = head;` `  int var = 0;` `  while(temp != null)` `  {` `  if(temp.getData() == data)` `  {` `  return var;` `  }` `  var = var+1;` `  temp = temp.getNext();` `  }` `  return Integer.MIN_VALUE;` `}`	2	C21444 3.5	III

	A) Find and delete a given element in the list B) Find and return the given element in the list C) Find and return the position of the given element in the list D) Find and insert a new element in the list			
	Unit II			
1.	Complete following steps which are required for sorting given 5 numbers in ascending order: for(i=0;i<5;i++) for(j=0;j<4;j++) { if(----------) { temp=a[j]; a[j]=a[j+1]; a[j+1]=temp; } } A) a[j]>a[j+1] B) a[j]<a[j+1] C) a[i]>a[j] D) a[i]>a[i+1]	1	C21444 3.2	I
2.	Complete following steps which are required for sorting given 5 numbers in descending order: for(i=0;i<5;i++) for(j=0;j<4;j++) { if(----------) { temp=a[j]; a[j]=a[j+1]; a[j+1]=temp; } } A) a[j]>a[j+1] B) a[j]<a[j+1] C) a[i]>a[j] D) a[i]>a[i+1]	1	C21444 3.2	I
3.	For 5 numbers, find out the time complexity for bubble sort for worst case. A) 5 B) 10 C) 20 D) 25	1	C21444 3.1	I
4.	What is the worst case time for binary search finding a single item in an array? A) Constant Time	1	C21444 3.1	I

	B) Quadratic Time C) Logarithmic Time D) Linear Time			
5.	Partition and exchange sort is …….. A) Tree sort B) Heap sort C) Bubble sort D) Quick Sort	1	C21444 3.4	I
6.	For merging two sorted lists of size m and n into sorted list of size m+n, we require comparisons of A) O(m) B) O(m+n) C) O(n) D) O(logm + logn)	1	C21444 3.2	I
7.	..... is rearranging pairs of elements which are out of order, until no such pairs remain. A) Insertion B) Exchange C) Selection D) Distribution	1	C21444 3.4	I
8.	In-place merge sort is a stable sort. A) True B) False	1	C21444 3.2	I
9.	Which of the following algorithm does not divide the list A) Linear Search B) Binary Search C) Merge Sort D) Quick Sort	1	C21444 3.4	I
10.	Quick sort algorithm is an example of A) Greedy approach B) Improved binary search C) Dynamic Programming D) Divide and conquer	1	C21444 3.4	I
11.	A sorting technique is called stable if it A) Takes O(nlogn) times B) Uses divide-and-conquer paradigm C) Maintains the relative order of occurrence of non-distinct element D) Takes O(n) space	1	C21444 3.2	II
12.	Which of the following algorithm is not stable? A) Bubble Sort B) Quick Sort C) Merge Sort D) Insertion Sort	1	C21444 3.2	II

13.	When is insertion sort a good choice of sorting an array? A) Each component of the array requires a large amount of memory B) the array has only a few items out of place C) Each component of the array requires a small amount of memory D) the processor speed is fast	1	C21444 3.2	II
14.	A sorting machine can sort numbers in ascending order only. This machine can be used to sort all negative numbers in descending order by A) Sort numbers, change sign of all numbers B) Add 100 to all numbers, sort, subtract 100 again from each numbers C) Subtract 100 to all numbers, sort, add 100 again from each numbers D) Change sign of all numbers, Sort numbers, Change sign again	1	C21444 3.5	II
15.	If the given input array is sorted or nearly sorted, which of the following algorithm gives the best performance? A) Insertion sort B) Selection sort C) Quick sort D) Merge sort	1	C21444 3.5	II
16.	How many swaps are required to sort the given array using bubble sort - { 2, 5, 1, 3, 4} ? A) 4 B) 5 C) 6 D) 7	1	C21444 3.5	II
17.	Choose the incorrect statement about merge sort from the following? A) both standard merge sort and in-place merge sort are stable B) standard merge sort has greater time complexity than in-place merge sort C) standard merge sort has greater space complexity than in-place merge sort D) in place merge sort has O(log n) space complexity	1	C21444 3.2	II
18.	A sorting algorithm is stable if A) its time complexity is constant irrespective of the nature of input B) preserves the original order of records with equal keys C) its space complexity is constant irrespective of the nature of input D) it sorts any volume of data in a constant time	1	C21444 3.2	II
19.	Selection sort and Quick sort both fall into the same category of sorting algorithms. What is this category? A) O (n log n) sorts B) Interchange Sorts C) Divide and Conquer sorts D) Average time is quadratic	1	C21444 3.4	II

20.	The following sorting algorithms maintain two sub-lists, one sorted and one to be sorted − A) Selection Sort B) Insertion Sort C) Merge Sort D) Both A & B	1	C21444 3.2	II
21.	Complete following given passes required for merge sort. pass #1- 55 11 77 22 99 66 pass #2- _____ pass #3- _____ pass #4- 11 22 55 66 77 99 A) pass #2- 55 11 22 66 77 99 pass #3- 11 22 66 55 77 99 B) pass #2- 11 55 22 77 66 99 pass #3- 11 22 55 77 66 99 C) pass #2- 11 55 22 77 66 99 pass #3- 11 55 22 77 66 99 D) pass #2- 11 55 22 77 66 99 pass #3- 11 22 55 66 77 99	2	C21444 3.5	III
22.	Which of the following is not a limitation of binary search algorithm? A) must use a sorted array B) requirement of sorted array is expensive when a lot of insertion and deletions are needed C) there must be a mechanism to access middle element directly D) binary search algorithm is not efficient when the data elements more than 1500.	2	C21444 3.2	III
23.	Assume that the algorithms considered here sort the input sequences in ascending order. If the input is already in ascending order, which of the following are TRUE? I. Quicksort runs in Θ(n2) time II. Bubble sort runs in Θ(n2) time III. Mergesort runs in Θ(n) time IV. Insertion sort runs in Θ(n) time A) I and II only B) I and III only C) II and IV only D) I and IV only	2	C21444 3.5	III
24.	Suppose we have a O(n) time algorithm that finds median of an unsorted array. Now consider a QuickSort implementation where we first find median using the above algorithm, then use median as pivot. What will be the worst case time complexity of this modified QuickSort. A) O(n^2 log n) B) O(n^2)	2	C21444 3.5	III

	C) O(n logn logn) D) O(nlog n)			
25.	You have to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate? A) Heap Sort B) Merge Sort C) Insertion Sort D) Quick Sort	2	C21444 3.5	III
	Unit III			
1.	Stack is used for A) CPU Resource Allocation B) Breadth First Traversal C) Recursion D) None of the above	1	C21444 3.5	I
2.	Postfix expression is just a reverse of prefix expression. A) True B) False	1	C21444 3.3	I
3.	What about recursion is true in comparison with iteration? A) very expensive in terms of memory. B) low performance. C) every recursive program can be written with iteration too. D) all of the above are true!	1	C21444 3.1	I
4.	A linear list of elements in which deletion can be done from one end (front) and insertion can take place only at the other end (rear) is known as a ? A) Queue B) Stack C) Tree D) Linked list	1	C21444 3.3	I
5.	If the elements “A”, “B”, “C” and “D” are placed in a queue and are deleted one at a time, in what order will they be removed? A) ABDC B) DCBA C) DCAB D) ABCD	1	C21444 3.5	I
6.	A normal queue, if implemented using an array of size MAX_SIZE, gets full when A) Rear = MAX_SIZE – 1 B) Front = (rear + 1)mod MAX_SIZE C) Front = rear + 1 D) Rear = front	1	C21444 3.3	I
7.	In a Queue, if a user tries to remove an element from empty Queue it is called _____. A) Underflow B) Empty collection C) Overflow	1	C21444 3.3	I

	D) Garbage Collection			
8.	The data structure required to check whether an expression contains balanced parenthesis is? A) Stack B) Queue C) Array D) Tree	1	C21444 3.5	I
9.	In Breadth First Search of Graph, which of the following data structure is used? A) Stack B) Queue C) Linked list D) None of the mentioned	1	C21444 3.5	I
10.	A data structure in which elements can be inserted or deleted at/from both the ends but not in the middle is? A) Queue B) Circular queue C) Dequeue D) Priority queue	1	C21444 3.3	I
11.	Let the following circular queue can accommodate maximum six elements with the following data.What will happen after ADD O operation takes place? front = 2 rear = 4 queue = _____; L, M, N, ___, ___ A) front = 2 rear = 5 queue = _____; L, M, N, O, ___ B) front = 3 rear = 5 queue = L, M, N, O, ___ C) front = 3 rear = 4 queue = _____; L, M, N, O, ___ D) front = 2 rear = 4 queue = L, M, N, O, ___	1	C21444 3.5	II
12.	A priority queue can efficiently be implemented using which of the following data structures? Assume that the number of insert and peek (operation to see the current highest priority item) and extraction (remove the highest priority item) operations are almost same A) Array B) Linked List C) Heap Data Structures like Binary Heap, Fibonacci Heap D) None of the above	1	C21444 3.5	II
13.	If the MAX_SIZE is the size of the array used in the implementation of a circular queue. How is rear manipulated while inserting an element in the queue? A) rear=(rear%1)+MAX_SIZE B) rear=rear%(MAX_SIZE+1) C) rear=(rear+1)%MAX_SIZE	1	C21444 3.5	II

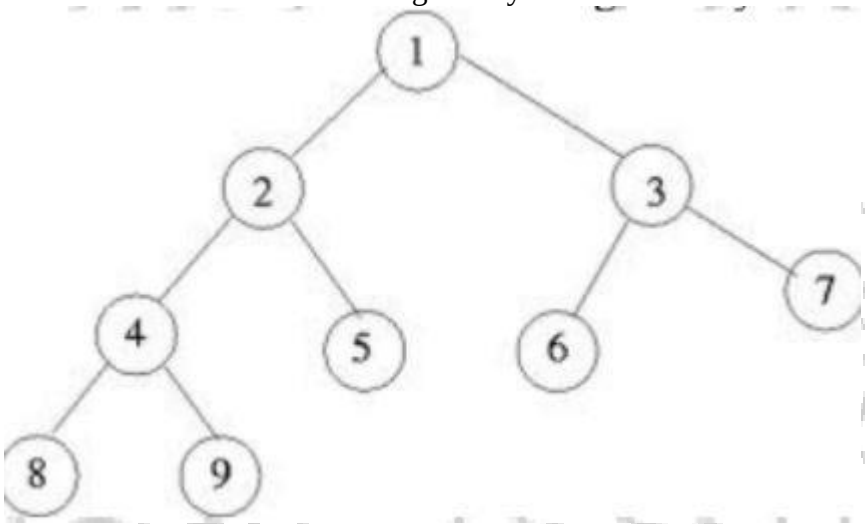
	D) rear= rear + (1%MAX_SIZE)			
14.	How many stacks are needed to implement a queue. Consider the situation where no other data structure like arrays, linked list is available to you. A) 1 B) 2 C) 3 D) 4	1	C21444 3.5	II
15.	What is the time complexity of deleting from the rear end of the dequeue implemented with a singly linked list? A) O(n log n) B) O(log n) C) O(n) D) O(n^2)	1	C21444 3.1	II
16.	The postfix form of the expression (A+ B)*(C*D- E)*F / G is? A) AB+ CD*E - FG /** B) AB + CD* E - F **G / C) AB + CD* E - *F *G / D) AB + CDE * - * F *G /	1	C21444 3.5	II
17.	When an operand is read, which of the following is done? A) It is placed on to the output B) It is placed in operator stack C) It is ignored D) Operator stack is emptied	1	C21444 3.5	II
18.	It is easier for a computer to process a postfix expression than an infix expression. A) True B) False	1	C21444 3.5	II
19.	What is the result of the following operation Top (Push (S, X)) A) S B) Null C) X D) None	1	C21444 3.5	II
20.	The prefix form of an infix expression p + q - r * t is? A) + pq - *rt B) - +pqr * t C) - +pq * rt D) - + * pqrt	1	C21444 3.5	II
21.	After performing these set of operations, what does the final list look contain? InsertFront(10); InsertFront(20); InsertRear(30); DeleteFront();	2	C21444 3.5	III

	InsertRear(40); InsertRear(10); DeleteRear(); InsertRear(15); display(); A) 10 30 10 15 B) 20 30 40 15 C) 20 30 40 10 D) 10 30 40 15			
22.	The result of evaluating the postfix expression 5, 4, 6, +, *, 4, 9, 3, /, +, * is? A) 450 B) 350 C) 650 D) 288	2	C21444 3.5	III
23.	Consider the following operation performed on a stack of size 5. Push(1); Pop(); Push(2); Push(3); Pop(); Push(4); Pop(); Pop(); Push(5); After the completion of all operation, the no of element present on stack are A) 1 B) 2 C) 3 D) 4	2	C21444 3.5	III
24.	Assume that the operators +,-, X are left associative and ∧ is right associative. The order of precedence (from highest to lowest) is ∧, X, +, -. The postfix expression corresponding to the infix expression a + b X c – d ∧ e ∧ f is A) abc X+ def ∧ ∧ - B) abc X+ de∧f∧ - C) ab+c Xd – e ∧f∧ D) -+aXbc∧ ∧def	2	C21444 3.5	III
25.	Consider the usual implementation of parentheses balancing program using stack. What is the maximum number of parentheses that will appear on stack at any instance of time during the analysis of	2	C21444 3.5	III

	(( ) (( )) (( )))? A) 1 B) 2 C) 3 D) 4			

Unit IV

	Unit IV			
	The in-order traversal of tree will yield a sorted listing of elements of tree in ..... A. Binary trees B. Binary search trees C. Heaps D. Full binary Tree ANSWER : B	1	C214443.5	IV
	In a binary tree, certain null entries are replaced by special pointers which point to nodes higher in the tree for efficiency. These special pointers are called ..... A. Leaf B. Branch C. Path D. Thread ANSWER : D	1	C214443.5	IV
	If node N is a terminal node in a binary tree then its ..... A. Right tree is empty B. Left tree is empty C. Both left & right sub trees are empty D. Root node is empty ANSWER : C	1	C214443.5	IV
	In-order traversing a tree resulted in E A C K F H D B G; the pre-order traversal would return. A. FAEKCDBHG B. FAEKCDHGB C. EAFKHDCBG D. FEAKDCHBG ANSWER : B	2	C214443.5	IV

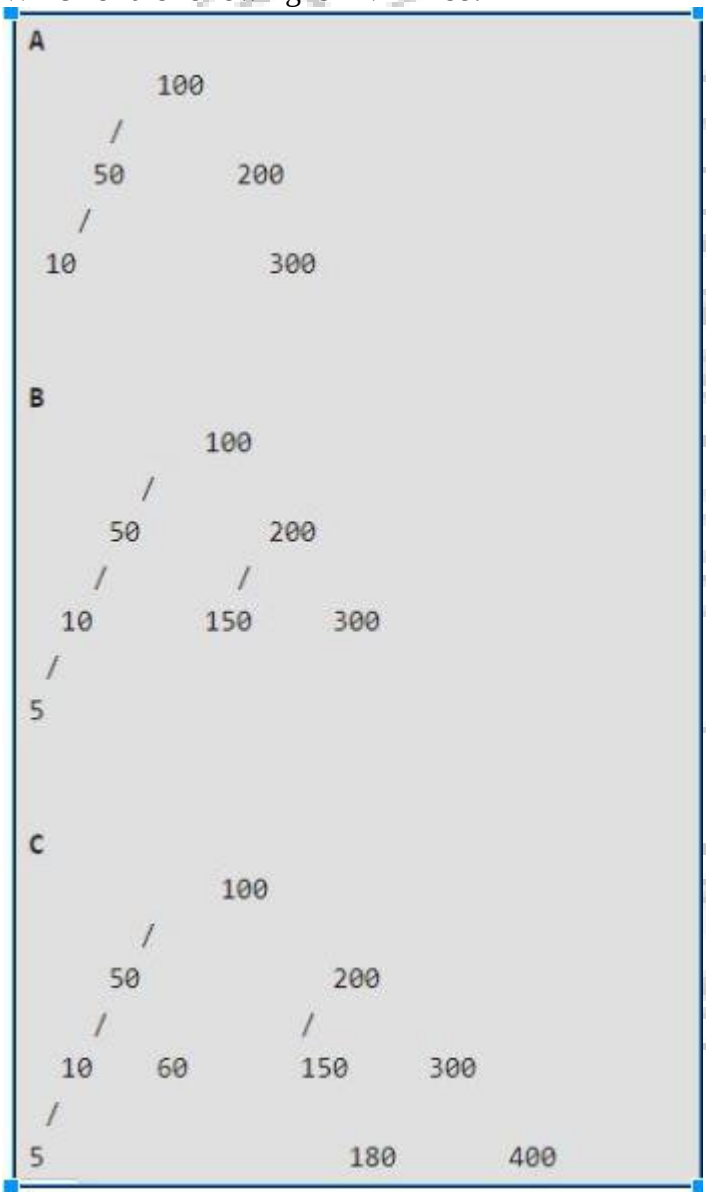
	Pre-order Traversal of Following Binary Tree is:  A. 8 9 4 5 2 6 7 3 1 B. 8 4 9 2 5 1 6 3 7 C. 1 2 4 8 9 5 3 6 7 D. 1 2 5 4 8 9 3 6 7 ANSWER : C	1	C214443.5	IV
	A binary tree T has n leaf nodes. The number of nodes of degree 2 in T is A. log2n B. n-1 C. n D. 2n ANSWER : B	1	C214443.5	IV
	A binary search tree is generated by inserting in order the following integers: 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24 The number of nodes in the left subtree and right subtree of the root respectively is A. 4, 7 B. 7, 4 C. 8, 3 D. 3, 8 ANSWER : B	1	C214443.5	IV
	The maximum number of binary trees that can be formed with three unlabeled nodes is: A. 1 B. 3 C. 4 D. 5 ANSWER : D	1	C214443.5	IV
	The inorder and preorder traversal of a binary tree are *d b e a f c g* and *a b d e c f g*, respectively. The postorder traversal of the binary tree is:	2	C214443.5	IV

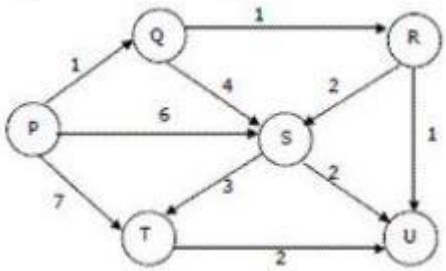
	A. d e b f g c a B. e d b g f c a C. e d b f g c a D. d e f g b c a ANSWER : A			
	The height of a tree is defined as the number of edges on the longest path in the tree. The function shown in the pseudocode below is invoked as height (root) to compute the height of a binary tree rooted at the tree pointer root. `int height (treeptr n)` `{` `if (n== NULL) return -1;` `if (n → left == NULL)` `if (n → right ==NULL) return 0;` `else return BI; // Box 1` `else {` `h1 = height (n → left);` `if (n → right == NULL) return (1 + h1);` `else {h2 = height (n → right);` `return B2 ; // Box 2` `}` `}` `}` The appropriate expression for the two boxes B1 and B2 are A. B1 : (1 + height(n->right)), B2 : max(h1,h2) B. B1 : (1 + height(n->right)), B2 : (1 + max(h1,h2)) C. B1 : (height(n->right)), B2 : (1 + max(h1,h2)) D. B1 : height(n->right), B2 : max(h1,h2) ANSWER : B	2	C214443.5	IV
	What are null nodes filled with in a threaded binary tree? A. inorder predecessor for left node and inorder successor for right node information B. right node with inorder predecessor and left node with inorder successor information C. they remain null D. some other values randomly ANSWER : A	1	C214443.5	IV
	What are the disadvantages of normal binary tree traversals? A. there are many pointers which are null and thus useless B. there is no traversal which is efficient C. improper traversals	1	C214443.5	IV

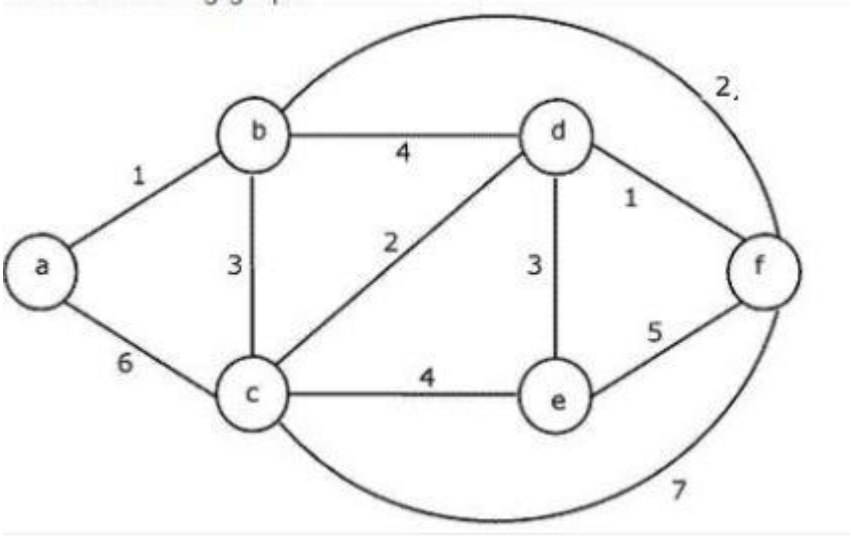
	D. complexity in implementing ANSWER : A			
	Which of the following is the most widely used external memory data structure? A. AVL Tree B. B-Tree C. Red Black Tree D. Both AVL and Red Black Tree ANSWER : B	1	C214443.5	IV
	What is the worst case time complexity for search, insert and delete operations in general binary search tree? A. O(n) for all B. O(log n) for all C. O(Logn) for search and insert, and O(n) for delete D. O(Logn) for search, and O(n) for insert and delete ANSWER : A	1	C214443.1	IV
	In delete operation of BST, we need inorder successor (or predecessor) of a node when the node to be deleted has both left and right child as non-empty. Which of the following is true about inorder successor needed in delete operation? A. inorder Successor is always a leaf node B. Inorder successor is always either a leaf node or a node with empty left child C. Inorder successor may be an ancestor of the node D. Inorder successor is always either a leaf node or a node with empty right child ANSWER : B	1	C214443.5	IV
	Which of the following traversal outputs the data in sorted order in a BST? A. Preorder B. Inorder C. Postorder D. Level Order ANSWER : B	1	C214443.5	IV
	A binary search tree contains the value 1, 2, 3, 4, 5, 6, 7, 8. The tree is traversed in pre-order and the values are printed out. Which of the following sequences is a valid output? A. 5 3 1 2 4 7 8 6 B. 5 3 1 2 6 4 8 7 C. 5 3 2 4 1 6 7 8 D. 5 3 1 2 4 7 6 8 ANSWER : D	2	C214443.5	IV
	The number of edges from the root to the node is called _____ of the tree. A. Height B. Depth	1	C214443.5	IV

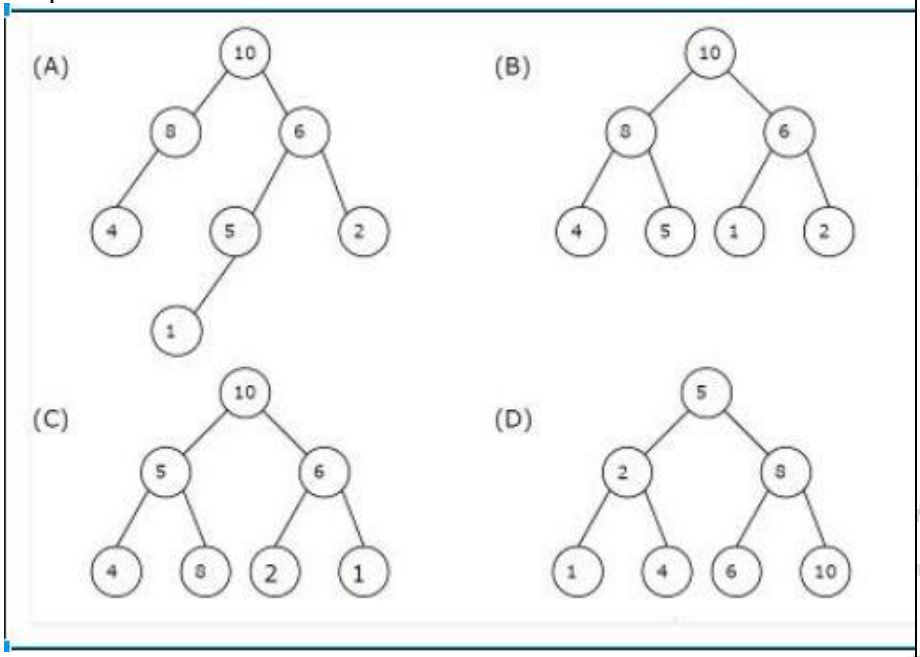
	C. Length D. Width ANSWER : B			
	What is a full binary tree? A. Each node has exactly zero or two children B. Each node has exactly two children C. All the leaves are at the same level D. Each node has exactly one or two children ANSWER : A	1	C214443.5	IV
	Which of the following is not an advantage of trees? A. Hierarchical structure B. Faster search C. Router algorithms D. Undo/Redo operations in a notepad ANSWER : D	1	C214443.5	IV
	The operation of processing each element in the list is known as …… A. sorting B. merging C. inserting D. traversal ANSWER : D	1	C214443.5	IV
	A terminal node in a binary tree is called …… A. Root B. Leaf C. Child D. Branch ANSWER : B	1	C214443.5	IV
	What does the following piece of code do? **public void** func(Tree root) { func(root.left()); func(root.right()); cout<<root.data(); } A. Preorder traversal B. Inorder traversal C. Postorder traversal D. Level order traversal ANSWER : C	1	C214443.5	IV
	What are the disadvantages of normal binary tree traversals? A. there are many pointers which are null and thus useless B. there is no traversal which is efficient C. complexity in implementing D. improper traversals ANSWER : A	1	C214443.5	IV

	Which of the following tree traversals work if the null left pointer pointing to the predecessor and null right pointer pointing to the successor in a binary tree? A. inorder, postorder, preorder traversals B.inorder C. postorder D. preorder ANSWER : A	1	C214443.5	IV
	Unit V			
1.	A minimal spanning tree of a graph G is A. A spanning subgraph B. A tree C. Minimum weights D. All of above ANSWER : D	1	C214443.5	V
2.	How many distinct spanning trees do exist in an undirected cycle graph of n vertices? A. n B. n +1 C. n-1 D. n+2 ANSWER : A	1	C214443.5	V
3.	What is an AVL tree? A. a tree which is balanced and is a height balanced tree B. a tree which is unbalanced and is a height balanced tree C. a tree with three children D. a tree with atmost 3 children ANSWER : A	1	C214443.5	V
4.	In the …….. traversal we process all of a vertex's descendants before we move to an adjacent vertex. A. Depth First B. Breadth First C. With First D. Depth Limited ANSWER : A	1	C214443.5	V
5.	Consider a max heap, represented by the array: 40, 30, 20, 10, 15, 16, 17, 8, 4. Now consider that a value 35 is inserted into this heap. After insertion, the new heap is A. 40, 30, 20, 10, 15, 16, 17, 8, 4, 35 B. 40, 35, 20, 10, 30, 16, 17, 8, 4, 15 C. 40, 30, 20, 10, 35, 16, 17, 8, 4, 15 D. 40, 35, 20, 10, 15, 16, 17, 8, 4, 30 ANSWER : B	1	C214443.5	V
6.	An adjacency matrix representation of a graph cannot contain information of :	1	C214443.5	V

	A. nodes B. edges C. direction of edges D. parallel edges ANSWER : D			
7.	What is the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0. A. 2 B. 3 C. 4 D. 5 ANSWER : B	1	C214443.5	V
8.	Which of the following is AVL Tree?  A. ONLY A	1	C214443.5	V

	B. A and C C. A, B and C D. ONLY B ANSWER : B			
9.	Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source. In what order do the nodes get included into the set of vertices for which the shortest path distances are finalised?  A. P, Q, R, S, T, U B. P, Q, R, U, S, T C. P, Q, R, U, T, S D. P, Q, T, R, U, S ANSWER : B	2	C214443.4	V
10.	Which of the following is an advantage of adjacency list representation over adjacency matrix representation of a graph? A. In adjacency list representation, space is saved for sparse graphs. B. DFS and BSF can be done in O(V + E) time for adjacency list representation. These operations take O(V^2) time in adjacency matrix representation. Here is V and E are number of vertices and edges respectively. C. Adding a vertex in adjacency list representation is easier than adjacency matrix representation D. All of the above ANSWER : D	1	C214443.5	V
11.	Which of the following statements is/are TRUE for an undirected graph? P: Number of odd degree vertices is even Q: Sum of degrees of all vertices is even A. P ONLY B. Q ONLY C. Both P and Q D. Neither P nor Q ANSWER : C	1	C214443.5	V
12.	To implement Dijkstra's shortest path algorithm on unweighted graphs so that it runs in linear time, the data structure to be used is: A. Queue B. Stack C. Heap	1	C214443.4	V

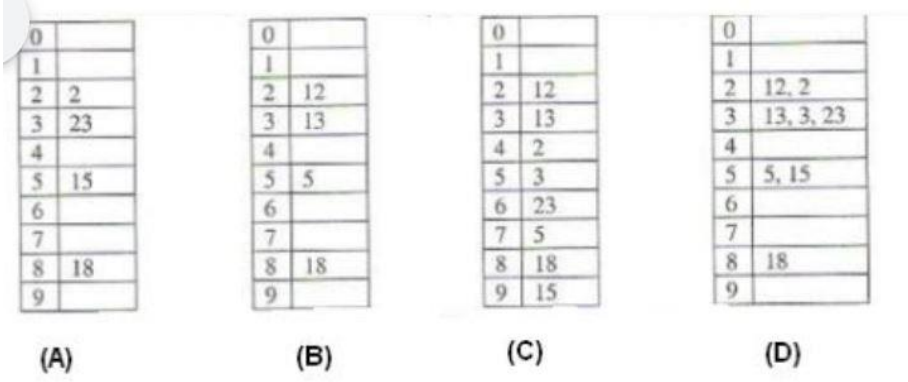
	D. B - Tree ANSWER : A			
13.	Which one of the following cannot be the sequence of edges added, in that order, to a minimum spanning tree using Kruskal's algorithm? Consider the following graph.  A. (a—b),(d—f),(b—f),(d—c),(d—e) B. (a—b),(d—f),(d—c),(b—f),(d—e) C. (d—f),(a—b),(d—c),(b—f),(d—e) D. (d—f),(a—b),(b—f),(d—e),(d—c) ANSWER : D	1	C214443.4	V
14.	Traversal of a graph is different from tree because A. There can be a loop in graph so we must maintain a visited flag for every vertex B. DFS of a graph uses stack, but inorrder traversal of a tree is recursive C. BFS of a graph uses queue, but a time efficient BFS of a tree is recursive. D. All of the above ANSWER : A	1	C214443.5	V
15.	What are the appropriate data structures for following algorithms? 1) Breadth First Search 2) Depth First Search 3) Prim's Minimum Spanning Tree 4) Kruskal' Minimum Spanning Tree A. 1) Stack 2) Queue 3) Priority Queue 4) Union Find B. 1) Queue 2) Stack 3) Priority Queue 4) Union Find C. 1) Stack 2) Queue 3)Union Find 4) Priority Queue D. 1) Priority Queue 2) Queue 3) Stack 4) Union Find ANSWER : B	1	C214443.4	V
16.	A network data model is best represented using A. Tree	1	C214443.5	V

	B. Graph C. Stack D. Hash Table ANSWER: B			
17.	Suppose we are sorting an array of eight integers using heapsort, and we have just finished some heapify (either maxheapify or minheapify) operations. The array now looks like this: 16 14 15 10 12 27 28 How many heapify operations have been performed on root of heap? A. 1 B. 2 C. 3 OR 4 D. 5 OR 6 ANSWER : B	1	C214443.5	V
18.	A max-heap is a heap where the value of each parent is greater than or equal to the values of its children. Which of the following is a max-heap?  A. A B. B C. C D. D ANSWER : B	1	C214443.5	V
19.	In a binary max heap containing n numbers, the smallest element can be found in time A. O(n) B. O(logn) C. O(loglogn) D. O(1) ANSWER : A	1	C214443.1	V

20.	Select static tree tables: A. Huffman's Tree B. OBST C. AVL Tree D. Both Huffman's tree and OBST ANSWER : D	1	C214443.5	V
21.	In OBST, the cost of searching a symbol occurring with higher frequency is A. small B. large C. depends on data D. none ANSWER : A	1	C214443.5	V
22.	The characters a to h have the set of frequencies based on the first 8 Fibonacci numbers as follows a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21 A Huffman code is used to represent the characters. What is the sequence of characters corresponding to the following code? 110111100111010 A. fdheg B. ecgdf C. dchfg D. fehdg ANSWER : A	2	C214443.5	V
23.	Which of the following is true? A. Prim's algorithm initialises with a vertex B. Prim's algorithm initialises with a edge C. Prim's algorithm initialises with a vertex which has smallest edge D. Prim's algorithm initialises with a forest ANSWER : A	1	C214443.4	V
24.	Prim's algorithm is a ..... A. Divide and Conquer algorithm B. Greedy Algorithm C. Dynamic Algorithm D. Approximation Algorithm ANSWER : B	1	C214443.4	V
25.	Which of the following is true? A. Prim's algorithm can also be used for disconnected graphs B. Kruskal's algorithm can also run on the disconnected graphs C. Prim's algorithm is simpler than Kruskal's algorithm D. In Kruskal's sort edges are added to MST in decreasing order of their weights ANSWER : B	1	C214443.4	V
	Unit VI			
1.	Files are logically partitioned into storage units of fixed length known as	1	C214443.6	VI

	A. Tracks B. Blocks C. Sectors D. Segments ANSWER : B			
2.	It is not possible to combine two or more file opening mode in open ()method. A. True B. False ANSWER : A	1	C214443.6	VI
3.	_____ is return type of is_open() function. A. int B. bool C. float D. char * ANSWER : B	1	C214443.6	VI
4.	Which stream class is to only write on files ? A. ofstream B. ifstream C. fstream D. iostream ANSWER : A	1	C214443.6	VI
5.	Consider a hash table of size seven, with starting index zero, and a hash function (3x + 4)mod7. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using closed hashing? Note that '_' denotes an empty location in the table A. 8, _, _, _, _, _, 10 B. 1, 8, 10, _, _, _, 3 C. 1, _, _, _, _, _,3 D. 1, 10, 8, _, _, _, 3 ANSWER : B	2	C214443.6	VI
6.	If several elements are competing for the same bucket in the hash table, what is it called? A. Diffusion B. Replication C. Collision D. None of the mention ANSWER : C	1	C214443.6	VI
7.	Which is correct syntax ? A. myfile:open ("example.bin", ios::out); B. myfile.open ("example.bin", ios::out); C. myfile::open ("example.bin", ios::out); D. myfile.open ("example.bin", ios:out); ANSWER : B	1	C214443.6	VI

8.	How to get position to the nth byte of fileObject ? A. fileObject.seekg('filename',n); B. fileObject.seekg(n, 'filename'); C. fileObject.seekg(n); D. fileObject.seekg(n, ios::app); ANSWER: C	1	C214443.6	VI
9.	ios::trunc is used for ? A. If the file is opened for output operations and it already existed, no action is taken. B. If the file is opened for output operations and it already existed, its previous content is deleted and replaced by the new one. C. If the file is opened for output operations and it already existed, then a new copy is created. D. None of above ANSWER : B	1	C214443.6	VI
10.	Which functions allow to change the location of the get and put positions ? A. sg() and sp() B. gog() and gop() C. seekg() and seekp() D. sekg() and sekp() ANSWER : C	1	C214443.6	VI
11.	offset counted from the current position using ? A. ios::cur B. ios::cr C. ios::curr D. ios::current ANSWER : A	1	C214443.6	VI
12.	Which of the following true about FILE *fp ? A. FILE is a stream B. FILE is a buffered stream C. FILE is a keyword in C for representing files and fp is a variable of FILE type D. FILE is a structure and fp is a pointer to the structure of FILE type ANSWER : D	1	C214443.6	VI
13.	If a file you are opening for appending does not exist, the operating system will detect the missing file and terminate the operation. A. True B. False ANSWER : B	1	C214443.6	VI
14.	In the code fout.open("scores.dat", ios::out); A. ios::out is the stream operation mode. B. fout is the header file reference. C. ios::out is the stream variable name.. D. fout is the name of the file.	1	C214443.6	VI

15.	The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table?  (A) (B) (C) (D) A. A B. B C. C D. D ANSWER : C	1	C214443.6	VI
16.	Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function x mod 10, which of the following statements are true? i. 9679, 1989, 4199 hash to the same value ii. 1471, 6171 hash to the same value iii. All elements hash to the same value iv. Each element hashes to a different value A. i Only B. ii Only C. i and ii Only D. iii and iv Only ANSWER : C	1	C214443.6	VI
17.	A hash function h defined h(key)=key mod 7, with linear probing, is used to insert the keys 44, 45, 79, 55, 91, 18, 63 into a table indexed from 0 to 6. What will be the location of key 18? A. 3 B. 4 C. 5 D. 6 ANSWER : C	1	C214443.6	VI
18.	Which of the following statement(s) is TRUE? 1. A hash function takes a message of arbitrary length and generates a fixed length code. 2. A hash function takes a message of fixed length and generates a code of variable length.	1	C214443.6	VI

	3 . A hash function may give the same hash value for distinct messages. A. 1 Only B. 1 and 2 only C. 1 and 3 only D. 2 Only ANSWER : C			
19.	Which of the following is not a collision resolution strategy for open addressing? A. Linear Probing B. Quadratic Probing C. Double Hashing D. Rehashing ANSWER : D	1	C214443.6	VI
20.	A hash table contains 10 buckets and uses linear probing to resolve collisions. The key values are integers and the hash function used is key % 10. If the values 43, 165, 62, 123, 142 are inserted in the table, in what location would the key value 142 be inserted? A. 2 B. 3 C. 4 D. 6 ANSWER : D	1	C214443.6	VI
21.	An advantage of chained hash table (external hashing) over the open addressing scheme is A. Worst case complexity of search operations is less B. Space used is less C. Deletion is easier D. None of the above ANSWER : C	1	C214443.6	VI
22.	What can be the techniques to avoid collision? A. Make the hash function appear random B. Use the chaining method C. Use uniform hashing D. All of the mentioned ANSWER : D	1	C214443.6	VI
23.	What is a hash function? A. A function has allocated memory to keys B. A function that computes the location of the key in the array C. A function that creates an array D. None of the mentioned ANSWER : B	1	C214443.6	VI
24.	A technique for direct search is A. Binary Search B. Linear Search C. Tree Search	1	C214443.6	VI

	D. Hashing ANSWER : D			
25.	The goal of hashing is to produce a search that takes a) O(1) time b) O(n2)time c) O(log n) time d) O(n log n) time ANSWER : A	1	C214443.6	VI

214444
Object Oriented Programming

SYLLABUS

Teaching Scheme: Lectures: 3 Hours/Week	**Credits:** 03	**Examination Scheme:** In-Semester : 30 Marks End-Semester: 70 Marks

Prerequisites:
1. Principles of Programming Languages.

Course Objectives :
1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

UNIT – I FOUNDATIONS OF OBJECT-ORIENTED PROGRAMMING 06 Hours

Introduction OOP : Software Evolution, Introduction to Procedural, Modular, Object-Oriented and Generic Programming Techniques, Limitations of Procedural Programming, Need of Object-Oriented Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members, Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance, Polymorphism, Static and Dynamic Binding, Message Passing.

UNIT – II CLASSES, OBJECTS AND METHODS 06 Hours

Class: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class, Returning a Value, Adding a Method That Takes Parameters, The 'this' Keyword, Method Overloading, Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory Allocation: 'new', Memory Recovery: 'delete', Static Data Members, Static Methods, Forward Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.

UNIT – III CONSTRUCTORS AND DESTRUCTORS 06 Hours

Constructors: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizes.

UNIT – IV INHERITANCE AND POLYMORPHISM 06 Hours

Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces.

Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and Polymorphism

UNIT – V EXCEPTION HANDLING AND GENERIC PROGRAMMING 06 Hours

Exception: Errors, Types of Errors, Exception and its Types, Exception-Handling Fundamentals, Uncaught Exception, Using try and Catch, Multiple Catch Clauses, Nested Try Statements, User Define Exception using Throw.

Generics: What are Generics? Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.

UNIT – VI FILE HANDLING AND DESIGN PATTERNS 06 Hours

File Handling: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.

Design Patterns: Introduction, Types of Design Patterns, Adapter, Singleton, Iterator

THEORY :

Text Books

1. An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley,2002
2. E. Balaguruswamy, "Object Oriented Programming Using C++ and Java", Tata McGraw Hill

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit / Assignment	Assessment Technique	Blooms Taxonomy Category
CO214444.1	Differentiate various programming paradigms.	I	UNIT TEST - I	L2-Understand
CO214444.2	Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.	II,III	UNIT TEST – II	L2-Understand
CO214444.3	Identify relationship among objects using inheritance and polymorphism principles.	IV	UNIT TEST – III	L2-Understand
CO214444.4	Handle different types of exceptions and perform generic programming.	V	UNIT TEST – VI	L3-Apply
CO214444.5	Use of files for persistent data storage for real world application.	VI	UNIT TEST – V	L2-Apply
CO214444.6	Apply appropriate design patterns to provide object-oriented solutions.	V,VI	UNIT TEST - VI	L3-Apply

PREREQUISITES

Sr. No.	Unit	Prerequisite subject name
1.	Foundations of Object Oriented Programming	Principles of Programming Languages
2.	Classes, Objects and Methods	Principles of Programming Languages
3.	Constructors and Destructors	Principles of Programming Languages
4.	Inheritance and Polymorphism	Principles of Programming Languages
5.	Exception Handling and Generic Programming	Principles of Programming Languages
6.	File Handling and Design Patterns	Principles of Programming Languages

TEACHING PLAN

Teaching Plan Short

Academic Year:- 2021-22 Semester :-I w. e. f. :- 5/07/2021
Class : - SE IT A & SE IT B Division: A & B
Subject :- OOP Subject Code :- 214444
Faculty In charge :- Mrs.Rajashri Sadafule / Mrs.Ashwini Bhmare. No. of Lectures/ weeks: 3

- **Lecture Plan**

Sr. No.	Unit No.	Unit/ Topic Name	Start Date	End Date
1.	I	Foundations of Object Oriented Programming	August 3rd Week	August 4th Week
2.	II	Classes, Objects and Methods	September 1st Week	September 2nd Week
3.	III	Constructors and Destructors	September 3rd Week	September 5th Week
4.	IV	Inheritance and Polymorphism	October 1st Week	October 2nd Week
5.	V	Exception Handling and Generic Programming	October 3rd Week	October 4th Week
6.	VI	File Handling and Design Patterns	November 1st Week	November 3rd Week

Detail Teaching Plan

Lect. No	Unit No.	Main Topic to be Covered	Sub Topics to be Covered	Chap. No. & Reference Books	CO to Attain	Measurable to attain CO	Mode of Delivery
1	I	Control structures		Lesson 2, YashwantKanetkar, "Let us C", BPB Publication	C214444.1	MCQ Test	Chalk and Talk , Machine Projector for Demo of Implementation, Video
2		Arrays		Lesson 8, YashwantKanetkar, "Let us C", BPB Publication			
3		2D Arrays and nD Array	Matrix operations				
4		Functions	Pass by Value	Lesson 5, YashwantKanetkar, "Let us C", BPB Publication			
5			Pass by reference	Lesson 5, YashwantKanetkar, "Let us C", BPB Publication			
6		String manipulation		Lesson 9, YashwantKanetkar, "Let us C", BPB Publication			
7		Structure		Lesson 10, YashwantKanetkar, "Let us C", BPB Publication			
8		Structure , union					
9	II	Introduction to Pointers	Dynamic Memory allocation, pointer to pointer, Array of Pointers	Lesson 5, YashwantKanetkar, "Let us C", BPB Publication	C214444.2	MCQ Test	Chalk and Talk, Machine Projector of Demo Implementation, Video

10		Pointer to arrays	Pointer to single dimensional arrays.	Lesson 8, YashwantKanetkar, “Let us C”, BPB Publication			
11			Pointer to Multidimensional Arrays	Lesson 8, YashwantKanetkar, “Let us C”, BPB Publication			
12		String manipulation using pointers		Lesson 8, YashwantKanetkar, “Let us C”, BPB Publication	C214444.2	MCQ Test	
13		structure manipulation using pointers		Lesson 10, YashwantKanetkar, “Let us C”, BPB Publication			
14		Pointer to functions		Lesson 5, YashwantKanetkar, “Let us C”, BPB Publication			
15		Pointer to file structure and basic operations on file		Lesson 12, YashwantKanetkar, “Let us C”, BPB Publication			
16		Functions used for text and binary file handling in C		Lesson 12, YashwantKanetkar, “Let us C”, BPB Publication			
17	III	Introduction to Data Structures Abstract Data Types, Realization of ADT in 'C'.	Concept of data, Data object, Data structure,	Chapter 1, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Chapter 1, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C"	C214444.3	MCQ Test	Chalk and Talk
18		Concept of Classification of Data Structures	Primitive and non-primitive, linear and Non-				

			linear, static and dynamic, persistent and ephemeral data structures				
19		Analysis of algorithm	Frequency count and its importance in analysis of an algorithm		C214444.3	MCQ Test	Chalk and Talk
20			Time complexity & Space complexity of an algorithm				
21			Big 'O', Omega and Theta notations				
22			Best, Worst and Average case analysis of an algorithm				
23	IV	Need of searching and sorting, Concept of internal and external sorting, sort stability		Chapter 7, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C"	C214444.4	MCQ Test	Chalk and Talk, Presentation, Video
24		**Searching methods:**	Linear search algorithms				

25			binary search and comparison with linear search and complexity analysis				
26		**Sorting methods:**	Bubble sort and time and space complexity analysis				Chalk and Talk, Presentation, Video
27			selection sort and time and space complexity analysis	Chapter 1, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C"			
28			Insertion sort and time and space complexity analysis	Chapter 7, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C"			
29			Merge sort and time and space complexity analysis		C214444.4	MCQ Test	Chalk and Talk, Presentation
30			Quick sort and time and space complexity analysis				
31			Bucket sort and their time and space complexity analysis				

32	VI	Concept of linked organization	singly linked list as an ADT	Chapter 4, E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C"	C214444.2 and C214444.5	End Term Test	Chalk and Talk and Presentation
33			doubly linked list as an ADT				
34			circular linked list as an ADT				
35		Representation and manipulations of polynomials using linked lists,					
36		Comparison of a sequential and linked memory organization,					
37		Concept of Generalized Linked List, representation polynomial using GLL					
38	V	Concept of sequential organization, Concept of Linear data structures, Concept of ordered list		R5 Chapter 2	C214444.5	End Term Test	Chalk and Talk and Presentation
39		Multidimensional Arrays and their	Row major and column major form and	Chapter 2, E. Horowitz, S. Sahani, S. Anderson-			

		storage representation	address calculation.	Freed "Fundamentals of Data Structures in C"			
40		Representation of sparse matrix using arrays	algorithms for sparse matrix addition and simple transpose and Analysis				Chalk and Talk, Presentation, Video
41			algorithms for sparse matrix fast transpose and Analysis				
42		Polynomial representation using arrays and Analysis					
43		Concept of stack and its implementation		Chapter 3, E. Horowitz, S. Sahani, S. Anderson- Freed "Fundamentals of Data Structures in C"			
44		Use of stack it in recursion,	Recursive algorithms e.g. Factorial, Fibonacci series, etc		C214444.5		
45		Concept of Queue and its implementation					

UNIT WISE QUESTION BANK

Unit-I

Sr. No	Question	CO No.	Marks	University Year
1	Write benefits of OOP.	CO214444.1	4	
2	Explain Friend function using example	CO214444.1	6	
3	Differentiate between Procedural Oriented Programming and Object-oriented Programming.	CO214444.1	6	
4	Short note public, private and protected members	CO214444.1	4	
5	What is static data member and static member function? Write its properties.	CO214444.1	6	
6	Explain features of object-oriented programming.	CO214444.1	4	
7	What are the limitation of object oriented programming?	CO214444.1	4	
8	Explain following terms: Object, Class	CO214444.1	6	
9	Explain following terms: inheritance and polymorphism.	CO214444.1	6	
10	List and explain fundamentals of Object-Oriented Programming	CO214444.1	6	
11	Explain Data Encapsulation, Data Abstraction and Information Hiding in detail.	CO214444.1	8	
12	Explain need of Object-Oriented Programming.	CO214444.1	4	

Unit-II

Sr. No	Question	CO No.	Marks	University Year
1	Explain Encapsulation with Example.	CO214444.2	4	
2	What is Memory Allocation? Explain 'new', Memory Recovery: 'delete' keywords.	CO214444.2	6	
3	Explain method overloading with example.	CO214444.2	6	
4	What is meant by static data members and static methods?	CO214444.2	6	
5	Explain Abstract Data Types?	CO214444.2	6	
6	Enlist and explain different Access Modifiers/	CO214444.2	9	
7	Write a short note on: 1. Class 2. Object	CO214444.2	6	

	3. This keywork			
8	What is static data member and static member function ? Write its properties	CO214444.2	8	
9	Short note public, private and protected members	CO214444.2	8	
10	What is class? how does it accomplish data hiding?	CO214444.2	5	
11	What are objects? How they are created?	CO214444.2	4	
12	Describe the mechanism of accessing data members and member functions in the following cases: 1. Inside a main program. 2. Inside a member function of same class. 3. Inside a member function of another class.	CO214444.2	9	

Unit:III

Sr. No	Question	CO No.	Marks	University Year
1	What is constructor? Is it mandatory to use constructor in a class?	CO214444.2	6	
2	How do we invoke constructor member function?	CO214444.2	4	
3	List some of special properties of the constructor functions.	CO214444.2	6	
4	What is parameterized constructor?	CO214444.2	6	
5	What do you mean by dynamic initialization of objects? Why do we need to do this?	CO214444.2	6	
6	How is dynamic initialization of object achieved?	CO214444.2	4	
7	Describe the importance of destructor.	CO214444.2	4	
8	explain garbage collection with different options.	CO214444.2	8	
9	Write a short note on: 1. Destructor 2. Finalize keyword	CO214444.2	8	
10	Who we can achive garbage collection using finalize option?	CO214444.2	4	

Unit IV

Sr. No	Question	CO No.	Marks	University Year
1	Explain inheritance with One Example.	CO214444.3	4	
2	What is method overriding?How it differs freom method overloading.	CO214444.3	6	
3	Explain the need of inheritance?	CO214444.3	4	
4	What is Abstract Classes?Give One Example.	CO214444.3	4	
5	Define polymorphism?also give one example of polymorphism	CO214444.3	4	
6	How would you show your understanding of constructor in derived classes?	CO214444.3	6	
7	Explain different types of inheritance with example?	CO214444.3	4	
8	Define interfaces ?Give One Example.	CO214444.3	6	
9	What are different types of polymorphism explain it with example?	CO214444.3	6	
10	What approach would you use in software reuse?	CO214444.3	6	

Unit-V

Sr. No	Question	CO No.	Marks	University Year
1	Explain Exceptions with its types?	CO214444.4	6	
2	What is Try and Catch block?Give one example.	CO214444.4	5	
3	What is meant by Errors? Explain with Types.	CO214444.4	6	
4	Write short note on Exception Handling Funadamentals.	CO214444.4	4	
5	What is Multiple catch clauses?Give any one example?	CO214444.4	6	
6	Differentiate List Interface and Set Interface?	CO214444.4	6	
7	What is meant by Generics? Explain with Example.	CO214444.6	6	
8	Write short note on Uncaught Exceptions.	CO214444.4	4	
9	Compare ArrayList Class and LinkedList Class.	CO214444.4	6	
10	What are Nested Try Statements?Give one Example.	CO214444.4	5	
11	Define User Defined Exception using Throw?	CO214444.4	4	

Unit VI

Sr. No	Question	CO No.	Marks	University Year
1	What is Stream classes ?Give One Example.	CO214444.5	4	
2	Write short note on concepts of stream?	CO214444.5	4	
3	Define use of byte stream classes?	CO214444.5	4	

4	How would you use character stream classs?Give One Example.	CO214444.5	6	
5	Write short note on useful i/o classes?	CO214444.5	4	
6	Explain constructor in file class?Give one example.	CO214444.5	6	
7	Describe different types of design patterns?	CO214444.6	6	
8	What is I/O exceptions ?Give One Example.	CO214444.5	6	
9	What is use of R/W Bytes ?Give One Example.	CO214444.5	6	
10	Write short note on concatenating and buffering files?	CO214444.6	4	
11	What is use of R/W Character ?Give One Example.	CO214444.5	6	

HOME AGSSIGNMENTS

Unit-I

Sr. No	Question	CO No.	Marks	University Year
1	How would you summarise benefits of OOP.	CO214444.1	4	
2	What is the main idea of following points: Object, Class	CO214444.1	6	
3	How would compare between Procedural Oriented Programming and Object-oriented Programming.	CO214444.1	6	
4	How would you summarise following points public, private and protected members	CO214444.1	4	
5	What can you say about static data member and static member function? Write its properties.	CO214444.1	6	
6	What is the main idea of following points: inheritance and polymorphism.	CO214444.1	4	

Unit-II

Sr. No	Question	CO No.	Marks	University Year
1	What is meant by Encapsulation, Data Abstraction and Information Hiding in detail? Explain with example.	CO214444.2	4	
2	What is the main idea of Memory Allocation? Explain 'new', Memory Recovery: 'delete' keywords.	CO214444.2	6	
3	How would you summarize method overloading with example.	CO214444.2	6	
4	How would you summarize Abstract Data Types?	CO214444.2	6	
5	How would you summarize different Access Modifiers.	CO214444.2	9	

Unit:III

Sr. No	Question	CO No.	Marks	University Year
1	How would you summarize about constructor? Is it mandatory to use constructor in a class?	CO214444.2	6	
2	How do we invoke constructor member function?	CO214444.2	4	
3	List some of special properties of the constructor functions.	CO214444.2	6	
4	What do you mean by dynamic initialization of objects? Why do we need to do this?	CO214444.2	6	
5	How we can achieve garbage collection using finalize option?	CO214444.2	4	

Unit IV

Sr. No	Question	CO No.	Marks	University Year
1	How would you use inheritance ? Give One Example.	CO214444.3	4	
2	What approach would you use in method overriding?	CO214444.3	6	
3	How would you show your understanding of constructor in derived classes?	CO214444.3	6	
4	How would you use interfaces ?Give One Example.	CO214444.3	6	
5	What approach would you use in software reuse?	CO214444.3	6	

Unit-V

Sr. No	Question	CO No.	Marks	University Year
1	How would you summarise Exceptions with its types?	CO214444.4	6	
2	What can you say about Try and Catch block?	CO214444.4	5	
3	State in your word Exception Handling Funadamentals.	CO214444.4	4	
4	How would you compare List Interface and Set Interface?	CO214444.4	6	
5	What is meant by Generics? Explain with Example.	CO214444.6	6	

Unit VI

Sr. No	Question	CO No.	Marks	University Year
1	How would you use Stream classes ?Give One Example.	CO214444.5	4	
2	How would you show your understanding of constructor in file class?	CO214444.5	6	
3	How would you organize different types of design patterns?	CO214444.6	6	
4	How would you use R/W Bytes ?Give One Example.	CO214444.5	6	
5	What approach would you use in concatenating and buffering files?	CO214444.6	4	

ADDITIONAL RESOURCES

- https://www.youtube.com/watch?v=7WhnYwoBY24&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0
- https://www.youtube.com/watch?v=Imy9TEJkKa8&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=2
- https://www.youtube.com/watch?v=qG4zIEjYz7I&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=3
- https://www.youtube.com/watch?v=9nRblRcb35Y&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=4
- https://www.youtube.com/watch?v=Zt-u1EPdlg&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=5
- https://www.youtube.com/watch?v=KELJ2kD6aeU&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=6
- https://www.youtube.com/watch?v=xnh7ip5gpzc&list=PLfVsf4Bjg79DLA5K3GLbIwf3baNVFO2Lq

214445

Basics of Computer Network

SYLLABUS

Teaching Scheme: **Credits Examination Scheme:**

Lectures: 4 Hours/Week 04In-Semester (Online): 50 Marks
End-Semester: 50 Marks

UNIT – I DATA COMMUNICATION AND NETWORK MODELS 06 Hours

Introduction to communication Theory - Basics of data communication, Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques, Data rate limits, Topologies, Noise, types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.

Network Models and addressing - OSI Model TCP/IP Model (Data Format, Addressing Mechanisms, Devices)

UNIT-II ERROR DETECTION, CORRECTION AND DATA LINK CONTROL 06 Hours

Data Link Layer: Data Link Layer Services, Error Detection and Correction: Introduction, Error Detection and Error Correction. **Linear Block Codes**: hamming code, Hamming Distance, parity check code. **Cyclic Codes**: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (Examples: CHECKSUM: One's Complement, Internet Checksum). **Framing:** fixed-size framing, variable size framing.

Flow control protocols- Noiseless channels: simplest protocol, stop-and-wait protocol. Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.

UNIT – III MULTI-ACCESS MECHANISM AND ETHERNET STANDARDS 06 Hours

Random Access Techniques: CSMA, CSMA/CD, CSMA/CA, Controlled Access Techniques: Reservation, Polling, Token Passing, **Channelization:** FDMA, TDMA, CDMA, **Ethernet:** IEEE Standards- 802.3, 802.4, 802.5, 802.6 Comparison of Ethernet Standards: Standard Ethernet, Fast Ethernet, Gigabit Ethernet with reference to MAC layer and Physical Layer (Wired Network Only)

UNIT – IV NETWORK LAYER: SERVICES AND ADDRESSING 06 Hours

Network Layer :Network Layer Services, IPv4 Addresses: Static and Dynamic Configuration Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, **IPv4**: Datagrams, Fragmentation, Options, Checksum, **IPv6Addressing**: Notations, Address Space, Packet Format, Transition from Ipv4 to IPv6

UNIT–V NETWORK LAYER: ROUTING PROTOCOLS 06 Hours

Routing: Metric, Static vs Dynamic Routing Tables, Routing Protocol, Unicast Routing Protocols - Optimality Principle, Intra and Inter Domain Routing, Shortest Path Routing, Flooding, Distant Vector Routing, Link State Routing, Path Vector Routing Interior Gateway Routing Protocol- OSPF, EIGRP, RIP, Exterior Gateway Routing Protocol– BGP

UNIT – VI TRANSPORT LAYER : SERVICES AND PROTOCOLS 06 Hours

Transport layer :Transport layer services(Duties), TCP: COTS, TCP header, Services, Segments, Connection Establishment, Flow control, Congestion Control, Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS, Timers, UDP: CLTS, UDP header, Datagram, Services, Applications, Socket: Primitives, TCP & UDP Sockets.

Text Books

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition

2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3

Reference Books

1. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1

2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition

3. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit	Assessment Technique	Blooms Taxonomy Category
214445.1	To Compare functions of OSI and TCP/IP model using concepts of communication theory.	Unit I	Mock Insem	Level 2 Understanding
214445.2	To Analyze data link layer services, error detection and correction, linear block codes, cyclic codes, framing and flow control protocols.	Unit II	Mock Insem	Level 4 Analyzing
214445.3	To Compare different access techniques, channelization and Ethernet standards.	Unit III	Mock Insem	Level 2 Understanding
214445.4	To Apply the skills of subnetting, supernetting and routing mechanisms.	Unit IV, V	Mock Endsem	Level 3 Applying
214445.5	To Differentiate IPv4 and IPv6.	Unit IV	Mock Endsem	Level 2 Understanding
214445.6	To Illustrate services and protocols used at transport layer	Unit VI	Mock Endsem	Level 2 Understanding

PREREQUISITES

Sr. No.	Unit	Prerequisite subject name
1.	Data Communication and Network Models	Data communication, Basics of Physical layer
2.	Error Detection, Correction and Data Link Control	Data communication, Basics of Data link layer
3.	Multi-Access Mechanism and Ethernet Standards	Data communication, Basics of Data link layer
4.	Network Layer: Services and Addressing	Data communication, Basics of Network layer
5.	Network Layer : Routing Protocols	Data communication, Basics of Network layer
6.	Transport layer - services and protocols	Data communication ,Basics of Transport layer

TEACHING PLAN

Academic Year: - 2021-21 Semester:-I w. e. f.:- 5-7-2021
Class: - SE IT A & SE IT B Division: A & B
Subject: - BCN Subject Code: - 214445
Faculty In charge: - Ms. Jyoti H. Jadhav No. of Lectures/ weeks:3

- **Lecture Plan**

Sr. No.	Unit No.	Unit/ Topic Name	Start Date	End Date
1.	I	Data Communication and Network Models	Aug Week 3	Aug Week 5
2.	II	Error Detection, Correction and Data Link Control	Sep Week 1	Sep Week 3
3.	III	Multi-Access Mechanism and Ethernet Standards	Sep Week 4	Oct Week 1
4.	IV	Network Layer: Services and Addressing	Oct Week 2	Oct Week 4
5.	V	Network Layer : Routing Protocols	Nov Week 1	Nov Week 3
6.	VI	Transport layer - services and protocols	Nov Week 4	Des Week 2

Detail Teaching Plan

Lect No	Unit No.	Main Topic to be Covered	Sub Topics to be Covered	Chap. No. & Reference Books	CO to Attain	Measurable to attain CO	Mode of Delivery
1	Unit-I	Data Communication and Network Models	Introduction to communication Theory - Basics of data communication, Types of Signals,	Chapter 1 to 6 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN : 978-0132-126953 and Data communication and networking by Behrouz Forouzan, edition 5	CO1	Pre-Insem	Online Lecture and PPT
2			Introduction to communication Theory -A/D, D/A, A/A, D/D Signal Conversion Methods				Online Lecture and PPT
3			Introduction to communication Theory -Bandwidth Utilization and Data Rate Limits				Online Lecture and PPT
4			multiplexing techniques Data rate limits,				Online Lecture and PPT
5			Topologies, Noise, types of noise				Online Lecture and PPT
6			Shannon Hartley Theorem				Online Lecture and PPT
7			Nyquist and Shannon Theorem, Bandwidth S/N trade off.				Online Lecture and PPT
8			Network Models And addressing - OSI Model				Online Lecture and PPT
9			TCP/IP Model				Online Lecture and PPT

10	Unit - II	Error Detection, Correction and Data Link Control	Data Link Layer: Data Link Layer Services, Error Detection and Correction: Introduction	Chapter no.10&11 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN : 978-0132-126953 and Data communication and networking by Behrouz Forouzan, edition 5	CO2	Pre-Insem	Online Lecture and PPT
11			Linear Block Codes: hamming code, Hamming Distance, Parity check code.				Online Lecture and PPT
12			Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes				Online Lecture and PPT
13			CHECKSUM: One's Complement				Online Lecture and PPT
14			Internet Checksum				Online Lecture and PPT
15			Framing: fixed-size framing, variable size framing.				Online Lecture and PPT
16			Flow control: flow control protocols. Noiseless channels: simplest protocol, stop-and-wait				Online Lecture and PPT
17			Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ				Online Lecture and PPT
18			Selective repeat ARQ, piggybacking.				Online Lecture and PPT
19	Unit-III		Random Access Techniques: CSMA,			Pre-Insem	Online Lecture and PPT

20		Multi-Access Mechanism and Ethernet Standards	CSMA/CD, CSMA/CA	Chapter 12 & 13 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN : 978-0132-126953 and Data communication and networking by Behrouz Forouzan, edition 5	CO3		Online Lecture and PPT
21			Controlled Access Techniques: Reservation				Online Lecture and PPT
22			Polling, Token Passing				Online Lecture and PPT
23			Channelization: FDMA				Online Lecture and PPT
24			TDMA, CDMA				Online Lecture and PPT
25			Ethernet: IEEE Standards- 802.3, 802.4				Online Lecture and PPT
26			802.5, 802.6				Online Lecture and PPT
27			Comparison of Ethernet Standards				Online Lecture and PPT
28	Unit-IV	Network Layer: Services and Addressing	Network Layer :Network Layer Services, IPv4 Addresses: Static and Dynamic Configuration Classful and Classless Addressing	Chapter 19 &20 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN :	CO4, 5	Pre-Endsem	Online Lecture and PPT
29			Special Addresses, NAT,				Online Lecture and PPT
30			Subnetting				Online Lecture and PPT
31			Supernetting				Online Lecture and PPT

32			Delivery and Forwarding of IP Packet	978-0132-126953 and Data communication and networking by Behrouz Forouzan, edition 5			Online Lecture and PPT
33			Structure of Router				Online Lecture and PPT
34			IPv4: Datagrams, Fragmentation, Options, Checksum				Online Lecture and PPT
35			IPv6Addressing: Notations, Address Space, Packet Format				Online Lecture and PPT
36			Transition from Ipv4 to IPv6				Online Lecture and PPT
37	Unit-V	Network Layer : Routing Protocols	Routing: Metric, Static vs Dynamic Routing Tables	Chapter 22 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN : 978-0132-126953 and Data communication and networking by Behrouz Forouzan edition 5	CO4	Pre-Endsem	Online Lecture and PPT
38			Routing Protocol, Unicast Routing Protocols - Optimality Principle, Intra and Inter Domain Routing				Online Lecture and PPT
39			Shortest Path Routing				Online Lecture and PPT
40			Flooding, Distant Vector Routing, Link State Routing, Path Vector Routing Interior Gateway Routing Protocol				Online Lecture and PPT
41			OSPF				Online Lecture and PPT
42			EIGRP				Online Lecture and PPT
43			RIP				Online Lecture and PPT
44			BGP				Online Lecture and PPT

45			Comparisons of all routing protocols				Online Lecture and PPT
46	Unit-VI	Transport layer - services and protocols	Transport layer :Transport layer services(Duties)	Chapter 23 & 24 Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN : 978-0132-126953 and Data communication and networking by Behrouz Forouzan edition 5	CO6	Pre-Endsem	Online Lecture and PPT
47			TCP: COTS, TCP header				Online Lecture and PPT
48			Services, Segments, Connection Establishment				Online Lecture and PPT
49			Flow control, Congestion Control				Online Lecture and PPT
50			Congestion Control Algorithms				Online Lecture and PPT
51			Leaky Bucket, Token Bucket and QoS,				Online Lecture and PPT
52			Timers, UDP: CLTS, UDP header , Datagram, Services, Applications				Online Lecture and PPT
53			Socket: Primitives, TCP				Online Lecture and PPT
54			UDP Sockets				Online Lecture and PPT

Unit wise Question Bank

Unit-I

Sr. No	Question	CO No.	Marks	University Year
1	How would you summarize the analog signals and digital Signals with the help of waveforms?	214445.1	6	May 2017
2	List the different signal conversion methods and explain any one method in brief.	214445.1	6	
3	Explain the Shanon Heartly theorem with example.	214445.1	6	May 2018
4	What are the functions of data link layer?	214445.1	5	
5	Compare the OSI and TCP/IP reference model.	214445.1	5	Dec 2017
6	What are the functions of transport layer?	214445.1	6	Dec 2016
7	Show how bandwidth of a signal related to its spectrum?	214445.1	6	May 2014
8	Summarize and illustrate different addressing schemes used in TCP/IP.	214445.1	6	May 2017
9	How would you describe techniques of digital-to-digital conversion?	214445.1	6	
10	How would you describe PCM and DM with the help of diagram.	214445.1	7	May 2017
11	Draw and explain PCM and DM.	214445.1	6	May 2017
12	Explain the following shift keying techniques with suitable examples: ASK FSK PSK	214445.1	7	Dec 2016
13	Summarize and illustrate the Nyquist theorem with example.	214445.1	6	

Unit: II

Sr. No	Question	CO No.	Marks	University Year
1	Explain in detail Go-Back-N and Selective Repeat ARQ System.	214445.2	6	May 2017
2	Explain Error Detection and Correction in Block coding.	214445.2	6	May 2016
3	Write a short note on character oriented framing methods	214445.2	6	May 2016
4	Explain two dimensional parity check.	214445.2	7	May 2016
5	Write a short note on internet checksum. OR What is Checksum? Describe in detail internet Checksum method	214445.2	6 / 7	Dec 2016

	with suitable example.			
6	Discuss the concept of redundancy in error detection and correction.	214445.2	7	Dec 2015
7	Explain in detail Stop and Wait and Selective Repeat ARQ System.	214445.2	7	Dec 2015
8	Explain selective repeat ARQ for noiseless channels.	214445.2	6	May 2014
9	What is Hamming distance? Explain it with an example. Explain simple parity check code.	214445.2	6	May 2014
10	What is CRC ? Explain CRC generator and CRC checker with suitable example.	214445.2	6	May 2014
12	How does a single-bit error differ from a burst error?	214445.2	4	
13	Explain the details about linear block and cyclic block code.	214445.2	6	
14	Elaborate humming distance in detail with suitable example.	214445.2	4	
15	How is the simple parity check related to the two-dimensional parity check?	214445.2	4	
16	What kind of arithmetic is used to add data items in checksum calculation? And explain it.	214445.2	4	
17	Explain Go-back-N automatic repeat request protocol.	214445.2	6	May 15
18	Explain the framing and its need.	214445.2	4	
19	Compare and contrast byte-oriented and bit-oriented protocols. Which category has been popular in the past (explain the reason)? Which category is popular now.	214445.2	6	
20	Compare and contrast byte-stuffing and bit-stuffing. Which technique is used in byte-oriented protocols? Which technique is used in bit-oriented protocols?	214445.2	4	
21	Compare and contrast flow control and error control.	214445.2	4	
22	What are the two protocols we discussed for noiseless channels?	214445.2	6	
23	Explain the three protocols used in noisy channels.	214445.2	6	
24	Compare and contrast the Go-Back-NARQ Protocol with Selective-Repeat ARQ.	214445.2	4	
25	Elaborate piggybacking and its usefulness in detail.	214445.2	6	
26	Generate the CRC code for the message 1101010101.Given Generator polynomial g(x)=x^4+x^2+1.	214445.2	7	Dec 15

Unit: III

Sr. No	Question	CO No.	Marks	University Year
1	Compare FDMA, TDMA and CDMA.	214445.3	6	May 2016
2	Explain CSMA and CSMA/CD. Also comment on the efficiency of each.	214445.3	6	May 2017

3	Write a short note on FDM and TDM.	214445.3	6	Dec 2016
4	Explain FDM and TDM multiplication Techniques.	214445.3	6	May 16
5	Discuss CSMA/CA random access technique. How collision avoidance is achieved in this technique?	214445.3	6	Dec 2016
6	Explain FDMA, TDMA and CDMA in detail.	214445.3	6	Dec 2016
12	Write a note on CSMA/CD.	214445.3	6	Dec 2015
13	Write a note on CSMA.	214445.3	6	Dec 2015
14	Discuss CSMA/CD random access technique. How collision detection is achieved in this technique?	214445.3	6	May 2014
15	Explain CSMA and CSMA/CD random access technique. How collision avoidance is achieved in this technique?	214445.3	6	Dec 14
16	A CSMA/CD bus spans a distance of 1.5 km. if the data rate is 5 mbps what is min frame size?	214445.3	4	
17	Compute a max channel utilization for a MAN which uses CSMA mechanism and has length of 50 km and operates at 50 mbps with frame length of 2000 bits.	214445.3	4	
18	Elaborate random access and list and explain three protocols in this category.	214445.3	6	
19	Define controlled access and list and explain three protocols in this category.	214445.3	6	
20	Define channelization and list and explain three protocols in this category.	214445.3	6	
21	Explain why collision is an issue in a random access protocol but not in controlled access or channelizing protocols.	214445.3	6	
22	Compare and contrast a random access protocol with a controlled access protocol.	214445.3	4	
23	Compare and contrast a random access protocol with a channelizing protocol.	214445.3	4	
24	Compare and contrast a controlled access protocol with a channelizing protocol.	214445.3	6	
25	Do we need a multiple access protocol when we use the 1ocal loop of the telephone company to access the Internet? Why?	214445.3	4	
26	Do we need a multiple access protocol when we use one CATV channel to access the Internet? Why?	214445.3	4	
27	In a CDMA-l CD network with a data rate of 10 Mbps, the minimum frame size is found to be 512 bits for the correct operation of the collision detection process. What should be the minimum frame size if we increase the data rate to 100 Mbps? To 1 Gbps? To 10 Gbps?	214445.3	6	
28	In a CDMA-l CD network with a data rate of 10 Mbps, the maximum distance between any station pair is found to be 2500 m for the correct operation of the collision detection	214445.3	6	

	process. What should be the maximum distance if we increase the data rate to 100 Mbps? To 1 Gbps? To 10 Gbps?			
29	How is the preamble field different from the SFD field?	214445.3	4	
30	Explain the frame format for IEEE 802.3	214445.3	4	
31	Explain types of standard Ethernet and Gigabit Ethernet.	214445.3	6	Dec 2015
32	Compare the data rates for Standard Ethernet, Fast Ethernet, Gigabit Ethernet, and Ten-Gigabit Ethernet.	214445.3	6	
33	What are the common Standard Ethernet implementations? Explain it	214445.3	6	
34	What are the common Fast Ethernet implementations? Explain it in detail.	214445.3	6	
35	Explain in detail common Gigabit Ethernet implementations?	214445.3	6	
36	What are the common Ten-Gigabit Ethernet implementations? Explain it in detail.	214445.3	6	
37	What is difference between IEEE 802.3, 802.4, 802.5	214445.3	6	
38	Explain the frame format of IEEE 802.5.	214445.3	6	
39	Explain the frame format of IEEE 802.4.	214445.3	6	
40	Discuss Fast Ethernet technology in brief. State its specification.	214445.3	6	May 2017

Unit IV

Sr. No	Question	CO No.	Marks	University Year
1	Explain the operation of NAT with suitable example.	214445.4,5	6	
2	Explain the IPV4 header format with suitable diagram.	214445.4,5	6	
3	Explain the delivery and forwarding of IP packet in brief	214445.4,5	6	
4	A company needs 6 subnets to its six departments. The company is granted site address 210.80.60.0. Design the subnets.	214445.4,5	6	
5	What is addressing techniques? Explain it.	214445.4,5	4	
6	What is fragmentation? Explain how it is supported to in IPV4 and IPV6?	214445.4,5	6	
7	Explain the details header format of IPv6.	214445.4,5	4	
8	Compare the classful IP address and classless IP address.	214445.4,5	6	
9	Compare IPV4 and IPV6.	214445.4,5	6	
10	Explain the transition of IPV4 to IPV6	214445.4,5	6	
11	Explain the supernetting with suitable example.	214445.4,5	6	

12	Divide the network 192.168.1.0 into 8 equal subnets. calculate the host address in each subnet and also find out first valid host and last valid host of 5th subnet.	214445.4,5	6	

Unit-V

Sr. No	Question	CO No.	Marks	University Year
1	Compare static routing and dynamic routing.	214445.4	6	
2	What is routing? State different types of routing .Explain two interior gateway routing protocols.	214445.4	6	
3	Compare between distance vector routing protocols and link state routing protocols.	214445.4	6	
4	Explain OSPF with its message format	214445.4	6	
5	Explain the structure of router in brief.	214445.4	6	
6	Write a short note on 1.RIP 2.EIGRP 3.OSPF 4.BGP	214445.4	6	
7	What is BGP? Explain the operations of BGP with suitable example.	214445.4	6	
8	Compare and contrast between RIP and OSPF	214445.4	6	
9	Compare between distance vector routing protocols and link state routing protocols.	214445.4	6	

Unit VI

Sr. No	Question	CO No.	Marks	University Year
1	Explain timers used with TCP.	214445.6	6	
2	Explain Leaky & Token bucket algorithm.	214445.6	6	
3	Write a short note of Quality of Service Parameter in Transport layer.	214445.6	6	
4	Explain various transport layer services	214445.6	6	
5	Explain how TCP provides flow control?	214445.6	6	
6	Explain the duties of transport layer and differentiate between connection oriented and connectionless service.	214445.6	6	
7	Write a short note on UDP.	214445.6	6	

8	Explain the all fields of TCP header.	214445.6	6	
9	Explain three way handshake algorithms for TCP connection establishment.	214445.6	6	
10	What is silly window syndrome ? how to overcome it ?	214445.6	6	
11	Explain the socket primitives in TCP protocol.	214445.6	6	
12	Explain the socket primitives in UDP protocol	214445.6	6	

HOME ASSIGNMENTS

Unit I

Sr. No	Question	CO No.	Marks	University Year
1	How would you summarize the analog signals and digital Signals with the help of waveforms?	214445.1	6	May 2017
2	List the different signal conversion methods and explain any one method in brief.	214445.1	6	
3	Explain the Shanon Heartly theorem with example.	214445.1	6	May 2018
4	What are the functions of data link layer?	214445.1	5	
5	Compare the OSI and TCP/IP reference model.	214445.1	5	Dec 2017

Unit-II

Sr. No	Question	CO No.	Marks	University Year
1	Explain in detail Stop and Wait and Selective Repeat ARQ System.	214445.2	7	Dec 2015
2	Write a short note on internet checksum. OR What is Checksum? Describe in detail internet Checksum method with suitable example.	214445.2	6 / 7	Dec 2016
3	What is CRC ? Explain CRC generator and CRC checker with suitable example.	214445.2	6	May 2014
4	Write a short note on character oriented framing methods	214445.2	6	May 2016
5	Explain Error Detection and Correction in Block coding.	214445.2	6	May 2016

Unit-III

Sr. No	Question	CO No.	Marks	University Year
1	Explain CSMA and CSMA/CD. Also comment on the efficiency of each.	214445.3	6	May 2017
2	Discuss CSMA/CD random access technique. How collision detection is achieved in this technique?	214445.3	6	May 2014
3	Elaborate random access and list and explain three protocols in this category.	214445.3	6	
4	Define controlled access and list and explain three protocols in this category.	214445.3	6	
5	What is difference between IEEE 802.3, 802.4, 802.5	214445.3	6	

Unit: IV

Sr. No	Question	CO No.	Marks	University Year
1	Explain the operation of NAT with suitable example.	214445.4, 5	6	
2	Explain the IPV4 header format with suitable diagram.	214445.4, 5	6	
3	A company needs 6 subnets to its six departments. The company is granted site address 210.80.60.0. Design the subnets.	214445.4, 5	6	
4	Compare the classful IP address and classless IP address.	214445.4, 5	4	
5	Compare IPV4 and IPV6.	214445.4, 5	6	

Unit-V

Sr. No	Question	CO No.	Marks	University Year
1	Compare static routing and dynamic routing.	214445.4	6	
2	What is routing? State different types of routing .Explain two interior gateway routing protocols.	214445.4	6	
3	Compare between distance vector routing protocols and link state routing protocols.	214445.4	6	
4	Explain OSPF with its message format	214445.4	6	
5	Explain the structure of router in brief.	214445.4	6	

Unit-VI

Sr. No	Question	CO No.	Marks	University Year
1	Explain various transport layer services	214445.6	6	
2	Explain how TCP provides flow control?	214445.6	6	
3	Explain the duties of transport layer and differentiate between connection oriented and connectionless service.	214445.6	6	
4	Write a short note on UDP.	214445.6	6	
5	Explain the all fields of TCP header.	214445.6	6	

ADDITIONAL RESOURCES

https://searchnetworking.techtarget.com/definition/Network-layer
https://www.quora.com/What-protocols-are-used-in-a-network-layer
https://www.ibm.com/support/knowledgecenter/.../com...znetwork/znetwork_21.html
https://www.youtube.com/watch?v=3QWrq5gN8VY&t=197s
https://www.youtube.com/watch?v=vru2wLvBS8s
https://www.youtube.com/watch?v=rs39FWDhzDs
https://www.youtube.com/watch?v=qIEHUUt2Wfc

214445

Logic Desin and Computer Organization Laboratory

SYLLABUS

214442: Logic Design & Computer Organization Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Lectures:2 Hours/Week	01	PR: 25Marks TW:25Marks

GROUP A
1. Design and implement 4-bit BCD to Excess-3code 2. Design and implement 1 digit BCD adderusingIC7483 3. Design and implement following using multiplexer IC 74153 1) full adder 2) Any three variable function (cascade method) 4. Design and implement full Subtractor using decoder IC74138
GROUP B
1. Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip- flop IC7476 2. Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip- flop IC7476 **3.** Design and implement Modulo 'N' counter using IC7490. (N= 100max)
GROUP C
Any **two** of following , using virtual lab simulator 1. Design& simulate single bit RAM cell **OR** 4 address*2bit memory using 8 single bit RAM cells. 2. Design& simulate single bit ALU with four functions(AND, OR, XOR,ADD). Design& simulation of single instruction CPU.

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill,ISBN:0-07-049492-4.
2. Virtual Lab simulator Link **http://vlabs.iitkgp.ac.in/coa/**

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Blooms Taxonomy Category
214442.1	Use logic function representation for simplification with K-Maps and design Combinational logic circuits using SSI & MSI chips.	LA 1,2,3,4	Mock Practical Test	Apply
214442.2	Design Sequential Logic circuits: MOD counters using synchronous counters.	LA 5,6,7		Understand
214442.3	Understand the basics of simulator tool & to simulate basic blocks such as ALU & memory.	LA 8,9		Understand

PREREQUISITES

Sr. No.	Assignment Number	Prerequisite Topic Name
1.	1	Code Converters, K maps, Combinational logic circuits , ,Basic IC and gates knowledge
2.	2	Adder, HA& Full Adder ,IC 7483,Basic IC and gates knowledge
3.	3	Basic IC and gates knowledge, Full adder ,Multiplexer ,Demultiplexer
4.	4	Basic IC and gates knowledge, Full Subtractor, Decoder IC, Counters, JK Flip flop
5.	5	Basic IC and gates knowledge, 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip- flop IC7476
6.	6	Basic IC and gates knowledge, 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip- flop IC7476
7.	7	Basic IC and gates knowledge, MOD counters
8	8	single bit RAM cell **OR**4 address*2bit memory using 8 single bit RAM cells.
9	9	single bit ALU with four functions

TEACHING PLAN

Practical Teaching Plan Short

Academic Year:-2021-22 Semester:-I w. e. f. :-5-7-2021

Class :-SE Division: A/B

Subject :-Logic Design& Computer Organization Lab Subject Code :- 214446

Faculty Incharge :-Mrs.Tanmayee Kute & Poonam Rakibe No.of Lectures/ eeks:3

- **Practical Plan**

Sr. No.	Assignment No.	Assignment Title	Start week	End week
1.	1	Design and implement 4-bit BCD to Excess-3 code	August3nd week	August 4th week
2.	2	Design and implement 1 digit BCD adder using IC 7483	August 4th week	August 5th week
3.	3	Design and implement following using multiplexer IC 74153 1) full adder 2) Any three variable function (cascade method)	Septembe r 1st week	Septemb er 2nd week
4.	4	Design and implement full Subtractor using decoder IC74138	September 3rd week	September 4 th week
5.	5	Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip- flop IC7476	September 5 th week	October 1st week
6.	6	Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip- flop IC 7476	October 2nd week	October 3rd week
7.	7	Design and implement Modulo 'N' counter using IC7490. (N= 100max)	October 4th week	October 5th week
8.	8	Design& simulate single bit RAM cell **OR**4 address*2bit memory using 8 single bit RAM cells.	November 1st week	November 2nd week
9.	9	Design and simulate single bit ALU with four functions (AND, OR, XOR, ADD).	November 3rd week	November 4 th week

ORAL QUESTION BANK

1. Why NAND & NOR gates are called universal gates?
2. Realize the EX – OR gates using minimum number of NAND gates.
3. Give the truth table for EX-NOR and realize using NAND gates?
4. What are the different methods to obtain minimal expression?
5. What is a Min term and Max term.
6. State the difference between SOP and POS.
7. What is meant by canonical representation?
8. What is K-map? Why is it used?
9. What are universal gates?
10. What is a half adder?
11. What is a full adder?
12. What are the applications of adders?
13. What is a half Subtractor?
14. What is a full Subtractor?
15. What are the applications of sub tractors?
16. Obtain the minimal expression for above circuits.
17. Realize a full adder using two half adders
18. Realize a full Subtractor using two half Subtractor.
19. What is the internal structure of 7483 IC?
20. What do you mean by code conversion?
21. What are the applications of code conversion?
22. How do you realize a Subtractor using full adder?
23. What is a ripple Adder? What are its disadvantages?
24. What are code converters?

25. What is the necessity of code conversions?

26. What is gray code?

27. Realize the Boolean expressions for

a) Binary to gray code conversion

b) Gray to binary code conversion

28. What is a multiplexer?

29. What is a de-multiplexer?

30. What are the applications of multiplexer and de-multiplexer?

31. Derive the Boolean expression for multiplexer and de-multiplexer.

32. How do you realize a given function using multiplexer

33. What is the difference between multiplexer &demultiplexer?

34. In 2n to 1 multiplexer how many selection lines are there?

35. How to get higher order multiplexers?

36. Implement an 8:1 mux using 4:1 muxes?

37. What are the applications of decoder?

38. What is the difference between decoder & encoder?

39. For n- 2n decoder how many i/p lines & how many o/p lines?

40. What are the different codes & their applications?

41. What are code converters?

42. Using 3:8 decoder and associated logic, implement a full adder?

43. Implement a full Subtractor using IC 74138?

44. What is the difference between decoder and de-mux?

45. What is the difference between Flip-Flop & latch?

46. Give examples for synchronous & asynchronous inputs?

47. What are the applications of different Flip-Flops?

48. What is the advantage of Edge triggering over level triggering?

49. What is the relation between propagation delay & clock frequency of flip-flop?
50. What is race around in flip-flop & how to overcome it?
51. Convert the J K Flip-Flop into D flip-flop and T flip-flop?
52. List the functions of asynchronous inputs?
53. What is the necessity for sequence generation?
54. What are PISO, SIPO, and SISO with respect to shift register?
55. Differentiate between serial data & parallel data
56. What is the significance of Mode control bit?
57. What is a ring counter?
58. What is a Johnson counter?
59. What are the different types of memory?
60. What is RAM?
61. What is CPU?
62. Name different blocks of CPU?
63. What is cache memory?
64. What is I/O?
65. What is ALU?
66. What are the different registers in CPU?
67. Draw instruction format?
68. What is SRAM, DRAM and ROM?
69. What is ISR?
70. What is difference between interrupt and exception?

214447
Data Structures and Algorithms Laboratory

1. Searching and Sorting

Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA.(array of structure) a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort) b) Arrange list of students alphabetically. (Use Insertion sort) c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort) d) Search students according to SGPA. If more than one student has the same SGPA, then print a list of all students having the same SGPA. e) Search a particular student according to name using binary search without recursion. (all the student records having the presence of search key should be displayed) (Note: Implement either Bubble sort or Insertion Sort.)

2. Stack

Implement stack as an abstract data type using singly linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression.

3. Circular Queue

Implement Circular Queue using Array. Perform following operations on it.

a) Insertion (Enqueue)

b) Deletion (Dequeue)

c) Display

(Note: Handle queue full condition by considering a fixed size of a queue.)

4. Expression Tree

Construct an Expression Tree from postfix and prefix expression. Perform recursive and nonrecursive In-order, pre-order and post-order traversals

5. Binary Search Tree

Implement binary search tree and perform following operations:

a) Insert (Handle insertion of duplicate entry)

b) Delete

c) Search

d) Display tree (Traversal)

e) Display - Depth of tree

f) Display - Mirror image

g) Create a copy

h) Display all parent nodes with their child nodes

i) Display leaf nodes

j) Display tree level wise

(Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three)

6. Threaded Binary Tree

Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.

7. Graph: Minimum Spanning Tree

Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree

a) Using Kruskal's algorithm.

b) Using Prim's algorithm.

8. Graph: Shortest Path Algorithm

Represent a graph of the city using adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destinations.

9. Heap Sort

Implement Heap sort to sort a given set of values using max or min heap.

10. FILE Handling

Department maintains student's database. The file contains roll number, name, division and address. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of student. Display information of a particular student. If the record of the student does not exist an appropriate message is displayed. If a student record is found it should display the student details.

Course Outcomes

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Bloom's Taxonomy Category
C214447.1	Analyze algorithms and to determine algorithm correctness and time efficiency class	ALL	Continuous Assessment, Mock Practical Exam	L : IV Analyze
C214447.2	Implement abstract data type (ADT) and data structures for given application.	1 TO 9		L : III Apply
C214447.3	Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.	1 TO 8, 10		L : III Apply
C214447.4	Solve problems using algorithmic design techniques and data structures	ALL		L : III Apply
C214447.5	Analyze algorithms with respect to time and space complexity.	ALL		L : IV Analyze

Teaching Plan

Sr. No.	Title of Assignment	Date of Implementation	Date of Evaluation
1	Sorting Algorithm on student Database	August 4th Week	September 1st Week
2	Stack as an ADT for expression conversion	September 1st Week	September 2nd Week
3	Circular queue using array	September 2nd Week	September 3rd Week
4	Construction and traversal of an Expression Tree from postfix and prefix expression	September 3rd Week	September 4th Week
5	Binary Search Tree	September 4th Week	September 5th Week
6	Implemention of In-order Threaded Binary Tree and its traversal	September 5th Week	October 1st Week
7	Using Kruskal's and Prim's algorithm to find minimum spanning tree	October 1st Week	October 2nd Week
8	Shortest path using Dijkstra's algorithm from single source to all destination	October 2nd Week	October 3rd Week
9	Implementation of Heap sort to sort given set of values using max or min heap	October 3rd Week	October 4th Week
10	Creation of a sequential file to store and maintain student data	October 4th Week	November 2nd Week

ORAL QUESTIONS

1. What is data structure?
2. In what areas do data structures are applied?
3. Give different examples of data structures.
4. Explain categories of data structures.
5. What is primitive and non-primitive data structures?
6. Give examples of primitive and non-primitive data structures.
7. Differentiate between primitive and non-primitive data structures.
8. What is static and dynamic data structures?
9. Differentiate between static and dynamic data structures.
10. Give examples of static and dynamic data structures.
11. What is persistent and ephemeral data structures?
12. Differentiate between persistent and ephemeral data structures?
13. Give examples of persistent and ephemeral data structures.
14. What is linear data structure?
15. What is non linear data structure?
16. Differentiate between linear and non-linear data structures
17. Give examples of linear and non-linear data structures
18. What is sequential data structure?
19. What is non-sequential data structure?
20. Give an example of sequential data structure and non-sequential data structure
21. Differentiate between sequential and non-sequential data structures.
22. What is an ADT?
23. Explain any data structure as an ADT.
24. What is array?
25. What is dimension of array data structure?
26. What are applications of 2D and 3D arrays?
27. How to calculate address calculated in arrays?
28. What is row and column major representation of arrays?
29. How do you reference all the elements in a one-dimension array?

30. What is linked organization?
31. What different types of linked lists?
32. What is SLL?
33. What is DLL?
34. What is CLL?
35. Explain all operations that we can perform on linked lists.
36. What are the applications of SLL, DLL and CLL?
37. Can Linked list be implemented by arrays? Support your and with explanation.
38. Explain file structure.
39. Differentiate between file and structure storage structure.
40. What is time complexity?
41. What is space complexity?
42. What are characteristics of algorithms?
43. What is frequency count?
44. Why frequency count is useful?
45. Why to consider time and space complexity while developing algorithms?
46. Why searching and sorting is included in data structures?
47. What is internal and external sorting?
48. What is sort stability?
49. State different types of searching techniques.
50. State different types of sorting techniques.
51. Why name BUBBLE is given to BUBBLE SORT?
52. Why name SELECTION is given to SELECTION SORT?
53. Why name INSERTION is given to INSERTION SORT?
54. Why name LINEAR/SEQUENTIAL is given to LINEAR/SEQUENTIAL SEARCH?
55. Why name BINARY is given to BINARY SEARCH?
56. State the Best, Average and Worst time complexity of
    a. Buuble Sort
    b. Selection Sort
    c. Insertion Sort
    d. Shell Sort

e. Merge Sort
f. Linear Search
g. Binary Dearch

57. When is a binary search best applied?
58. What is LIFO?
59. What is stack?
60. What is queue?
61. What is FIFO?
62. What are applications of stack and queue?
63. Can we implement stack/queue with linked organised data structure?
64. Which data structure works with both ends?
65. What is use of TOP in stack data structure?
66. What is use of FRONT and REAR in queue data structure
67. What is circular queue?
68. What are advantages of circular queue data structure over linear queue data structure?
69. What are disadvantages of linear queue data structure?
70. What is recursion?
71. Give any example where recursion can be used.
72. Explain the concept of implicit and explicit stack.
73. Convert given infix expression to postfix and prefix.
74. Evaluate given prefix and postfix expressions.
75. Explain the concept of double ended queue.
76. Explain priority queue.
77. Give applications of priority queue.
78. What is tree data structure?
79. What are application of tree data structure?
80. What are types of tree data structure?
81. What is binary tree?
82. Why the name BINARY is given to BINARY TREE?
83. What is general tree?
84. Differentiate general tree and binary tree.

85. Explain structure of binary tree.
86. What is complete binary tree?
87. What is a full binary tree?
88. What is a skewed binary tree?
89. What types of skewed binary tree?
90. Draw
    a. General Tree
    b. Binary tree
    c. Complete Binary Tree
    d. Full Binary Tree
    e. Skewed Binary Tree
91. Draw and label different parts of binary tree
    a. Root
    b. Leaf
    c. node
    d. Parent node
    e. Branch
    f. Path
    g. Intermediate node
92. What is the traversal of a Binary Tree?
93. What are different types of tree traversals?
94. What is depth first search?
95. What is breadth first search?
96. What is pre-order traversal?
97. What is in-order traversal?
98. What is post-order traversal?
99. Which data structure is useful in depth first search traversal?
100. Which data structure is useful in breadth first search traversal?
101. Draw a binary tree and traverse
    a. In pre-order
    b. In post-order

c. In in-order

d. Level wise.

102. Draw a binary tree and explain the logic to

a. Insert a new node in tree

b. Search any particular node

c. Find all leaf nodes

d. Find an intermediate node having only left child

e. Find an intermediate node having only right child

f. Find an intermediate node having both children

103. Draw BST for given data set and traverse it in all orders.

104. Draw BST for given data set and explain the logic to

a. Insert a new node in tree

b. Search any particular node

c. Delete a node with all cases

105. Explain the logic of recursive and non-recursive algorithm for

a. pre-order

b. post-order

c. In-order

106. What is TBT?

107. Explain the concept of TBT.

108. Explain the pre-order traversal of in-ordered TBT.

109. Explain the in-order traversal of in-ordered TBT.

110. List out the applications of tree data structure.

111. What is expression tree?

112. In expression tree, what are the leaf nodes?

113. In expression tree, what are the intermediate nodes?

114. Draw expression tree from given prefix/postfix expression.

115. Which data structure helps you to construct expression tree.

116. What is graph?

117. Draw any graph and name its all terminologies.

118. What is directed graph?

119. What is undirected graph?

120. Represent any given graph using
    a. Adjacency matrix
    b. Adjacency lists
121. How can we traverse a graph? What different methods to traverse a graph?
122. What is BFS and DFS?
123. Which data structure helps to traverse a graph in BFS?
124. Which data structure helps to traverse a graph in DFS?
125. Take any graph for reference and traverse it in
    a. BFS
    b. DFS
126. What is the difference between DFS and BFS.
127. What is Spanning Tree?
128. What is Minimum Spanning Tree?
129. What are methods or algorithms used to find MST?
130. What is PRIM's Algorithm?
131. What is KRUSKAL's Algorithm?
132. Explain the logic of PRIM's Algorithm.
133. Explain the logic of KRUSKAL's algorithm.
134. Find out MST for any given graph by applying PRIM's and KRUSKAL's algorithm.
135. Differentiate between PRIM's and KRUSKAL's algorithm.
136. What is shortest path algorithm?
137. Explain applications of Shortest Path Algorithm.
138. Explain the logic of Dijkstra's Shortest Path Algorithm.
139. For any graph, apply the logic of Dijkstra's Shortest Path Algorithm to find out shortest path.
140. Which algorithm is useful to findout shortest path from one source to all destinations?
141. Which algorithm is useful to findout shortest path from all sources to all destinations?
142. What is topological sorting?
143. Explain the concept of topological sorting.
144. Where topological sorting concept is useful?
145. Draw a graph and apply topological sorting on the same graph.

146. What is symbol table?
147. What is use of symbol table?
148. Where the symbol table can be used?
149. What is the syntax of symbol table?
150. What is OBST?
151. What is frequency count in optimal binary search tree?
152. Draw any BST and make it optimal by applying formula to find out OBST.
153. What is an AVL Tree?
154. What are rotations?
155. What different types of rotations that can be applied on BST to find out AVL Tree?
156. What is single rotation?
157. What is double rotation?
158. Explain the situation in which single rotation is sufficient?
159. Explain the situation in which double rotation can be applied?
160. What is Left Rotation (LL)?
161. In which situation, Left Rotation can be applied?
162. What is Right Rotation (RR)?
163. In which situation, Right Rotation can be applied?
164. What is Left Right Rotation (LR)?
165. In which situation, LeftRight Rotation can be applied?
166. What is Right Left Rotation (RL)?
167. In which situation, Right Left Rotation can be applied?
168. State true or false - “Every AVL Tree is a BST but not every BST is AVL tree”
169. What is Heap?
170. What is Heap Data Structure?
171. What is min heap?
172. What is max heap?
173. Construct complete binary tree from given values.
174. What is heapify?
175. Why to apply heapify on complete binary tree?
176. What are the steps used to heapify the complete binary tree?

177. What are the applications of heap?
178. What is hashing?
179. What are hashing techniques?
180. Explain characteristics of good hash function.
181. Explain different types of hash functions that can be used for hashing.
182. Explain different key to address transformation techniques
183. Explain the term synonyms.
184. Explain the term collision.
185. What is collision resolution.
186. What different techniques used to resolve the collision.
187. What is linear probing?
188. What is quadratic probing?
189. What different techniques used in linear probing?
190. Explain the concept of rehashing.
191. What is linear probing without replacement?
192. What is linear probing with replacement?
193. Explain linear probing without replacement with any example.
194. Explain linear probing with replacement with any example.
195. Explain quadratic probing with example.
196. State whether the given statement is true or false? "While using modulo-division method, division by prime number near to size of hash table is more efficient."
197. Why to use prime number near to size of hash table while using modulo-division method?
198. For given set of values, construct hash table using linear probing without replacement.
199. For given set of values, construct hash table using linear probing with replacement.
200. For given set of values, construct hash table using quadratic probing.

214448 Object Oriented Programming Lab

SYLLABUS

Teaching Scheme Practical : 4 Hours/Week	Credits: 02	Examination Scheme: Term Work : 25 Marks Oral: 25 Marks

Prerequisites:

1. Student should have knowledge of programming language.

Course Objectives :

1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Guidelines for Instructor's Manual

The instructor‘s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc.), University syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by student in the form of journal.
2. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- OOP feature/Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.
3. Program codes with sample output of all performed assignments are to be submitted as hardcopy.
4. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.
5. Use of DVD containing students programs maintained by lab In-charge is highly encouraged.
6. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

1. Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student.
2. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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SUGGESTED LIST OF LABORATORY ASSIGNMENTS
Assignment No.1: **Classes and object:** Design a class 'Complex 'with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.
Assignment No.2: **Polymorphism:** Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.
Assignment No.3: **Inheritance:** Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address, Mail_id, and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
Assignment No.4: **Dynamic Binding:** Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.
Assignment No.5: Interface: Design and develop a context for given case study and implement an interface for Vehicles Consider the example of vehicles like bicycle, car and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.
Assignment No.6: **Exception handling:** Implement a program to handle Arithmetic exception, Array Index Out of Bounds. The user enters two numbers Num1 and Num2. The division of Num1 and Num2 is displayed. If Num1 and Num2 are not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception. Display the exception.
Assignment No.7: **Template:** Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.
Assignment No.8: **File Handling:** Implement a program for maintaining a database of student records using Files.

Student has Student_id, name, Roll_no, Class, marks and address. Display the data for few students.
1. Create Database
2. Display Database
3. Delete Records
4. Update Record
5. Search Record

Assignment No.9:

Using concepts of Object-Oriented programming develop solution for any one application

1) Banking system having following operations :

1. Create an account 2. Deposit money 3. Withdraw money 4. Honor daily withdrawal limit
5. Check the balance 6. Display Account information.

2) Inventory management system having following operations :

1. List of all products 2. Display individual product information 3. Purchase 4. Shipping
5. Balance stock6. Loss and Profit calculation.

Assignment No.10:

Factory Design Pattern: Implement Factory design pattern for the given context. Consider Car building process, which requires many steps from allocating accessories to final makeup. These steps should be written as methods and should be called while creating an instance of a specific car type. Hatchback, Sedan, SUV could be the subclasses of Car class. Car class and its subclasses, CarFactory and Test Factory Pattern should be implemented.

Assignment No.11:

Strategy Design Pattern: Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.

Test Book:

1. E. Balagurusamy, “Programming with Java – A Primer”, Tata – McGraw-Hill Publication, 4th Edition, 2019
2. Kathy Sierra, “OCA /OCP Java SE 7 Programmer I & II Study Guide”(Exams 1Z0-803 & IZ-804)
Oracle Press (2017)
3. Steven Holzner et al. “Java 2 Programming”, Black Book, Dreamtech Press, 2009

References

1. H.M. Deitel, P.J. Deitel, “Java - How to Program”, PHI Publication, 6th Edition, 2005
2. Bruce Eckel, “Thinking in Java”, PHI Publication
3. Poo, Danny, Kiong, Derek, Ashok, Swarnalatha,“ Object-Oriented Programming and Java”, ISBN 978-1-84628-963-7
4. Erich Gamma,Richard Helm ,Ralph Johnson,JohnVlissides, “Design Patterns ,Elements of Reusable Object- Oriented Software” ISBN-13: 978-0201633610
5. RohitJoshi, “Java Design patterns, Reusable solutions to common problems” Java Code Geeks

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Blooms Taxonomy Category
CO214444.1	Differentiate various programming paradigms.	I	Continuous Assessments & Mock Test	L2-Understand
CO214444.2	Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.	I, IX		L2-Understand
CO214444.3	Identify relationship among objects using inheritance and polymorphism principles.	II,III,IV,V		L2-Apply
CO214444.4	Handle different types of exceptions and perform generic programming.	VI,VII		L3-Apply
CO214444.5	Use of files for real world application.	VIII,IX		L2-Apply
CO214444.6	Apply appropriate design patterns to provide object-oriented solutions.	X,XI		L3-Apply

PREREQUISITES

Sr No	Title of assignment	Prerequisites
1	Classes and object	Students show know basics of programming language
2	Polymorphism	Students show know basics of programming language
3	Inheritance	Students show know basics of programming language
4	Dynamic Binding	Students show know basics of programming language
5	Interface	Students show know basics of programming language
6	Exception handling	Students show know basics of programming language
7	Template	Students show know basics of programming language
8	File Handling	Students show know basics of programming language
9	Case Study	Students show know basics of programming language & object oriented concepts
10	Factory Design Pattern	Students show know basics of programming language & object oriented concepts
11	Strategy Design Pattern	Students show know basics of programming language & object oriented concepts

TEACHING PLAN

TEACHING PLAN SHORT		
Academic Year:- 2021-22	Semester :- I	w. e. f. :- 20/08/2021
Class : -SE		Division:A/B
Subject :- Object Oriented Programming Laboratory		Subject Code :- 214448
Faculty In charge :- Ms. Rajashri Sadafule/Ms.Ashwini Bhamre		No. of Practical/ weeks: 1

Practical Plan

Sr. No.	Assignment No.	Unit/ Topic Name	Start Date	End Date
1.	I	Design a class 'Complex 'with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.	4th Week August	4th Week August
2.	II	Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.	1st Week September	2nd Week September
3.	III	Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address, Mail_id, and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF,	3rd Week September	3rd Week September

		0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.		
4.	IV	Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.	4th Week September	4th Week September
5.	V	Design and develop a context for given case study and implement an interface for Vehicles Consider the example of vehicles like bicycle, car and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.	1st week October	2nd week October
6.	VI	Implement a program to handle Arithmetic exception, Array Index Out of Bounds. The user enters two numbers Num1 and Num2. The division of Num1 and Num2 is displayed. If Num1 and Num2 are not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception. Display the exception.	3rd week October	3rd week October
7.	VII	Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.	4th week October	4th week October
8.	VIII	Implement a program for maintaining a database of student records using Files. Student has Student_id,name, Roll_no, Class, marks and address. Display the data for few students.	2nd week November	2nd week November

		1. Create Database 2. Display Database 3. Delete Records 4. Update Record 5. Search Record		
9.	IX	Using concepts of Object-Oriented programming develop solution for any one application 1) Banking system having following operations : 1. Create an account 2. Deposit money 3. Withdraw money 4. Honor daily withdrawal limit 5. Check the balance 6. Display Account information. 2) Inventory management system having following operations : 1. List of all products 2. Display individual product information 3. Purchase 4. Shipping 5. Balance stock6. Loss and Profit calculation.	3rd week November	3rd week November
10.	X	Implement Factory design pattern for the given context. Consider Car building process, which requires many steps from allocating accessories to final makeup. These steps should be written as methods and should be called while creating an instance of a specific car type. Hatchback, Sedan, SUV could be the subclasses of Car class. Car class and its subclasses, CarFactory and Test Factory Pattern should be implemented.	4th week November	4th week November
11	XI	Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.	1st week November	1st week November

PRACTICAL PRACTICE QUESTIONS

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Using concepts of Object-Oriented programming develop solution for any one application

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5. Check the balance 6. Display Account information.

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Assignment No.11:

Strategy Design Pattern: Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.

ORAL QUESTION BANK

Assignment No 1

3. Describe benefits of OOP? (BL2)
4. Define constructor? (BL1)
5. Sketch pictorial representation of object from your program. (BL3)
6. Compare class variables and static variables (BL2)
7. Explain types of constructor with example. (BL1)
8. Discuss use of constructor (BL2)
9. Differentiate constructor and destructor. (BL4)
10. Define class & object. (BL1)
11. What is return type of constructor. (BL1)

Assignment No 2

1. Define is polymorphism. (BL1)
2. List out polymorphism types. (BL1)
3. Differentiate static & runtime polymorphism. (BL4)
4. Define method overloading. (BL1)
5. Define method overriding. (BL1)
6. Differentiate method overloading and method overriding. (BL4)
7. Explain superclass & subclass. (BL2)

Assignment No. 3

1. Justify inheritance/ class relationship with classes Surgeon and Doctor.
2. Explain type of inheritance.
3. What is base and child class.
4. What is the use of inheritance .
5. Explain why multiple inheritance is not supported by Java.
6. Compare Composition and Inheritance in OOP.
7. Create an abstract class 'Parent' with a method 'message'. It has two subclasses each having a method with the same name 'message' that prints "This is first subclass" and "This is second subclass" respectively. Call the methods 'message' by creating an object for each subclass
8. Explain Dynamic Method Dispatch with example.
9. Explain Super Keyword in Java.

Assignment No. 4

1. Justify inheritance/ class relationship with classes Surgeon and Doctor.
2. Explain type of inheritance.
3. What is base and child class.
4. What is the use of inheritance .
5. Explain why multiple inheritance is not supported by Java.
6. Compare Composition and Inheritance in OOP.
7. Create an abstract class 'Parent' with a method 'message'. It has two subclasses each having a method with the same name 'message' that prints "This is first subclass" and "This is second subclass" respectively. Call the methods 'message' by creating an object for each subclass
8. Explain Dynamic Method Dispatch with example.
9. Explain Super Keyword in Java.

Assignment No. 5

1. Write a java interface which provides the implementation of Bank interface to calculate Rate of Interest.
2. Explain interface.
3. What is the use of interface.
4. Write a Drawable interface has only one methoddraw(). Its implementation is provided by Rectangle and Circle classes
5. A class implements an interface, but one interface extends another interface.
6. Create a vehicles as interface mention all common functionalities and create classes like bicycle, car, bike implement all these functionalities in their own class in their own way.
7. Create a animal class using interface and provide some common functionalities and implement into some other classes.
8. How would you use interfaces ?Give One Example.
9. Can we declare an Interface with “abstract” keyword?
10. Can we override an interface method with visibility other than public?

11. What are marker interfaces? What is the use of marker interfaces?
12. Write down Syntax to declare Interface.

Assignment 6

1. Design one login page and ask user to enter user id and password. If one of the field is empty generate null pointer exception.
2. Write a method to process only text file , so we can provide caller with appropriate error code when some other type of file is sent as input.
3. Write a bank class if user will provide account number which is greater than specified size then method will produce array out of bound exception.
4. What is an exception?
5. How the exceptions are handled in java? OR Explain exception handling mechanism in java?
6. What is the difference between error and exception in java?
7. Can we keep other statements in between try, catch and finally blocks?
8. There are three statements in a try block – statement1, statement2 and statement3. After that there is a catch block to catch the exceptions occurred in the try block. Assume that exception has occurred in statement2. Does statement3 get executed or not?
9. What are run time exceptions in java. Give example?
10. What is the difference between ClassNotFoundException and NoClassDefFoundError in java?
11. Does finally block get executed If either try or catch blocks are returning the control?
12. Can we throw an exception manually? If yes, how?
13. What is the difference between final, finally and finalize in java?
14. What is the difference between throw, throws and throwable in java?

Assignment No. 7

1. What Is a Generic Type Parameter
2. What Are Some Advantages of Using Generic Types?
3. How Does a Generic Method Differ from a Generic Type?
4. What Is Type Inference?

5. What Is a Wildcard Type?
6. How does the compiler translate Java generics?
7. What is type erasure?
8. Is generic code faster or slower than non generic code?
9. Parameterized type bounds?

Assignment No 8

1. Give the basic methods in File class?
2. Why to use FileWriter class and give its advantages .
3. Write a File-Copy program which copies the content of one file to another. Take both the file names from the user
4. How to read data from a file ,using FileReader class?
5. Give usage of BufferedWriter and BufferedReader classes in Java with example
6. Write a code to generate database for Criket player ising file handling operations
7. What is the difference between InputStream and OutputStream in Java?
8. What is the difference between BufferedReader and Scanner in Java?
9. What is the file descriptor?
10. How do you check the permission of a file or directory in Java?
11. When does java.io.FileNotFoundException: (Access is denied) comes? How do you fix that?

Assignment No 9

1. List the features which are used for application development
2. How the polymorphism applied
3. Can we apply interface or abstract class in given case study ? How.
4. Did the application takes care of garbage collection
5. Have you applied user defined exceptions in given case study ? Give examples .
6. How many objects are created and how they are stored in memory

Assignment No 10

1. Give the applications where design patterns can be applied ?
2. Why factory pattern?

3. Explain factory pattern?
4. Draw the design Pattern with a context.
5. Give examples of creational design pattern .
6. Design application by applying the factory pattern .
7. Represent and implement a *Shape* interface which implements Circle ,Square, rectangle using Fatory pattern
8. Represent and implement for bill generation using GetPlanFactory to get a Plan object. Pass information (Domestic / commercial/ institutional) to get the type of object it needs.

Assignment No 10

1. Give intents of Strategy Design pattern
2. How problems can be designed and solved using design pattern
3. Represent Solution of real world problem using Strategy design pattern
4. Give Real-World Analogy of strategy design pattern .
5. Design application by applying the Strategy design pattern .
6. Represent and implement Strategy design pattern to perform mathematical operations such as add,sub,mul,div
7. Represent and implement Strategy design pattern for sorting operation such as Quick sort ,Merge sort etc.
8. Represent and implement Strategy design pattern for searching techniques such as Sequential Search, Binary Search etc.

ADDITIONAL RESOURCES

https://www.youtube.com/watch?v=7WhnYwoBY24&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0

https://www.youtube.com/watch?v=Imy9TEJkKa8&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=2

https://www.youtube.com/watch?v=qG4zIEjYz7I&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=3

https://www.youtube.com/watch?v=9nRblRcb35Y&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=4

https://www.youtube.com/watch?v=Zt-u1EPdlg&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=5

https://www.youtube.com/watch?v=KELJ2kD6aeU&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&index=6

https://www.youtube.com/watch?v=xnh7ip5gpzc&list=PLfVsf4Bjg79DLA5K3GLbIwf3baNVFO2Lq

214449
Soft Skill
Laboratory

SYLLABUS

214449: Soft Skill Lab

Teaching Scheme:	Credits Scheme:	Examination Scheme:
Practical (PR) :2 Hours/Week	01	TW: 25 Marks

UNIT I: Introspective & Self Development (04 Hours)

Introduction to soft skills, SWOC analysis, planning career, setting short-term & long-term goals, identifying difference between jobs & career, aligning aspirations with individual skills, understanding self-esteem, developing discipline and critically evaluating oneself.

UNIT II: Communication Skills (04 Hours)

Essentiality of good communication skills, importance of feedback, different types of communication, barriers in communication and how to overcome these barriers, significance of non-verbal messages as augmentation to verbal communication, group discussion, listening vs hearing, reading to comprehend, learning to skim and scan to extract relevant information, effective digital communication.

UNIT III: Language and Writing Skills (04 Hours)

Fundamentals of English grammar, improve lexical resource, essential steps to improve spoken and written English, business vocabulary, writing – email, resume, formal letter, official communication, essay, presentation – planning, organizing, preparing and delivering professional presentation.

UNIT IV: Leadership Skills and Group Dynamics (04 Hours)

Understanding corporate culture and leadership skills, difference between a leader and a manager, importance of resilience in a professional surrounding, developing empathy and emotional intelligence, being assertive and confident, 4-Ds of decision making, creative and solution-centric thinking, resolving conflicts, working cohesively as a team to achieve success, five qualities of an effective team – positivity, respect for others, trust, goal-focused, supportiveness.

UNIT V: Ethics, Professional Etiquette (04 Hours)

Understanding ethics and morals, importance of professional ethics, hindrances due to absence of work ethics, professional etiquette – introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing.
UNIT VI: Stress and Time Management (04 Hours) Stress as integral part of life, identifying signs and sources of stress, steps to cope with stress – open communication, positive thinking, belief in oneself, ability to handle failure, retrospective thinking for future learning, organizing skills to enhance time management, focusing on goals, smart work vs hard work, prioritizing activities, perils of procrastination, daily evaluation of "to-do" list.

Text Book:

1. Gajendra Singh Chauhan, Sangeeta Sharma, "Soft Skills – An Integrated Approach to Maximize Personality", WILEY INDIA, ISBN:13:9788126556397.

Reference Books:

1. Indrajit Bhattacharya, "An Approach to Communication Skills", Delhi, DhanpatRai, 2008
2. Simon Sweeney, "English for Business Communication", Cambridge University Press, ISBN 13:978-0521754507
2. Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press, ISBN 10:9780199457069
3. Atkinson and Hilgard, "Introduction to Psychology", 14th Edition, Geoffrey Loftus, ISBN-10:0155050699, 2003
4. Kenneth G. Mcgee, "Heads Up: How to Anticipate Business Surprises & Seize Opportunities First", Harvard Business School Press, Boston, Massachusetts, 2004, ISBN 10:1591392993
6. Krishnaswami, N. and Sriraman T., "Creative English for Communication", Macmillan

RECOMMENDED LIST OF LAB SESSIONS

1. Introduction of Self / SWOC Analysis

a. Explain how to introduce oneself in a professional manner and presenting oneself positively Name, Academic Profile, Achievements, Career Aspirations, Personal Information (hobbies, family, social).

b. Focus on introspection and become aware of one's Strengths, Weakness, Opportunities and Challenges.

Students can write down their SWOC in a matrix and the teacher can discuss the gist personally.

2. Career Goals and Planning

a. Make students understand the difference between a job and a career. Elaborate steps on how to plan a career.

Students can choose a career and they should write down what skills, knowledge, steps are need to be successful in that particular career and how they can get the right opportunity.

b. Explain to students how to plan short term and long-term goals.

Think and write down their short-term goals and long terms goals. Teacher can read and discuss (provide basic counselling) about the choices written.

3. Public Speaking (Choose any 2)

a. Prepared Speech

Topics will be shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher will evaluate each student based on content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

b. Extempore Speech

Various topics will be laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher will evaluate each student based on ability to think on his/her feet, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

c. Reviewing an Editorial article

Either using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor's perspective is and what the student's perspective is.

d. Book Review

Each student will orally present to the audience his/her review of a book that he/she has recently read.

4. Group Discussion

a. The class will be divided into groups of 8 – 10 students in for a discussion lasting 10 minutes.

b. Topics should be topical and non-controversial. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only.

5. Listening and Reading Skills

a. Listening Worksheets to be distributed among students

Each student will be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines)

b. Reading Comprehension Worksheets to be distributed/displayed to students

Teacher will choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance student's reading skills by learning how to skim and scan for information.

6. Writing Skills (Choose any 2)

a. Letter / Email Writing

After explaining to the students, the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter,

i. Requesting opportunity to present his/her product.

ii. Complaining about a faulty product / service.

iii. Apologizing on behalf of one's team for the error that occurred.

iv. Providing explanation for a false accusation by a client.

b. Report Writing

After describing various formats to write report and explaining how to write a report, each student should be asked to write a report (digital/ paper-based) on any of the following topics,

i. Industrial visit.

ii. Project participated in.

iii. Business / Research Proposal.

c. Resume Writing

The teacher should conduct a brief session outlining the importance of a CV / Resume and students can write / type out their own resumes

i. Share various professional formats.

ii. Focus on highlighting individual strengths.

iii. Develop personalized professional goals / statement at the beginning of the resume.

7. Team Building Activities

The class will be divided into groups of 4-5 students in each group and an activity will be given to each group.

The activities chosen for each team should be competitive and should involve every student in the team. The activities may be conducted indoors or outdoors depending on infrastructure. While selecting the team, ensure that each team has a mix of students who have varied skills. The teacher should give critical feedback including areas of improvement at the end of the activity.

8. Expert Lecture

Highlighting the need to manage stress and time, experts from the fields of health and fitness, counselling, training, medical or corporate HR may be invited to deliver a participatory session that focus on helping students to cope with parental, social, peer and career pressures.

9. Lateral and Creative Thinking

Every student needs to step out of the linear thinking and develop lateral and creative thinking. Teacher can develop creative activities in the classroom / lab that will help students enhance their creative thinking. Some of the suggested activities,

i. Each group (3-4 students) can be given random unrelated items and they will be given sufficient time to come up with creative ideas on how the objects can be used for activities / purposes other than its intended one.

ii. Each student is given a random line and he/she has to spin a fictional story and tell it to the class (3 minutes). Each story should have a beginning, middle and end.

iii. Each group (3-4 students) can be given a fictional / hypothetical dangerous situation and they have to find a solution to that problem. They can present it to the other teams who will then get the opportunity to pick flaws in the ideas.

10. Mock Interviews

Student has to undergo interview session and the teacher should seek the assistance of another faculty member / TPO Officer/ Alumni to act as interview panel. Students will be informed beforehand about the job profile that they are appearing the interview for and they have to come prepared with a printed copy of their resume, formally dressed. Questions will include technical as well as HR. Interviewer can choose to give problems to solve using technical skills. Students will be graded on the basis of their technical knowledge, ability to answer questions well, presentation of self, body language and verbal skills.

11. Presentation Skills

Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. The topic can either be technical or non-technical. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be instructed about it.

12. Corporate and Business Etiquette

The teacher can design an interactive session that allows students to be involved in understanding the requirements of a corporate environment. This can be done using innovative quiz competition in the classroom and the teacher explaining the concept / relevance of that particular aspect in the professional context. Alternatively, the teacher can invite professionals to have an interactive session with students about various aspects of professional etiquette.

COURSE OUTCOMES

CO No.	Course Outcome	Mapping With Unit/ Assignment	Assessment Technique	Blooms Taxonomy Category
CO214449.1	Introspect about individual's goals, aspirations by evaluating one's SWOC and think creatively.	1,2,9,12	Mock Oral Examination and Continuous Assessment	L4: Analyzing L5: Evaluating
CO214449.2	Develop effective communication skills including Listening, Reading, Writing and Speaking.	3,4,5,6,10,11		L3: Applying
CO214449.3	Constructively participate in group discussion, meetings and prepare and deliver Presentations.	3,4,7,10,11		L3: Applying
CO214449.4	Write precise briefs or reports and technical documents.	1,2,7,8,9,12		L5: Evaluating
CO214449.5	Practice professional etiquette, present oneself confidently and successfully handle personal interviews.	12		L3: Applying
CO214449.6	Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality	7		L4: Analyzing

PREREQUISITES

Sr. No.	Unit Number	Prerequisite subject name
1.	I	Basic knowledge of English Language
2.	II	Basic knowledge of English Language
3.	III	Basic knowledge of English Language
4.	IV	Basic knowledge of English Language
5.	V	Basic knowledge of English Language
6.	VI	Basic knowledge of English Language

TEACHING PLAN

Teaching Plan Short

Academic Year:- 2021-22 Semester :- I w. e. f. :- 5-7-2021
Class : - S.E Division: A/B
Subject :- Soft Skill Lab Subject Code :- 214449
Faculty In charge :- : Mrs. Suhasini L. Bhat,
Ms. Poonam Rakibe, Ms. Ashwini Bhamare No. of Practical/ weeks: 2 Hour

- **Practical Plan**

Assignment No.	Assignment Title	Start	End
1	Interaction With Students, Introduction of Soft Skills Lab and Communication Skills, Introduction of Self / SWOC Analysis	August 3rd Week	August 4th Week
2	Career Goals and Planning	August 5th Week	September 1st Week
3	Public Speaking	September 2nd Week	September 2nd Week
4	Group Discussion	September 3rd Week	September 3rd Week
5	Listening and Reading Skills	September 4th Week	September 4th Week
6	Writing Skills	September 4th Week	September 4th Week
7	Team Building	September 5th Week	October 1st Week
8	Stress Management	October 2nd Week	October 2nd Week
9	Lateral and Creative Thinking	October 2nd Week	October 2nd Week
10	Mock Interviews	October 3rd Week	October 4th Week
11	Presentation Skills	October 5th Week	November 1st Week
12	Corporate and Business Etiquette	November 2nd Week	November 2nd Week

ORAL QUESTION BANK

Assignment No. 1

Q.No.	Question
Q1	Tell me something about yourself.
Q2	What is Communication Skill?
Q3	What is Soft Skill?
Q4	What is the difference between Communication Skill and Soft Skill?
Q5	What is SWOC analysis?
Q6	What is your Strength?
Q7	What is your Weakness?
Q8	What is the need of SWOC analysis?
Q9	How do you write a good SWOC analysis?
Q10	What are the examples of Opportunities in your field?
Q11	What are the examples of Challenges in your field?
Q12	Who will do SWOC analysis?

Assignment No. 2

Q. No.	Question
Q1	What is Career?
Q2	What is the best Career decision you have ever made?
Q3	How do you organise your Time?
Q4	What is the difference between Career and Job?
Q5	List few examples of Career.
Q6	What is Goal and why is it important?
Q7	What is Short Term Goal?
Q8	What is Long Term Goal?

Q9	What is the difference between Short- and Long-Term Goals?
Q10	What are the steps involved in creating a Career Plan?
Q11	What are your Goals in Life?
Q12	What does a Job mean to Employee?

Assignment No. 3

Q. No.	Question
Q1	What is Public Speaking?
Q2	What is the importance of Public Speaking?
Q3	What are the different types of Public Speaking?
Q4	List some qualities of good Speaker.
Q5	What is the purpose of Public Speaking?
Q6	What are the benefits of Public Speaking?
Q7	List some of the elements of Public Speaking.
Q8	How to improve Public Speaking?
Q9	What is Voice Modulation?
Q10	What are the tips for Public Speaking?
Q11	List few elements of Voice Modulation.
Q12	What is the role of Voice Modulation in Communication?

signment No. 4

Q. No	Question
Q1	What is Group Discussion?
Q2	What is the importance of Group Discussion?
Q3	What are the rules for Group Discussion?
Q4	What are the do's and don'ts of Group Discussion?
Q5	What should be avoided in Group Discussion?
Q6	What are the benefits of Group Discussion?

Q7	What are the characteristics of successful Group Discussion?
Q8	What are the two most important skills required in the GD?
Q9	What is group discussion in soft skills?
Q10	Is group discussion important during interviews?
Q11	Who holds a Group Discussion?
Q12	Why is a "Group Discussion" conducted?

Assignment No. 5

Q. No.	Question
Q1	What are the 7 strategies of reading?
Q2	What are the methods of teaching reading skills?
Q3	What are different reading skills?
Q4	What are the 3 basic skills of listening?
Q5	How do you test listening skills?
Q6	What are 4 types of listening?
Q7	What are the importance of listening skills?
Q8	What distinguishes listening from hearing?
Q9	How can you communicate non-verbally that you are listening?
Q10	What are strategies that help hold your listeners' attention during your speech?
Q11	What are some benefits for you personally from effective listening
Q12	What does an effective listener do with the extra thought process time while a speaker is speaking only 150 words-per-minute?

Assignment No. 6

Q.No.	Question
Q1	What skills are needed for writing?

Q2	What are the basics of writing?
Q3	How one can improve on writing skills?
Q4	What is effective writing skills?
Q5	What are the 7 types of writing?
Q6	What are the different types of creative writing?
Q7	Why are writing skills tested?
Q8	What are examples of writing skills?
Q9	How can we testour writing skills?
Q10	What are the four key components writing tests?
Q11	What are the good writing skills?
Q12	What are the types of written test?

Assignment No. 7

Q. No.	Question
Q1	What Is Team Building?
Q2	How Does Team Building Work
Q3	What is the main purpose of team building?
Q4	What are the 5 stages of team building?
Q5	What is team building and why is it important?
Q6	What are Types of team building?
Q7	What are the 4 concepts of team building constitutes?
Q8	What are 3 types of team building?
Q9	List 10 of the best team building activities.
Q10	How do you create a team bond?
Q11	Why are team building activities for work important?

Assignment No. 8

Q. No.	Question
Q1	How do we manage stress?
Q2	What are the main causes of stress?
Q3	What are 5 ways to relieve stress?
Q4	What is the best medicine for stress?
Q5	What is the best medicine for stress?
Q6	What can I drink to relieve stress?
Q7	What is the 3 3 3 rule for anxiety?
Q8	Which fruit is good for anxiety?
Q9	What foods are bad for anxiety?
Q10	What is the 3% rule?
Q11	Does drinking milk reduce stress?
Q12	How can I relax my brain?

Assignment No. 9

Q. No.	Question
Q1	What is Lateral thinking and creative thinking?
Q2	How is Lateral thinking and creativity is related?
Q3	How lateral thinking is used in our daily life?
Q4	What are the techniques of Lateral thinking?
Q5	How is lateral thinking possible in workplace?
Q6	How lateral thinking will be useful in problem solving?
Q7	Why are recruiters asking about your ability to solve a problem using lateral thinking?
Q8	Solve following sample puzzles on Lateral thinking :

	P1: Someone falls out of a thirty story building, but lives. With luck and their landing pad not being factors, how could they have survived the fall?
Q9	P2: A man lives on the tenth floor of a building. Every day he takes the elevator to go down to the ground floor to go to work or to go shopping. When he returns he takes the elevator to the seventh floor and walks up the stairs to reach his apartment on the tenth floor. He hates walking so why does he do it?
Q10	P3: A man is lying dead in a field. Next to him there is an unopened package. There is no other creature in the field. How did he die?
Q11	P4: A man walks into a bar and asks the barman for a glass of water. The barman pulls out a gun and points it at the man. The man says 'Thank you' and walks out.
Q12	P4: Woman had two sons. They were born at the same hour on the same day of the same month in the same year. However, they were not twins. How could this be?

Assignment No. 10

Q. No.	Question
Q1	What is a Mock Interview?
Q2	What preparation will you do for the mock interview?
Q3	What is the importance of body language during interview?
Q4	How to dress for job interview?
Q5	How will you explain Your Greatest Strengths? ..
Q6	What Do You Consider to Be Your Weaknesses?
Q7	How can you introduce yourself during interview?
Q8	Why Do You Want to Work at This Company? ..
Q9	Why Should We Hire You?
Q10	What motivates you?
Q11	What have you learned from your mistakes?

Q12	Why did you decide to pursue a career in this field/industry?

Assignment No. 11

Q. No.	Question
Q1	How do you prepare before delivering a presentation?
Q2	What tools do you use to create a presentation? (e.g. Powerpoint, SlideShare, Canva)
Q3	What do you mean by good presentation?
Q4	What skills do you need for presentation?
Q5	Describe a memorable presentation you've attended. What made it successful? (e.g. interesting topic, visual aids, entertaining speaker)
Q6	What are the techniques of effective presentation?
Q7	What are 10 elements of a powerful presentation?
Q8	Which of these must be avoided in any presentation?
Q9	How do you modify your presentations for different audiences?
Q10	What makes a good presenter?
Q11	What would you do if you noticed that your audience looked bored during a presentation?
Q12	When is it appropriate for speakers to use humor?

Assignment No. 12

Q. No.	Question
Q1	What are types of etiquette?
Q2	What are the 3 etiquette rules?
Q3	What are the types of corporate etiquette?
Q4	What is business etiquette and corporate grooming?
Q5	What are 5 basics of business etiquette?

Q6	What are 5 inappropriate etiquette practices in business?
Q7	What is corporate etiquette and what is the importance of corporate etiquette?
Q8	What are the four areas covered by business etiquette?
Q9	How does one say “No” without sounding rude and offensive?
Q10	Is it a good idea to add my colleagues to my social networking sites?Explain.
Q11	Why Is Business Etiquette Important In The Workplace?
Q12	What Is Business Netiquette? Why Is Netiquette Important And Give Examples?