

Examination:	November-December 2017	Date:	23-11-17
Branch:	Computer Engineering	Subject:	AM-III
Class/SEM:	SE/III	Paper Code:	24510
Examination:	November-December 2017	Date:	29-11-17
Branch:	Computer Engineering	Subject:	DLDA
Class/SEM:	SE/III	Paper Code:	24869
Examination:	November-December 2017	Date:	29-11-17
Branch:	Computer Engineering	Subject:	ECCF
Class/SEM:	SE/III	Paper Code:	23885
Examination:	November-December 2017	Date:	7/12/2017
Branch:	Computer Engineering	Subject:	DS
Class/SEM:	SE/III	Paper Code:	25225
Examination:	November-December 2017	Date:	7/12/2017
Branch:	Computer Engineering	Subject:	DS
Class/SEM:	SE/III	Paper Code:	24787
Examination:	November-December 2017	Date:	13-12-17
Branch:	Computer Engineering	Subject:	DLDA
Class/SEM:	SE/III	Paper Code:	24867
Examination:	November-December 2017	Date:	13-12-17
Branch:	Computer Engineering	Subject:	ECCF
Class/SEM:	SE/III	Paper Code:	26299
Examination:	November-December 2017	Date:	19-12-17
Branch:	Computer Engineering	Subject:	DS
Class/SEM:	SE/III	Paper Code:	24783
Examination:	November-December 2017	Date:	19-12-17
Branch:	Computer Engineering	Subject:	DS
Class/SEM:	SE/III	Paper Code:	24629
Examination:	November-December 2017	Date:	26-12-17
Branch:	Computer Engineering	Subject:	OOPM
Class/SEM:	SE/III	Paper Code:	26234

SE / Comp / sem III / (CBCRS)

23/11/2017



Q.P. Code : 23178

[Time: Three Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question.No.1 is compulsory.
 2. Attempt any three from the remaining six questions.
 3. Figures to the right indicate full marks.

- Q.1
- a) If the Laplace transform of $\sin^2 3t$ 20
 - b) Prove that $f(z) = \log z$ is analytic
 - c) Obtain Fourier series for $f(x) = x^2$ in $(-2,2)$
 - d) Find the Z-Transform of $\cos 2k, k \geq 0$
- Q.2
- a) Prove that $\vec{F} = 2xyz^3\mathbf{i} + x^2z^3\mathbf{j} + 3x^2yz^2\mathbf{k}$ is irrotational. Find Scalar potential for \vec{F} 06
 - b) Find the inverse Laplace Transform using Convolution theorem
 $\frac{1}{(s^2+6s+18)^2}$ 06
 - c) Find Fourier Series of $f(x) = \frac{\pi-x}{2}$ in $(0,2\pi)$. 08
Hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \dots$
- Q.3
- a) Find the Analytic function $f(z) = u + iv$ if $u + v = \cos x \cosh y - \sin x \sinh y$ 06
 - b) Find Inverse Z transform of $\frac{2z^2-10z+13}{(z-3)^2(z-2)}$, $2 < |z| < 3$ 06
 - c) Solve the Differential Equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dx}y = 3te^{-1}$, $y(0) = 4, y'(0) = 2$ using Laplace Transform 08
- Q.4
- a) Find the Orthogonal Trajectory of $x^2 + y^2 - 3xy + 2y = c$ 06
 - b) Using Greens theorem evaluate $\int_C (x^2 - y)dx + (2y^2 + x)dy$, C is closed path formed by $y = 4, y = x^2$ 06

c) Express the function $f(x) = \begin{cases} \sin x & ; 0 < x \leq \pi \\ 0 & ; x > \pi \end{cases}$ as Fourier Integral. Hence evaluate $\int_0^{\infty} \frac{\cos(\lambda \pi / 2)}{1-\lambda^2} d\lambda$

08

a) Find Inverse Laplace Transform of $\frac{2s^2-6s+5}{s^2-6s^2+11s-6}$

06

b) Find the Bilinear Transformation that maps the points $z = 1, i, -1$ into $w = i, 0, -i$

06

c) Evaluate using Stoke's theorem $\int_C \vec{F} \cdot \vec{dr}$ where c is the boundary of the circle $x^2 + y^2 + z^2 = 1, z = 0$ and $\vec{F} = yzi + zxj + xyk$

08

a) Find the Directional derivative of $\phi = x^2 + y^2 + z^2$ in the direction of the line $\frac{x}{3} = \frac{y}{4} = \frac{z}{5}$ at $(1, 2, 3)$

06

06

b) Find complex form of Fourier series for $e^{ax}; (-\pi, \pi)$

08

c) Find Half Range sine Series for $f(x) = x(2-x)$ $0 < x < 2$
hence deduce that $\sum \left(\frac{1}{n^2}\right) = \frac{\pi^2}{6}$

Total Marks: 80

Time Duration: 3Hr

- N.B.: 1) Question no. 1 is compulsory.
 2) Attempt any three questions from Q.2 to Q.6.
 3) Figures to the right indicate full marks.

Maximum
 Marks

- Q1. a) Find the Laplace transform of $\frac{1}{t} e^{-t} \sin t$. [5]
 b) Find the inverse Laplace transform of $\frac{1}{\sqrt{2s+1}}$. [5]
 c) Show that the function $f(z) = \sinh z$ is analytic and find $f'(z)$ in terms of z . [5]
 d) Find the Fourier series for $f(x) = x$ in $(0, 2\pi)$. [6]

- Q2. a) Use Laplace transform to prove $\int_0^{\infty} e^{-t} \frac{\sin^2 t}{t} dt = \frac{1}{4} \log 5$. [6]
 b) If $f(k) = \begin{cases} 4^k, & k < 0 \\ 3^k, & k \geq 0 \end{cases}$, find $Z(f(k))$. [8]
 c) Show that the function $u = \cos x \cosh y$ is a harmonic function. Find its harmonic conjugate and corresponding analytic function. [6]

- Q3. a) Find the equation of the line of regression of Y on X for the following data.

X	5	6	7	8	9	10	11
Y	11	14	14	15	12	17	16

- b) Find the bilinear transformation which maps the points 1, -i, 2 on z-plane onto 0, 2, -i respectively of w-plane. [6]
 c) Find half range sine series for $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$, Hence find the sum of [8]

$$\sum_{n=1}^{\infty} \frac{1}{(2n-1)n^4}$$

- Q4. a) Find the inverse Laplace transform by using convolution theorem $\frac{1}{(s-a)(s+a)^2}$. [6]
 b) Calculate the coefficient of correlation between X and Y from the following data. [6]

X	8	8	7	5	6	2
Y	3	4	10	13	22	8

- c) Find the inverse Z-transform of

i) $\frac{1}{(z-a)^2} \quad |z| < a$

ii) $\frac{1}{(z-3)(z-2)} \quad |z| > 3$



- Q5.a) Using Laplace transform evaluate $\int_0^{\infty} e^{-t} (1 + 2t - t^2 + t^3) H(t - 1) dt$. [6]
- b) Show that set of functions $\cos x, \cos 2x, \cos 3x \dots$ Is a set of orthogonal functions over $[-\pi, \pi]$. Hence construct a set of orthonormal functions. [6]
- c) Solve using Laplace transform $(D^3 - 2D^2 + 5D)y = 0$, with $y(0) = 0, y'(0) = 0, y''(0) = 1$. [8]

- Q6.a) Find the complex form of Fourier series for $f(x) = 2x$ in $(0, 2\pi)$. [6]
- b) If $f(z)$ and $\overline{f(z)}$ are both analytic, prove that $f(z)$ is constant. [6]
- c) Fit a curve of the form $y = ab^x$ to the following data. [8]

X	1	2	3	4	5	6
Y	151	100	61	50	20	8

29/11/2017

Q.P. Code: 24869

(3 Hours)

[Max. Marks 80]

- N.B. (1) Question No. 1 is compulsory
 (2) Assume suitable data if necessary
 (3) Attempt any three questions from remaining questions

1

- (a) Convert $(1762.46)_{10}$ into octal, binary and hexadecimal. (3)
 (b) Prove OR-AND configuration is equivalent to NOR-NOR configuration. (3)
 (c) Perform Subtraction using 16's complement. (4)
 i) $(CB1)_{16} - (971)_{16}$
 ii) $(426)_{16} - (DBA)_{16}$
 (d) Find 8's complement of following numbers. (2)
 i) $(27)_8$ ii) $(321)_8$
 (e) Perform following subtraction $(52)_{10} - (65)_{10}$ using 2's complement method. (2)
 (f) Write the hamming code for 1010. (2)
 (g) Implement the following Boolean equation using NAND gates only. (2)
 $Y = AB + CDE + F$
 (h) Explain the term prime implicant. (2)

- 2 (a) Design a 4-bit ripple adder. (10)
 (b) Obtain the minimal expression using Quine Mc-Cluskey method (10)
 $F(A,B,C,D) = \sum m(1, 5, 6, 12, 13, 14) + d(2, 4,)$

- 3 (a) Implement a full adder using 8:1 multiplexer. (10)
 (b) Implement the following functions using demultiplexer. (5)
 $F_1(A, B, C) = \sum m(0, 3, 7)$ $F_2(A, B, C) = \sum m(1, 2, 5)$
 (c) Simplify $F(A, B, C, D) = \prod M(3, 4, 5, 6, 7, 10, 11, 15)$ and implement using (5)
 minimum number of gates.

- 4 (a) Compare TTL and CMOS logic with respect to fan in, fan out, propagation delay, (5)
 power-consumption, noise margin, current and voltage parameters.
 (b) Draw the circuit for S-R flip flop using two NOR gates and write the architecture (5)
 body for the same using structural modelling.
 (c) Explain 1-digit BCD Adder. (10)

- 5 (a) Convert JK flip flop to SR flip flop and D flip flop. (10)
 (b) Design 3 bit synchronous counter using T flip flops. (10)

- 6 Write short note on (any four) (20)
 (a) State table
 (b) ALU IC 74181
 (c) Sequence Generator
 (d) Data flow modelling
 (e) 4-bit ring counter





29/11/2017

Q.P. Code: 23885

Time:-3 Hrs

Marks: 80

- N.B. : 1. Question ONE is compulsory
 2. Solve any THREE out of remaining questions
 3. Draw neat and clean diagrams
 4. Assume suitable data if required.

- Q. 1. A. Justify that JFET can be used as a Voltage Variable Resistor. 5
 B. Explain the ideal characteristics of op-amp 5
 C. With neat circuit diagram explain the use of PLL in frequency demodulation. 5
 D. Explain detection of pulse code modulation. 5
- Q. 2 A. Explain various biasing techniques used in case of JFET. 10
 B. Explain how op-amp can be used as differentiator. 10
- Q. 3 A. Explain the concept of virtual ground in operational amplifier. 5
 B. State and explain Barkhausens criteria for oscillations. 5
 C. Explain any one pulse modulation technique of your choice. 5
 D. Determine the magnitude of g_m for a JFET with $I_{DSS} = 6 \text{ mA}$ and $V_P = -3 \text{ V}$ at $V_{GS} = -0.5 \text{ V}$ and also at $V_{GS} = -1.5 \text{ V}$. 5
- Q. 4 A. Explain the generation of DSBSC using balanced modulator. 10
 B. With neat diagram and waveforms explain the operating principle of PLL. 10
- Q. 5 A. With block diagram describe the principle of analog communication system. 10
 B. Explain phase modulation in detail. 10
- Q. 6 A. What is Nyquist Criteria? What is its significance? 5
 B. Discuss Class C power amplifier. 5
 C. Write short note on generation of FM by Armstrong method 5
 D. Mention important specifications of ADC and DAC required for communication. 5

Q.P. Code: 25225

(3 Hours)

[Total Marks: 80]

1. Question No. 1 is compulsory.
2. Attempt any three out of the remaining five questions.
3. Assume suitable data if necessary
4. Figures to right indicate full marks.

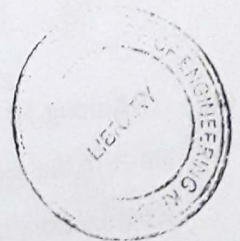
- Q.1 (a) Prove that $1.1! + 2.2! + 3.3! + \dots + n.n! = (n+1)! - 1$, where n is a positive integer. [5]
- (b) Let $A = \{a, b, c\}$. Show that $(P(A), \subseteq)$ is a poset and draw its Hasse diagram. [5]
- (c) Explain the terms : - (i) Lattice [5]
(ii) Poset
(iii) Normal Subgroup
(iv) Group
(v) Planar Graph
- (d) Comment whether the function f is one to one or onto. [5]
Consider function: $f: N \rightarrow N$ where N is set of natural numbers including zero.

$$f(j) = j^2 + 2$$

- Q.2 (a) Find the number of ways a person can distribute Rs. 601 as pocket money to his three sons, so that no son should receive more than the combined total of the other two. (Assume no fraction of a rupee is allowed.) [6]
- (b) Let $A = \{a_1, a_2, a_3, a_4, a_5\}$ and let R be a relation on A whose matrix is [6]

$$M_R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Find M_R^* by Warshall's algorithm.



[4]

- (c) Find the complete solution of the recurrence relation:
 $a_n + 2a_{n-1} = n+3$ for $n \geq 1$ and with $a_0 = 3$.

[4]

- (d) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^3$ and
 $g: \mathbb{R} \rightarrow \mathbb{R}$ defined as $g(x) = 4x^2 + 1$
 Find out $g \circ f, f \circ g, f^2, g^2$

- Q.3 (a) Given that a student had prepared, the probability of passing a certain entrance exam is 0.99. Given that a student did not prepare, the probability of passing the entrance exam is 0.05. Assume that the probability of preparing is 0.7. The student fails in the exam. What is the probability that he or she did not prepare? [6]
- (b) Define equivalence relation with example. Let 'T' be a set of triangles in a plane and define R as the set $R = \{(a,b) \mid a, b \in T \text{ and } a \text{ is congruent to } b\}$ then show that R is an equivalence relation. [6]
- (c) Let $A=B=\mathbb{R}$, the set of real numbers
 Let $f: A \rightarrow B$ be given by the formula $f(x) = 2x^3 - 1$ and Let $g: B \rightarrow A$ be given by

[4]

$$g(y) = \sqrt[3]{\frac{1}{2}y} + \frac{1}{2}$$

Show that f is a bijection between A and B and g is a bijection between B and A.

- (d) Let Z_n denote the set of integers $\{0, 1, 2, \dots, n-1\}$. Let \circ be binary operation on Z_n such that $a \circ b =$ the remainder of ab divided by n . [4]
- (i) Construct the table for the operation \circ for $n=4$.
- (ii) Show that (Z_n, \circ) is a semigroup for any n .

- 4 (a) (i) Among 50 students in a class, 26 got an A in the first examination and 21 got an A in the second examination. If 17 students did not get an A in either examination, how many students got an A in both examinations? [6]

(ii) If the number of students who got an A in the first examination is equal to that in the second examination, if the total number of students who got an A in exactly one examination is 40 and if 4 students did not get an A in either examination, then determine the number of students who got an A in the first examination only, who got an A in the second examination only, and who got an A in both the examination.

(b) Consider the (2,5) group encoding function [6]

$e : B^2 \rightarrow B^5$ defined by

$$e(00) = 00000$$

$$e(01) = 01110$$

$$e(10) = 10101$$

$$e(11) = 11011$$

Decode the following words relative to a maximum likelihoods decoding function.

(i) 11110 (ii) 10011 (iii) 10100

(c) (i) Is every Eulerian graph a Hamiltonian? [4]

(ii) Is every Hamiltonian graph a Eulerian?

Explain with the necessary graph.

(d) Given the parity check matrix [4]

$$H = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

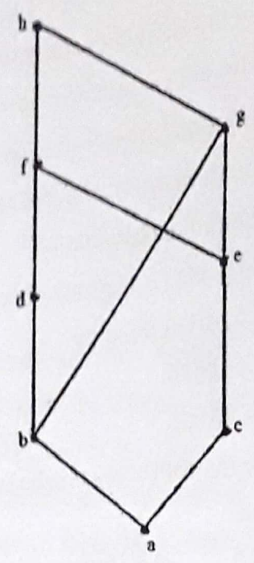
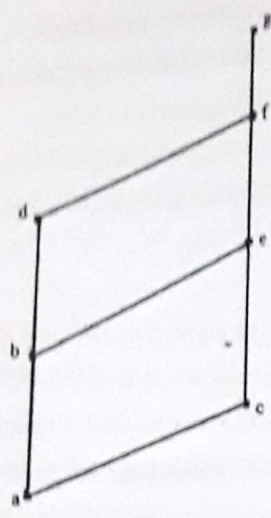
Find the minimum distance of the code generated by H. How many errors it can detect and correct?

(a) Explain Pigeonhole principle and Extended Pigeonhole principle. Show that in [6]

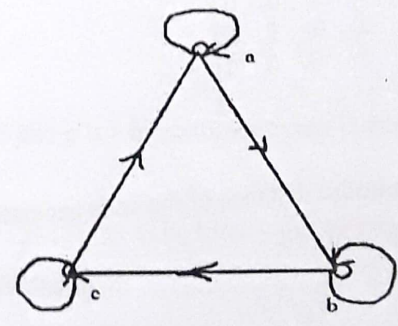
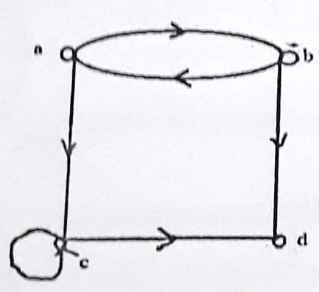
any room of people who have been doing some handshaking there will always be atleast two people who have shaken hands the same number of times.

(b) Determine whether the Poset with the following Hasse diagrams are lattices or [6]

not. Justify your answer.



(c) From the following digraphs, write the relation a set of ordered pairs. Are the relations equivalence relations? [4]



(d) For the set $X = \{2, 3, 6, 12, 24, 36\}$, a relation \leq is defined as $x \leq y$ if x divides y . [4]
 Draw the Hasse diagram for (X, \leq) . Answer the following:

- (i) What are the maximal and minimal elements?
- (ii) Give one example of chain & antichain.
- (iii) Is the poset a lattice?

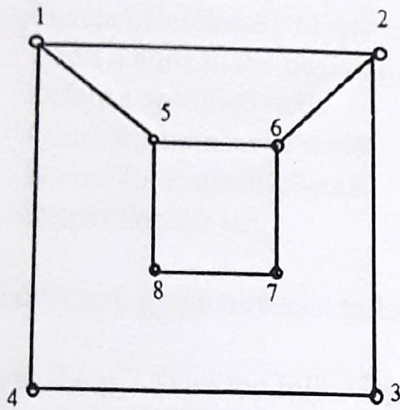
Q.6 (a) Prove that the set $\{1,2,3,4,5,6\}$ is group under multiplication modulo 7. [6]

(b) Given a generating function, find out corresponding sequence. [6]

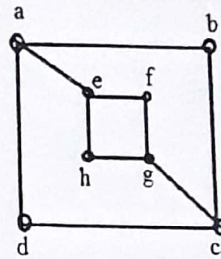
(i) $\frac{1}{3 - 6x}$

(ii) $\frac{x}{1 - 5x + 6x^2}$

(c) Determine whether following graphs are isomorphic or not. [4]



G_1



G_2

(d) Prove the following (use laws of set theory)

$A \times (X \cap Y) = (A \times X) \cap (A \times Y)$

[4]

- NB : (1) Question No.1 is Compulsory.
(2) Attempt any three questions of the remaining five questions.
(3) Figures to the right indicate full marks.
(4) Make suitable assumptions wherever necessary with proper justification.

1. (a) Explain linear and non-linear data structures with suitable example. 5
(b) Differentiate singly linked list and doubly linked list. 5
(c) Write ADT for Queue. Also give applications for queue. 5
(d) What is recursion? Write a recursive function to calculate sum of n natural numbers. 5
2. (a) What are the various searching techniques? Write a program to implement binary search. 10
(b) What is Huffman coding? Find the Huffman code for each character in the sentence 'DATA STRUCTURE'. 10
3. (a) Write a program to implement Singly Linked List that performs following functions : 10
(i) Insert a node in the beginning
(ii) Delete a specified node
(iii) Count the number of nodes
(iv) Search for a specific value
(v) Displaying the list
(b) Explain different graph traversal techniques with suitable example. 10
4. (a) What is hashing? Store the following dataset using linear probing and quadratic probing in a table of size 11. 10
25, 5, 10, 11, 22, 33, 40, 50, 30, 51, 31.
(b) Write a program to convert infix expression to postfix expression using stack. 10
5. (a) Construct B-tree of order 5 for the following dataset : 10
50, 25, 10, 5, 7, 3, 30, 20, 8, 15 .
(b) What is a circular queue? Write a program to implement circular queue. 10
6. Write a short notes on (any two) 20
(i) AVL Trees
(ii) Threaded binary trees
(iii) Memory representation of graphs
(iv) Radix sort
(v) Sparse Matrix



Q.P. Code: 24267

N.B

(3 Hours)

[Max. Marks 80]

- (1) Question no. 1 is compulsory.
- (2) Attempt any 3 from the remaining questions.
- (3) Assume suitable data if necessary.
- (4) Figures to right indicate full marks.

Q 1 (a)	Prove using Boolean algebra: "NAND gate is Universal gate"	05
Q 1 (b)	A 7-bit even parity hamming code is received as 1000010. Correct it for any errors and extract 4 bit data	05
Q 1(c)	Simplify $F(P,Q,R,S) = \pi M(3,4,5,6,7,10,11,15)$ using kmap and implement using minimum number of gates.	05
Q 1(d)	Explain Johnson Ring Counter	05
Q 2(a)	Reduce equation using Quine McCluskey method and realize circuit using basic gates- $F(A,B,C,D) = \sum m(1,5,6,12,13,14) + d(2,4)$	10
Q 2(b)	Compare TTL and CMOS wrt to gate, voltage level, fan in fan out, propagation delay	10
Q 3 (a)	What is race around condition? How to overcome it?	10
Q 3 (b)	Implement full subtractor using basic gates	10
Q 4(a)	Design a 32:1 multiplexer using 4:1 multiplexer with suitable diagrams and tables	10
Q 4 (b)	Explain 3 bit asynchronous down counter with timing diagram and truth table	10
Q 5(a)	Explain the working of 4-bit parallel adder. Identify its disadvantage how to overcome it?	10
Q 5(b)	Convert SR flipflop to D flipflop.	10
Q 6	Write short note on (any 4)	20
	1) VHDL	
	2) 4 bit magnitude Comparator	
	3) Pseudo random number generator	
	4) Universal Shift Register	
	5) ALU	



SE 1010 / 11 / 13005 / ECE / 130217

Q. P. Code : 26299

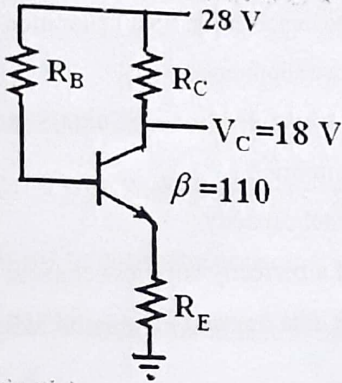
(3 Hours)

(Total Marks: 80

- N.B. :
1. Question ONE is compulsory.
 2. Solve any THREE out of remaining questions.
 3. Draw neat and clean diagrams.
 4. Assume suitable data if required.

- Q. 1. A. What is the source of the leakage current in a transistor?
If the emitter current of a transistor is 8 mA and I_B is 1/100 of I_C , determine the levels of I_C and I_B . 5
- B. Explain the concept of virtual ground in operational amplifiers. 5
- C. Draw the spectrum of amplitude modulated wave and explain its components. 5
- D. Explain adaptive delta modulation. 5

- Q. 2 A. The emitter bias configuration as shown in following figure has the specifications:
 $I_{CQ} = \frac{1}{2} I_{Csat}$ $I_{Csat} = 8 \text{ mA}$ $V_C = 18 \text{ V}$ and $\beta = 110$
 Determine R_C , R_E and R_B . 10



B Explain the following parameters and their values for 741 opamp
 CMRR, Slew Rate, Gain Bandwidth Product, Input Offset Voltage and
 Output Resistance. 10

TURN OVER

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Q. 3 A. Given $\beta=120$ and $I_E=3.2\text{ mA}$ for a common-emitter configuration with $r_o=\infty\ \Omega$, determine:

- (a) Z_i
- (b) A_v if a load of $2\text{ k}\Omega$ is applied.
- (c) A_i with the $2\text{ k}\Omega$ load.

5

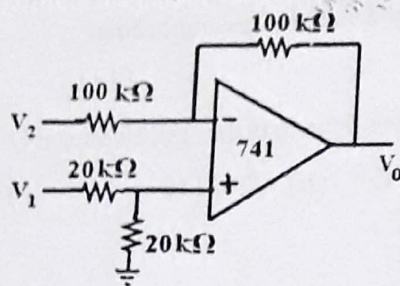
5

B. State and explain Barkhausens criteria for oscillations.

5

C. Explain principle of TDM.

D. Determine the output voltage for the circuit if $V_1=5\text{V}$ and $V_2=3\text{V}$



5

Q. 4 A. Draw the block diagram of phase cancellation SSB generation and explain how the carrier and unwanted sidebands are suppressed.

10

B. Draw the PAM, PPM and PWM waveforms in time domain assuming a sinusoidal modulating signal. Explain them in brief.

10

Q. 5 A. State Shannon's theorem on channel capacity.

What is the maximum capacity of a perfectly noiseless channel whose bandwidth is 120 Hz , in which the values of the data transmitted may be indicated by any one of the 10 different amplitudes?

10

B. With respect to neat diagram explain the elements of analog communication system.

10

Q. 6 A. What is Nyquist Criteria? What is its significance?

5

B. Give the proper definition for entropy and information rate.

5

C. Write short note on op-amp as comparator.

5

D. Differentiate between Class A and Class C power amplifiers with respect to circuit diagram, operating cycle and power efficiency.

5

Q.P. Code : 24783

[Time: 3 Hours]

[Marks: 80]

Please check whether you have got the right question paper.

- N.B:
1. Question No.1 is compulsory.
 2. Attempt any three questions of the remaining five questions.
 3. Figures to the right indicate full marks
 4. Make suitable assumptions wherever necessary with proper justifications

1. a. Explain ADT. List the Linear and Non-linear data structures with example (5)
b. Explain B Tree and B+ Tree. (5)
c. Write a program to implement Binary Search on sorted set of Integers (10)
2. a. Write a program to convert Infix expression into Postfix expression. (10)
b. Explain Huffman Encoding with an example (10)
3. a. Write a program to implement Doubly Linked List. Perform the following operations: (10)
(i) Insert a node in the beginning
(ii) Insert a node in the end.
(iii) Delete a node from the end
(iv) Display the list
b. Explain Topological sorting with example (10)
4. a. Write a program to implement Quick sort. Show the steps to sort the given numbers: (10)
25, 13, 7, 34, 56, 23, 13, 96, 14, 2
b. Write a program to implement linear queue using array. (10)
5. a. Write a program to implement STACK using Linked List. What are the advantages of linked list over array? (10)
b. Write a program to implement Binary Search Tree (BST), Show BST for the following input: (10)
10, 5, 4, 12, 15, 11, 3
6. Write Short notes on (any two) (20)
(a) AVL Tree
(b) Graph Traversal Techniques
(c) Expression Trees
(d) Application of Linked list- Polynomial Addition.



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Discrete structure

Duration: 3hrs

Q.P. Code: 24629

[Total Marks: 80]

- 1) Question no.1 is compulsory.
- 2) Solve any three questions out of remaining five questions.
- 3) All questions carry equal marks as indicated by figures to the right.
- 4) Assume appropriate data whenever required. State all assumptions clearly.

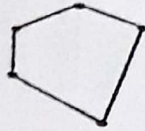
Q.1 a) Prove by induction that n^2+n is an even number, for every natural number n. (05M)

b) Find the generating function for the following finite sequences (05M)

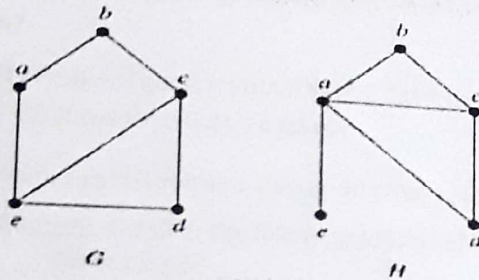
- i) 2,2,2,2,2 ii) 1,1,1,1,1

c) Let $A=\{a,b,c,d,e\}$ and $R=\{(a,a),(a,b),(b,c),(c,e),(c,d),(d,e)\}$
 Compute R^2 and R^{-1} (05M)

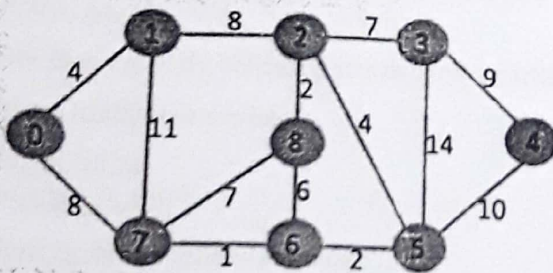
d) Define Lattice. Check if the following diagram is a lattice or not. (05M)



Q.2 a) Define Isomorphism of graphs. Find if the following two graphs are isomorphic. If yes, find the one-to-one correspondence between the vertices. If not justify your answer. (08M)



b) Find Minimum spanning tree for the following graph using Kruskal's Algorithm. (08M)



c) Prove $(p \vee q) \wedge (p \wedge \neg q) \vee q \leftrightarrow p \vee q$

Q. 3 a) Prove that set $G = \{0,1,2,3,4,5\}$ is a finite abelian group of order 6 with respect to addition modulo 6. (08M)

b) Let $A = \{1,2,3,4\}$, let $R = \{(1,2), (2,3), (3,4), (2,1)\}$ Find Transitive closure of R using Warshall's Algorithm. (08M)

c) Test whether the following function is one-to-one, onto or both. (04M)

$$f: \mathbb{Z} \rightarrow \mathbb{Z}, f(x) = x^2 + x + 1$$

(08M)

Q.4 a) Show that the (2,6) encoding function $e: B^2 \rightarrow B^6$ defined by

$$e(00) = 000000$$

$$e(01) = 011110$$

$$e(10) = 101010$$

$$e(11) = 111000$$

is a group code. Find Minimum distance. How many errors will it detect and correct?

b) Let $H = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$



Be a parity check matrix. Decode the following words relative to a maximum likelihood decoding function associated with e_H . 1) 01111 2) 01110 3) 11001 (08M)

c) How many friends must you have to guarantee that at least five of them will have birthdays in the same month? (04M)

Q.5 a) Let G be a set of rational numbers other than 1. Let $*$ be an operation on G defined by $a*b = a + b - ab$ for all $a, b \in G$. Prove that $(G, *)$ is a group. (08M)

b) Solve the recurrence relation $a_r - a_{r-1} - 6a_{r-2} = -30$ given $a_0 = 20, a_1 = -5$ (04M)

c) Let $A = \{a, b, c, d, e, f, g, h\}$. Consider the following subsets of A

$$A1 = \{a, b, c, d\}$$

$$A2 = \{a, c, e, g, h\}$$

$$A3 = \{a, c, e, g\}$$

$$A4 = \{b, d\}$$

$$A5 = \{f, h\}$$

Determine whether following is partition of A or not. Justify your answer.

i) $\{A1, A2\}$ ii) $\{A3, A4, A5\}$

Q.6 a) Draw the Hasse Diagram of the following sets under the partial order relation divides and indicate which are chains. Justify your answers. (08M)

i. $A = \{2, 4, 12, 24\}$

ii. $A = \{1, 3, 5, 15, 30\}$

(08M)

b) Let the functions f, g, and h defined as follows:

$$f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 2x + 3$$

$$g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = 3x + 4$$

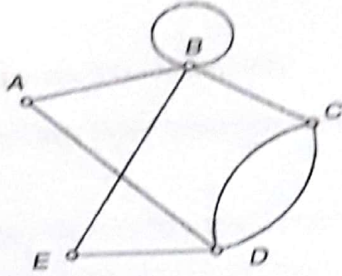
$$h: \mathbb{R} \rightarrow \mathbb{R}, h(x) = 4x$$

Find $g \circ f, f \circ g, f \circ h, h \circ f$

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c) Determine Euler Cycle and path in graph shown below

(04M)



N.B 1) Question no. 1 is compulsory.

2) Attempt any three from remaining questions.

Q. 1 a What role does "interface" play in multiple inheritance. Explain with example. [10]
Demonstrate use of interface to achieve polymorphism with example.

b Differentiate between abstract class and interface. [5]

c Create a method size(Object z), that accepts a single reference argument, z. If z refers to "Rectangle" then size(z) returns its area, and if z is a reference to a "Cube" then size(z) returns its volume. If z refers to an object of any other class, then size(z) returns -1. [5]

(Hint: Use instanceof operator)

Q. 2 a Explain different types of relationships among entities. [10]

Define the relationships among the objects of given sentences:

1) Employee works on project.

2) Customer places order.

3) WebOrder, TelephoneOrder is a kind of order.

b What is the advantage of clause "finally" [10]

List any 2 exceptions defined in Java. Explain use of try, catch and use of multiple catch block. [10]

Q. 3 a Create class Student (roll number, name). [10]

Class Test (mark1, mark2) inherit student class.

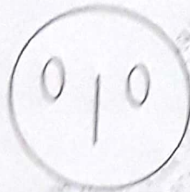
Create interface Sport with data member as sports_mark and method set_sportMark().

Create class Result which extends Test and implements Sport and has a method named calculate which finds total as (total=marks1+marks2+sports_mark) and

method which display all the details .

Create an object of Result class and show result.

- b What is a class? How does it accomplish data hiding? What is the need of a constructor? [10]
- Q.4 a Explain access specifiers in JAVA. Can all methods of a class be private? [10]
- b Which are the two different ways to create a thread? Write a multithreaded program to show inter-leaving of actions from 2 threads and display ABABABABABABAB [5]
- c Write an applet program to display [5]



- Q.5 a Explain different features of JAVA. [10]
- b Write a program to perform following operations on vector [10]
1. To add city name to vector
 2. To remove city name from vector
 3. To display all city name
- Q.6 a Write a program to create a Package College with class Student and Marks [10]
- Create class Student with data member as roll_num and Name. Accept the value from the user in getdata() and display it in putdata()
- Create class Marks that inherits Student with data member as marks (It is array accepting marks for 5 different subject). Accept the Marks in getdata() , Calculate the sum of marks display result of student in putdata() based on percentage (if >= 90 display Merit if >=75 and <90 Distinction if >= 60 and <75 First class)
- Create class Demo with Main function, create the object of the appropriate class and display the result for 2 different students.
- b Explain System.arraycopy() method with example. [5]
- c Differentiate between Array and Vector. [5]
