SE-IT | Regular | Sem III | C-scheme | 24/05/2023

(Time: 3 hours) Max. Marks: 80

N.B. (1) Question No. 1 is compulsory.

(2) Answer any three questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to the right indicate full marks

Q1.

(a) Find the Laplace transform of $t\sqrt{1+\sin t}$ [5]

(b) Find the constants a, b ,c, d, e if [5]

$f(z) = (ax^3 + bxy^2 + 3x^2 + cy^2 + x) + i(dx^2y - 2y^3 + exy + y)$ is analytic.

(c) Calculate the Spearman's rank correlation coefficient R [5]

X : 85, 74, 85, 50, 65, 78, 74, 60, 74, 90

Y : 78 91, 78, 58, 60, 72, 80, 55, 68, 70

(d) Find inverse Laplace transform of $tan^{-1}\left(\frac{s+a}{b}\right)$. [5]

Q2.

(a) Find the Laplace transform of $e^{-4t}\int_0^t u\sin 3u\, du$ [6]

(b) find the value of k if the function $f(x) = kx^2(1-x^3)$, $0 \le x \le 1$. [6]

$$F(x) = 0 \qquad \text{otherwise}$$

Is a probability density function. find mean and variance. [6]

(c) Obtain the Fourier series to represent $f(x) = x^2$ in $(0, 2\pi)$

Hence show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \ldots\ldots$ [8]

Q3.

(a) Find the analytic function $f(z) = u + iv$ such that [6]

$u + v = \frac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$.

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(b) Using convolution theorem Find inverse Laplace transform of $\dfrac{s^2}{(s^2+9)(s^2+4)}$. [6]

(c) Fit a second-degree parabolic curve to the following data

Year (x)	: 1974	1975	1976	1977	1978	1979	1980	1981
Production (y)	: 12	14	26	42	40	50	52	53.	[8]

Q4.

(a) Obtain the Fourier series to represent $f(x) = 9 - x^2$ in $(-3, 3)$. [6]

(b) . Find the coefficients of regression and hence obtain the equation of the lines of Regression for the following data

X : 78 , 36 , 98 , 25 , 75, 82, 90, 62, 65, 39 .

Y : 84 , 51, 91, 60, 68, 62 , 86, 58, 53, 47. [6]

(c) Prove that $\int_0^\infty e^{-t} \dfrac{\sin 2t + \sin 3t}{t}\, dt = \dfrac{3\pi}{4}$. [8]

Q5.

(a) Find the orthogonal trajectories of the family of curves $3x^2y + 2x^2 - y^3 - 2y^2 = c$. [6]

(b) If X denotes the outcome when a fair die is tossed, find Moment generating function

Of X and hence find the mean and variance of X. [6]

(c) Obtain the half range cosine series of $f(x) = x(\pi - x)$ in $(0, \pi)$

Hence show that $\dfrac{\pi^4}{96} = \dfrac{1}{1^4} + \dfrac{1}{2^4} + \dfrac{1}{3^4} + \dfrac{1}{4^4} + \ldots\ldots$ [8]

Q6.(a) Find inverse Laplace transform of $\dfrac{s+29}{(s+4)(s^2+9)}$. [6]

(b) The probability density function of a random variable X is

X	: 0	1	2	3	4	5	6
P (X =x) :	k	3k	5k	7k	9k	11k	13k

Find k , p (X < 4), P (3 < X ≤ 6). [6]

(c) Verify Laplace equation for $u = \left(r + \dfrac{a^2}{r}\right)\cos\theta$. also find v and f (z). [8]

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SE-IT | DSE| Sem III | C-scheme | 29/05/2023.

(Time: 3 hours)   Max. Marks: 80

N.B. (1) Question No. 1 is compulsory.

     (2) Answer any three questions from Q.2 to Q.6.

     (3) Figures to the right indicate full marks

Q.1 a) Find $L(t + e^t + \cos t)^2$ [5]

Q.1 b) Find the Fourier series for $f(x) = x \sin x$ in $(-\pi, \pi)$ [5]

Q.1 c) Find Karl Pearson's coefficients of correlation between X and Y from the following data   [5]

X	100	200	300	400	500
Y	30	40	50	60	70

Q.1 d) If $f(z) = (x^3 + axy^2 + bxy) + i(3x^2y + cx^2 + y^2 + dy^3)$ is analytic, then find a, b, c, d [5]

Q.2 a) A random variable X has the following probability function   [6]

X	1	2	3	4	5	6	7
P(X=x)	k	2k	3k	k^2	k^2+k	$2k^2$	$4k^2$

Find i) k, ii) $P(X \geq 4)$, iii) $P(X < 5)$

Q.2 b) Determine the analytic function whose real part is $u = e^x \cos y$ [6]

Q.2 c) Evaluate $\int_0^\infty e^{-t} \cosh t \cos 2t \, dt$.   [8]

Q.3 a) Obtain the Fourier series for $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $(0, 2\pi)$ [6]

Q.3 b) A continuous random variable X has the p.d.f. $f(x) = kx^2 e^{-x}$, $x \geq 0$ [6]

     Find i) k, ii) $P(1 \leq x \leq 2)$

Q.3 c) Find $L^{-1}\left[\frac{s+29}{(s+4)(s^2+9)}\right]$ using partial fraction method   [8]

Q.4 a) Find $L[f(t)]$, where $f(t) = \cos t$, $0 < t < \pi$ and $f(t) = 0$, $t > \pi$ [6]

Q.4 b) Compute Spearman's rank correlation coefficient for the following data   [6]

X	18	20	34	52	12
Y	39	23	35	18	46

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Q.4 c) Obtain the Fourier series for [8]

$$f(x) = \begin{cases} 1, & 0 \le x \le \pi \\ 2 - \dfrac{\pi}{x}, & \pi \le x \le 2\pi \end{cases}$$

Q.5 a) Find $L^{-1}\left[\dfrac{4s+13}{s^2+8s+13}\right]$ [6]

Q.5 b) Find $L[(1 + sin2t)^2]$ [6]

Q.5 c) Find the line of regression of Y on X for the following data [8]

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

Q.6 a) Find mean and variance for the following distribution [6]

X	8	12	16	20	24
P(X = x)	1/8	1/6	3/8	1/4	1/12

Q.6 b) Find i) $L^{-1}[cot^{-1}2s]$ ii) $L^{-1}\left[\log\left(1 + \dfrac{4}{s^2}\right)\right]$ [6]

Q.6 c) Prove that the function $f(z) = e^{2z}$ is analytic. Also, find its derivative. [8]

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SE-IT | DSE-Sem III | C-scheme | 26/05/23.

(3 Hours) [Marks: 80]

N.B.: 1) Question No. 1 is compulsory.
     2) Answer any three out of remaining questions.
     3) Assume suitable data if necessary.
     4) Figures to the right indicate full marks.

Q1. (a) With a neat diagram explain different types of link list. (10)
Q1.(b) Define Graph. With a neat diagram explain different types of graph. (10)

Q2. (a) Write an algorithm to covert infix expression to postfix expression. Convert the following infix expression to postfix expression using stack- (10)
$$K+L-M*N+(O\char94P)*W/U$$

Q2. (b) Write an algorithm to perform following operations on circular link list: (10)
     i)   Insertion from the End
     ii)   Deletion from End
     iii)   Display the contents of list

Q3. (a) Define B-tree. Step by step construct a B-tree for the following data for order 5: (10)

     20,30,35,15,85,10,55,60,25,89,90,100

Q3.(b) Define AVL tree. Construct an AVL tree from the following data and mention the rotations in each step 51,26,11,6,8,4,31,21,9,16 (10)

Q4. (a) Define Minimum Spanning Tree. Construct a minimum spanning tree shown in figure 1 using Kruskal's and Prim's Algorithm and find out the cost with all intermediate steps. (10)
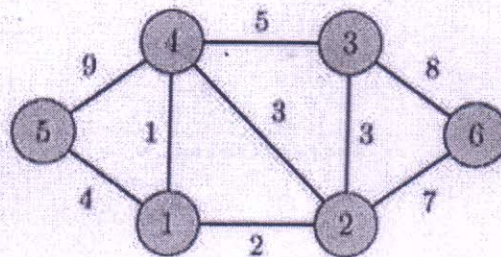

Figure 1

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Q4.(b) Explain graph traversal algorithms and traverse the graph shown in figure 2 using Breadth and Depth first search techniques:
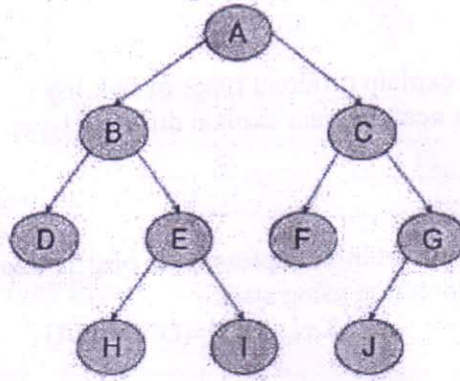

Figure 2: Graph

Q5.(a) Explain the method of collision resolution. With the help of example explain linear probing collision resolution technique. (10)

Q5.(b) Define Binary Tree. Construct the binary tree from following data: (10)

In-order Traversal: 4,2,1,7,5,8,3,6

Post-orderTraversal:4,2,7,8,5,6,3,1

Q6. Solve any Four: (20)

a) Game Tree
b) Threaded Binary Tree
c) B+-tree
d) Graph Representation Techniques
e) Huffman Coding

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Time: 3 hours   Marks: 80

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

Q1. Attempt All questions   20M
(a) Explain generalization and Specialization with example.
(b) Discuss primary key and foreign key with example.
(c) Write a short note on conflict serializability
(d) Explain DCL commands in detail.

Q2.
(a) Draw and explain Database System architecture   10M
(b) Explain different type of attributes with example in Entity Relational Model 10M

Q3
(a) Draw EER diagram for railway reservation management System   10M
(b) Draw and explain notations of ER/EER diagram   10M

Q4.
(a) Explain the DDL and DML Commands with suitable example.   10M
(b) Discuss procedure, functions and cursors with example.

Q5
(a) Define normalization. Explain 1NF in detail with example   10M
(b) Explain ACID properties in details with example.

Q6. write short note on   20M
(a) Constraints in SQL
(b) Need of normalization in Database Design
(c) Group by clause
(d) JDBC Connection

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SE-IT | Regular | e-scheme | 01/06/2023.

(3 Hours)   [Total Marks: 80]

N.B. (1). Question No.1 is compulsory.
   (2). Out of remaining attempt any three.
   (3). Assume & mention suitable data wherever required.
   (4). Figures to right indicates full marks.

Q.1. Solve any four   [20]
   a) Explain need of modulation. Justify it with example.
   b) Define the following terms.
      i) Noise figure   ii) Noise temperature
      iii) Noise bandwidth   iv) Noise voltage   v) Modulation.
   c) Compare AM and FM.
   d) Explain in short pre-emphasis and De-emphasis.
   e) What is PSK signal. Draw the PSK signal for the following binary signal 111010011.
   f) Explain the principle of reflection and refraction.

Q.2 a) Define signal to noise ratio. Explain the effect of cascade connection on a signal to
       noise ratio. Derive Friss formula for two stage cascade amplifier.   [10]
    b) State and prove the following properties of Fourier transform with example
       i) Convolution in time domain ii) Time scaling   [10]

Q.3. a) The AM Transmitter develops an unmodulated power o/p of 400 Watts across a
        50Ω resistive load. The carrier is modulated by a sinusoidal signal with a
        modulation index of 0.8. Assuming f_m= 5KHz and f_c= 1MHz.
        (i) Obtain the value of carrier amplitude Vc and hence write the expression for AM
            signal.
        (ii) Find the total sideband power.
        (iii) Draw the AM wave for the given modulation index.   [10]

     b) With the help of neat circuit diagram explain the working of Ratio detector.   [10]

Q.4 a) What are the limitations of TRF receiver? Explain how these limitations are avoided
        using super-heterodyne receiver.   [10]
     b) Compare ground wave, sky wave, space wave and tropospheric scatter propagation.
                                                                                       [10]

Q.5 a) State Sampling theorem, write down the steps to prove sampling theorem, draw
        waveform for low pass band limited signal   [10]
     b) Draw the block diagram of PAM generator and detector. Explain the working giving
        waveforms at the output of each block.   [10]

Q6. a) Explain slope overload error and hunting error in Delta modulation. Derive the
        condition to avoid slope overload distortion.   [10]
     b) Explain the generation and detection of ASK signal.   [10]

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SE- IT | DSE | e-schemel o$ |06|2023.

Time: 3 Hours   **Max. Marks: 80**

N.B.
1. **Question No.1 is Compulsory**
2. **From Remaining 5 Questions You are Required to Solve any 3 Questions.**
3. **Assume the data if Necessary**

1   Attempt Any Four: -   20
   a) Explain Block Diagram of Analog Communication System.
   b) Explain pre-emphasis and de-emphasis in FM.
   c) Justify how modulation reduces the height of antenna.
   d) Differentiate Between Analog and Digital Communication system.
   e) Explain importance of Fourier transforms in communication.

2   Attempt the Following   20
   a) Define Noise and explain in detail various sources of Noise.
   b) Explain different types of channels in communication.

3   Attempt the Following   20
   a) A modulating signal $20 \sin(2\pi \times 10^3 t)$ is used to modulate carrier signal $40 \sin(2\pi \times 10^4 t)$. Find
     1. Modulation Index
     2. Percentage Modulation
     3. Sideband Frequencies and their amplitude
     4. Bandwidth of AM wave
     5. Draw the frequency spectrum
   b) Explain in detail generation of DSBFC .

4   Attempt the Following   20
   a) Draw and explain in detail FM demodulator: Foster Seeley discriminator.
   b) Explain in detail Armstrong method of generation of FM.

5   Attempt the Following   20
   a). Derive Friss formula for two stage cascade amplifiers. Am amplifier operating over a frequency range from 17 to 19MHz has an input resistance of 5kohms. What is the rms thermal noise voltage at the input of this amplifier. Assume the operating temperature to be 27 C.
   b) Draw and explain in detail with block diagram High Level AM Modulator.

6   Attempt the Following (any four)   20
   a) Draw and explain Electromagnetic Spectrum and specify applications of different bands.
   b) Write short note on phase shift method of SSB generation
   c) Derive time shifting property of Fourier Transform.
   d) Compare AM and FM.
   e) Explain sensitivity and selectivity in AM Receiver.

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IT) III R) R+9) PCBF / 5-6-23

(3 Hours)   **(Total Marks: 80)**

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

Q6.   Solve any four   **(20)**

a) Compare Static Scoping vs. Dynamic Scoping
b) Explain Inheritance in OOP
c) How to choose a programming language?
d) Explain Types of binding in Programming Languages

Q2.   a) Explain database manipulation commands in Prolog with an example.   **(10)**

b) Explain different storage allocation mechanisms.   **(10)**

Q3.   a) What do you mean by Programming Paradigm? Explain with example the difference between declarative and imperative programming paradigm.   **(10)**

b) What are Scripting Languages? Explain characteristics of scripting languages.   **(10)**

Q4.   a) What is logic programming? Explain Facts and Rules along with an example.   **(10)**

b) Discuss Call by value vs. Call by reference.   **(10)**

Q5.   a) Explain Type and Type classes in Haskell.   **(10)**

b) Explain encapsulation. How does it differ from abstraction?   **(10)**

Q6.   a) What is the role of an Exception Handler in a programming language? Briefly explain important tasks it performs.   **(10)**
b) Explain the life cycle of a thread with neat labeled diagram.   **(10)**

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