

**QUESTION PAPERS FOR END TERM THEORY
EXAMINATIONS**

November/ December-2023



**M.Tech., MTPT, M.Sc., MBA, EMBA, M.Des.,
1st, 3rd & 5th SEMESTER**

**QUESTION PAPERS FOR END TERM THEORY
EXAMINATION**

NOV-DEC -2023

M.TECH/M.Sc./M.DES/MBA/EMBA

I/III/V/VII SEM

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M.TECH

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Roll No.

FIRST SEMESTER

Ph.D

END SEMESTER EXAMINATION

Nov/Dec-2023

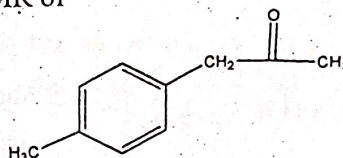
ACPT-901 Spectroscopy: Application for Structure Determination

Time: 3 Hours

Max. Marks: 50

Note: Assume suitable missing data if any. Do any 5 questions

- [1] What do you understand by figure print region in IR spectroscopy? Write the stretching frequency in wave number for the following functional groups: -OH, -NH₂, -NO₂, -CH₃, -CN, & -CHO. Write four important application of IR spectroscopy. [CO1, 2+6+2]
- [2] Why TMS is commonly used as Internal standard in NMR? Which type of nuclei are NMR active? How many types of protons are there in propane, diethylether, and 1,4-dinitrobenzene? [CO2, 2+2+6]
- [3] What do you understand by McLafferty rearrangement in mass spectrometry? Explain. [CO2&3, 5+5]
Discuss the ¹H NMR of



- [4] Define the following: Chromophore, Auxochrome, Bathochromic shift, and Hyperchromic shift. [CO1, 10]
- [5] Write short note on any two of the following: (a) Molecular vibrations in IR spectroscopy (b) Coupling Constant in NMR (c) Role of UV-Visible spectroscopy in characterization. [CO1-3, 10]
- [6] Find the molecule with following data: FTIR: 1745, 1225, 749 cm⁻¹; HNMR: δ 1.96 (s, 3H), 5.00 (s, 2H), 7.20-7.26 (m, 5H). Explain the values. Discuss the possible transitions in benzaldehyde when irradiated with UV-Visible light. [CO1,2, 6+4]

Total No of Pages: 1

Roll. No.....

FIRST SEMESTER

Ph.D (AC)

END TERM EXAMINATION

NOV/DEC-2023

ACPT-902 ANALYTICAL TECHNIQUES FOR

MATERIALS CHARACTERIZATION

Time: 2 Hours

Max. Marks: 50

Note: Answer any five questions. Assume suitable missing data, if any.

1. Draw a block diagram of DSC and explain the working of each component in detail. Where is the need of this analytical technique? 10
2. What do you know about the X-ray diffraction? Discuss its instrumentation and applications. 10
3. Explain the working of thermogravimetric analyzer using a suitable block diagram. Explain the importance of this technique by considering a suitable example. 10
4. What is the principle of scanning electron microscopy? Elaborate the working of SEM. Discuss its importance in research and development activities. 10
5. What do you mean by transmission electron microscopy? Discuss the working of all components in TEM and utility in detail by using suitable examples. 10
6. What is STM? Explain the working of this instrument by using its block diagram and discuss its applications. 10
7. Write short notes on any two of the following: 5x2
 - I. Atomic force microscopy
 - II. Electron diffraction
 - III. XRF
 - IV. DTA

Note: Answer any five questions. (Assume suitable missing data, if any.)

- 1) (i) What are the major difference between the programming in C language and MATLAB. Name Five MATLAB Toolbox for advance data processing with relevant example. (CO2, CO3) (6)
 (ii) Write a C program to check whether an integer is odd or even using function which should return 0 if odd and 1, if even. (CO2, CO3) (4)
- 2) Find the value of X in each of the following: (CO1) (2 x 5)
 - i. $(781)_{(10)} = (X)_{(2)}$
 - ii. $(101101.001)_{(2)} = (X)_{(10)}$
 - iii. $(3BD)_{(16)} = (X)_{(2)}$
 - iv. $(246)_{(8)} = (X)_{(16)}$
 - v. $(25)_{(10)} = (100)_{(X)}$
- 3) (i) Write a sample Latex document that include section, subsection, image, Table and equation along with labelling and referencing each in the document at appropriate places. (CO5) (8)
 Note: Specific Table and equations required to be included is given as:

Whole Sale Items		
Item.	Qty	Cost
Pencil 2B	10	50
	20	70
	50	100

$$\mu_{ij} = \left\{ \sum_{p=1}^k \left(\frac{\exp(\|x_i^T w_j + b_j\|^2)}{\exp(\|x_i^T w_p + b_p\|^2)} \right)^{\frac{1}{\alpha}} \right\}^{-1}$$

4

(ii) Identify error in the following Latex code:

(CO5) (2)

```
\documentclass{article}
\begin{document}
  \maketitle
  \chapter{Overview}
  \section{Introduction}
  \subsection{Definitions}
  \paragraph{}
  In this ...
\end{document}
```

- 4) (i) Give detailed description of tools available for report writing and presentation preparation in context of technical documentation. Discuss the advantages and disadvantages of Microsoft word processor and Microsoft Power point over Latex and Beamer. (CO1, CO5) (6)
- (ii) Write the code for making a beamer presentation that include the title of the presentation page, outline of presentation, two slides with appropriate title (one slide should include an image and another slide with List of items). (CO5) (4)
- 5) (i) Write a MATLAB function to check the consistency of the system of linear equations $Ax = b$; where A is coefficient matrix of size (m, n) for m number of equation and n is number of variable, x is column matrix of size n, and b is column matrix of size n. (CO3, CO4) (6)
- (ii) Write a program to plot the functions $f(x) = x^2$ and $g(x) = e^{(x^2)}$ for $x = -1 \dots 1$ on the same axis. Label the x and y axes, and create a legend indicating the individual functions in the figure. (CO3, CO4) (4)
- 6) (i) Find the zeros of the polynomial $f(x) = x^5 - 4x^4 + 12x^2 - 9x + 1$ in Mathematica. Convert the result to a list of numbers. (CO3, CO4) (6)
- (ii) Differentiate the use of command piece wise and which in Mathematica with example. (CO3, CO4) (4)

*****All The Best*****

END TERM EXAMINATION

Nov/Dec-2023

AI501 Advance Data Structure and Algorithm

Time-3:00 Hours

Max. Marks-40

Note: Answer all questions. Write pseudo codes for all algorithms asked. Assume suitable missing data, if any.

Answer any 5 Questions

Q1 (a) The operation HEAP-INSERT ($A, item$) insert the $item$ in a binary heap, A containing n element. Propose an implementation of HEAP-INSERT that runs in $O(\log n)$ time for a max heap.

[4M][CO3]

(b) Write the pseudocode to perform union or merge of two binomial heaps and tell the time complexity?

[4M][CO3]

Q 2(a) A k -way merge operation. Suppose you have k sorted arrays, each with n elements, and you want to combine them into a single sorted array of kn elements.

(i) Here's one strategy: Using the merge procedure, merge the first two arrays, then merge in the third, then merge in the fourth, and so on. What is the time complexity of this algorithm, in terms of k and n ?

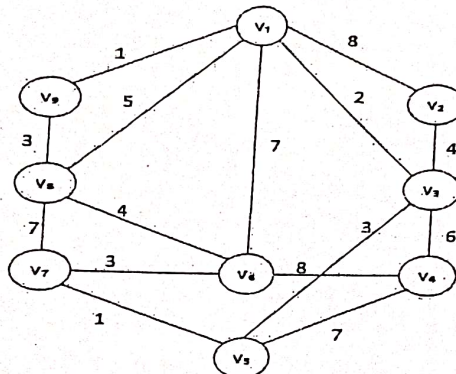
(ii) Give a more efficient solution to this problem.

[2+2=4M] [CO4]

(b) Give an algorithm to find a maximum spanning tree. Is this harder than finding a minimum spanning tree?

[CO3] [4M]

Q3. Find the minimum spanning tree of the graph given below using Prim's algorithm. Clearly write all steps involved.



[8M][CO4]

Q4. Using the idea of dynamic programming perform the matrix chain multiplication of four matrices, namely, A, B, C, D with order as 10×5 , 5×15 , 15×8 , 8×20 , respectively. Find the minimum number of scalar multiplications needed to parenthesize the matrices and also produce the corresponding parenthesized matrices. [8 M][CO5]

Q5. "Edit distance" measures the minimum the number of simple changes to move from one string to another. Possible changes include the insertion of a single character, the deletion of a single character, or the substitution from one character to another. All the operations are of equal costs. For Example:- Edit Distance for input sequences "sunday" and "saturday" is 3. Last three and first characters are same. We need to convert 'un' to 'atur'. This can be achieved by inserting character 'a', inserting character 't' and replacing character 'n' with character 'r'. Develop a strategy to find the minimum edit distance between two strings using Dynamic Programming. Your program must calculate edit distance between pairs of strings and find the time complexity of the program. [8M][CO5]

Q6(a). Given a sorted array of distinct integers $A[1, \dots, n]$, you want to find out whether there is an index i for which $A[i] = i$. Give a divide-and-conquer algorithm that runs in time $O(\log n)$. [4M][CO4]

(b) What do you mean by topological sorting in case of directed acyclic graph? Write the pseudocode for finding topological sorting? [4M][CO3]

(b) Suppose we make an initial observation E1 that confirms our belief in H with $MB(H, E1) = 0.5$ and disbelief $MD(H, E1) = 0$. Consider second observation E2 that also confirms H with $MB(H, E2) = 0.4$, $MD(H, E2) = 0.1$. Calculate Certainty factor of CF(H, E1 and E2)

[CO2][4,4]

Q8. Write short notes on any two of following

- (a) Different components of Expert System.
- (b) Syntactic analysis in NLP.
- (c) Learning using Neural Network

[CO4][4,4]

Total No. of Pages: 4

ENDSEMESTER EXAMINATION

Roll No.....

(November – 2023)

M.Tech.(AI) Ist SEMESTER

AI 503 Principles of Artificial Intelligence

Time: 3Hours

Max. Marks:40

Note: All diagrams and pseudocode should be neat and clean.

Answer any 5 questions.

Assume suitable missing data, if any.

Q1.(a) What are common AI techniques used in all application domains? What is the application of AI in domain of Natural Language processing?

(b) What are the characteristics of good control strategy. What analysis is required for choosing a good search strategy?

[CO3][4,4]

Q2. (i) Why best search is better than hill climbing?

(ii) Work out few steps of A* algorithm for slide back puzzle having following moves.

I. A tile may move to adjacent cell with unit cost

II. A tile may swap another tile with a cost of 4

Initial and goal nodes are described as:

1	3	2
---	---	---

1	2	3
---	---	---

[CO2][4,4]

Q3. (a) Give an abstract algorithm to solve crypt arithmetic problems. Work out the couple of steps for following problem

CROSS
+ ROADS

DANGER

(b) Name some applications where Means End Analysis using both forward and backward reasoning is suitable. Justify your answer

[CO4][6,4]

```

graph TD
    A((A)) --> B((B))
    A --> C((C))
    A --> D((D))
    A --> E((E))
    B --> F((F [11]))
    B --> G((G))
    B --> H((H [5]))
    C --> I((I))
    C --> J((J [3]))
    D --> K((K))
    E --> L((L [24]))
    E --> M((M))
    F --> N((N [10]))
    F --> O((O [4]))
    G --> P((P [3]))
    G --> Q((Q [15]))
    I --> R((R [6]))
    I --> S((S [2]))
    K --> T((T [1]))
  
```

Q5. (a) Express the following statement in first order predicate. Describe the steps to Convert it in to clause form. Write the final clause.
Everything that weighs the same as something that floats, does floats too.

(b) (i) What are the main issues in unifying two clauses.
(ii) Given fact: $A \rightarrow (B \wedge C)$ and A , Use resolution procedure to prove that B is true.

Q6. (a) With help of following example, illustrate how knowledge is represented using semantic net. Also write the corresponding property inference procedure.

Tom is a cat. Tom caught a bird. Tom is owned by John. Tom is ginger in colour. Cats like cream. The cat sat on the mat. A cat is a mammal. A bird is an animal. Birds can fly. All mammals are animals. Mammals have fur.

(b) Write the corresponding prolog representation and rules for inferences. Illustrate it to prove that tom has fur and can not fly.

(c) What are semantic frames. What are the various links used in semantic frames? With the help of above example prove that they are better than semantic nets

[CO3][2,3,3]

Q7. (a) How probability is used to handle Non monotonic reasoning?
Write down production rules in the domain of faulty computer with explanation.

- (i) "half of the time when a computer does not work, then the battery is dead"
- (ii) "95% of the time when a computer has electrical problem and battery is old, then the battery is dead"
- (iii) If children play with key board it is 80% sure that fault is with disk.

Time: 3 hours

Max. Marks: 40

Note: Attempt all questions. All questions carry equal marks
Assume suitable missing data, if any.

1. A. Explain the five types of algorithm modes (both encryption and decryption) used for designing symmetric encryption/block cipher algorithms. Let m be a message consisting of L AES blocks (say $L=100$). Alice encrypts m using CBC mode and transmits the resulting ciphertext to Bob. Due to a network error, ciphertext block number $L/2$ is corrupted during transmission. All other ciphertext blocks are transmitted and received correctly. Once Bob decrypts the received ciphertext, how many plaintext blocks will be corrupted? Similarly in previous case, how many plaintext blocks will be corrupted if Alice had encrypted m using randomized counter mode and transmitted the resulting ciphertext to Bob.

B. Suppose $n + 1$ parties, call them B, A_1, \dots, A_n , wish to setup a shared group key. They want a protocol so that at the end of the protocol they all have a common secret key k , but an eavesdropper who sees the entire conversation cannot determine k . The parties agree on the following protocol that runs in a group G of prime order q with generator g : for $i = 1, \dots, n$ party A_i chooses a random a_i in $\{1, \dots, q\}$ and sends to Party B the quantity $X_i \leftarrow g^{a_i}$. Party B generates a random b in $\{1, \dots, q\}$ and for $i = 1, \dots, n$ responds to Party A_i with the messages $Y_i \leftarrow X_i^b$. The final group key should be g^b . Clearly Party B can compute this group key. How would each Party A_i compute this group key? Also compute group key in DHKE, if $g = 3, p = 11, a = 5$ and $b = 4$.

[10][CO 1,2,3,6]

2. A. Define the type of security attack in each of the following cases. Also provide solutions to avoid these attacks.
- A student breaks into the office of the professors office to obtain a copy of next day question paper.
 - A student gives a cheque of Rs 500/- to buy a book. Later the student finds out the cheque was cashed for Rs 5000/-.
 - A student sends thousands of emails per hour to another student using a phony return email address.

B. Explain the four types of Cryptanalysis attack. What is difference in terms of authentication property between the two ciphers $c1 = E(m, SK_{\text{sender}})$ and $c2 = E(m, PK_{\text{receiver}})$ send by sender to receiver where SK_{sender} represents secret key of sender and PK_{sender} represents public key of sender. Similarly, SK_{receiver} and PK_{receiver} represents secret and public key of receiver? [7][CO 1,2,3]

3. A. Suppose Alice and Bob live in a country with 50 states. Alice is currently in state $a \in \{1, \dots, 50\}$ and Bob is currently in state $b \in \{1, \dots, 50\}$. They can communicate with one another and Alice wants to test if she is currently in the same state as Bob. If they are in the same state, Alice should learn that fact and otherwise she should learn nothing else about Bob's location. Bob should learn nothing about Alice's location. They agree on the following scheme: They fix a group G of prime order p and generator g of G . Alice chooses random x and y in Z_p and sends to Bob $(A0, A1, A2) = (g^x, g^y, g^{xy+a})$. Bob chooses random r and s in Z_p and sends back to Alice $(B1, B2) = (A_1^r g^s, (\frac{A_2}{g^b})^r A_0^s)$. What should Alice do now to test if they are in the same state (i.e. to test if $a=b$)? Note that Bob learns nothing from this protocol because he simply received a plain ElGamal encryption of g^a under the public key g^x . One can show that if $a \neq b$, then Alice learns nothing else from this protocol because she receives the encryption of a random value. Which of the following is the right option and why?
- Alice tests if $a=b$ by checking if $B_1^x B_2 = 1$.
 - Alice tests if $a=b$ by checking if $B_1/B_2^x = 1$.
 - Alice tests if $a=b$ by checking if $B_2^x B_1 = 1$.
 - Alice tests if $a=b$ by checking if $B_2 B_1^x = 1$.
 - Alice tests if $a=b$ by checking if $B_2/B_1^x = 1$.
- B. Consider an encryption scheme defined as $E(m) = (k_1 * m + k_2) \bmod 26$ for message m and private keys k_1 and k_2 . It is known that the plaintext $m1 = ab$ is encrypted to cipher, $c1 = GL$. The numeric values assigned to uppercase and lowercase alphabets are same. (A=a=00, B=b=01, C=c=02, .. so on).
- Using brute force decipher XPALASXYFGFUK.
 - Encrypt $m = \text{Twenty}$ for $k_1 = 17$ and $k_2 = 20$ and then decipher it back to original message showing multiplicative inverse calculations involved.
- C. Using $e=13$, $d=37$ and $n=77$ in the RSA algorithm, encrypt the message "FINE" using the values 00 to 25 for letters A to Z. For simplicity, do the encryption and decryption character by character. [13][CO1,2,3,6]
4. Write short note on (any two) [10] [CO 2,5]
- Secure Electronic Transaction (SET) architecture with diagram.
 - ElGamal Digital Signature
 - Firewall
 - DNS

Total No. of Pages 01

FIRST SEMESTER

END-TERM SEMESTER EXAMINATION

COURSE CODE: AI-5403

COURSE TITLE: ADVANCE DATABASE MANAGEMENT SYSTEM

Time: 3:00 Hours

Roll No.

M.Tech

November-2023

Max. Marks: 40

Note: All questions carry equal marks
Answer Any Four questions.
Assume suitable missing data, if any.

1. (a) What is the need of external merge sort? Write down the merge sort algorithm. [5] [CO3]
(b) What is meant by transparency in database. What are the various types of database transparency in distributed database? [5] [CO2]
2. (a) How is a horizontal partitioning of a relation specified? How can a relation be put back together from a complete horizontal partitioning. [5] [CO1]
(b) What are the conditions that must be satisfied for two schedules S and S' to be view equivalent? [5] [CO4]
3. (a) Prove that strict two-phase locking guarantees strict schedules. [5] [CO5]
(b) What are triggers? Write a trigger to check whenever an employee's salary is greater than the salary of his or her supervisor in the company database. [5] [CO2]
4. (a) How generalization or specialization is mapped into relational schema. Give example. [5] [CO3]
(b) Describe three partitioning techniques to partition relations among available disks. Give example of a query for each of the three partitioning techniques. [5] [CO7]
5. (a) What are two types of interoperation parallelism. Describe the benefits and drawbacks of interoperation parallelism. [5] [CO6]
(b) What is a time stamp. How does the system generate time stamp. [5] [CO3]
6. Write a short note on any of the following two: [5] [5] [CO3]
 - a) Spatial database
 - b) Active database
 - c) Query optimization
 - d) Cost of query evaluation
 - e) Log based recovery

Note: Attempt any five questions.
Assume suitable missing data if any.
Usage of Statistical Table is allowed

- Q1. Consider an example where values of the CBO (number of other classes to which a class is coupled to) metric is given before and after applying refactoring technique to improve. The data is given in below Table. Kindly perform paired t -test. [10]

CBO Values

CBO before refactoring	45	48	49	52	56	58	66	67	74	75	81	82	83	88	90
CBO after refactoring	43	47	49	52	56	57	66	67	74	73	80	82	83	87	90

- Q2. Let us consider another example for large sample size, where we want to ascertain whether the two sets of observations (sample 1 and sample 2) are extracted from identical populations by observing the cohesion values of the two samples. Kindly perform Wilcoxon-Mann-Whitney test.

Sample 1: 55, 40, 71, 59, 48, 40, 75, 46, 71, 72, 58, 76

Sample 2: 46, 42, 63, 54, 34, 46, 72, 43, 65, 70, 51, 70. [10]

- Q3. Consider the below Table, where the performance values of six different classification methods are stated when they are evaluated

on six data sets. Investigate whether the performance of different methods differ significantly. Kindly perform Friedman Test.

Performance Values of Different Methods

Data Sets	Methods					
	M1	M2	M3	M4	M5	M6
D1	83.07	75.38	73.84	72.30	56.92	52.30
D2	66.66	75.72	73.73	71.71	70.20	45.45
D3	83.00	54.00	54.00	77.00	46.00	59.00
D4	61.93	62.53	62.53	64.04	56.79	53.47
D5	74.56	74.56	73.98	73.41	68.78	43.35
D6	72.16	68.86	63.20	58.49	60.37	48.11

- Q4. Explain the various statistical tests available in research for verifying hypothesis along with their categories. [10]
- Q5. Explain the following:
- Threats to validity along with its categories
 - Wrapper and Filter attribute selection methods
- [10]
- Q6. Explain any two:
- Hypothesis, Hypothesis formulation, and Hypothesis testing
 - Univariate regression analysis
 - Categories of Machine Learning Algorithms
- [10]
- Q7. Explain the following:
- Independent and Dependent Variable
 - ROC Curve
 - Mean Relative Error and Mean Absolute Relative Error
 - Cross validation
- [10]

Total no. of Pages:01

Roll no.....

THIRD SEMESTER
M.Tech (AI)

END TERM EXAMINATION

Nov/Dec-2023

AI6307 Block chain and Application

Time: 03:00 Hours

Max. Marks: 50

Note: All questions are compulsory.
Attempt all questions.
Assume suitable missing data, if any.

- Q.1 Discuss the Practical Byzantine Fault Tolerance with a suitable example. [Max. Marks:5][CO-1]
- Q.2 Explain different types of Nodes in Ethereum. [Max. Marks:5][CO-2]
- Q.3 Explain the role of Nonce and Timestamp in the mining process with a suitable example. [Max. Marks:5][CO-3]
- Q.4 Discuss UTXO with a suitable example. What is the role of UTXO in Bitcoin? [Max. Marks:5][CO-3]
- Q.5 Illustrate Bitcoin's Monetary Policy in detail. [Max. Marks:5][CO-4]
- Q.6 Explain Smart Contract in Ethereum. [Max. Marks:5][CO-3]
- Q.7 Describe the Bitcoin Mining Process by taking a suitable example and diagram. [Max.Marks:10][CO-4]
- Q.8 Write short note on the following
- a. Private Blockchain
 - b. Public Blockchain
 - c. Consortium Blockchain
 - d. Hybrid Blockchain
- [Max. Marks:10][CO-1]

-----All the Best-----

intuitive interpretation of the Focal Loss as it relates to handling hard and easy examples in a classification task. [4][CO2, CO3]

- iii. What are the key components of a Vision Transformer (ViT) architecture, and how does self-attention play a crucial role? [4][CO3, CO4]

—————BEST OF LUCK—————

Total No. of Pages: 4

Roll No.

THIRD SEMESTER

M. Tech

END TERM EXAMINATION

Dec-2023

AI6405 ADVANCE COMPUTER VISION

Time: 3:00 Hours

Max. Marks: 40

Note: All questions are compulsory.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 Attempt both questions:

- Suppose you have an image of size 640x480 pixels, rotate the image by 75 degrees counterclockwise around its center. Calculate the coordinates of the four corners of the rotated image. [4][CO1, CO2]
- Suppose you have a grayscale image with pixel intensities ranging from 0 to 255. Design a spatial filter that enhances edges in the image. Provide the filter's kernel and explain how it works. [4][CO1, CO2]

Q.2 Attempt both questions:

- Consider a simple sequence-to-sequence model with an attention mechanism. We have an input sequence with three elements and an output sequence with four elements. The attention mechanism calculates attention scores between each input element and each

output element. The input sequence is: [3, 1, 2] and The output sequence is: [0, 1, 0, 2]. The attention scores are computed using a dot-product attention mechanism and can be represented as an attention matrix A, where each element $A[i][j]$ represents the attention score between the i^{th} input element and the j^{th} output element. The attention matrix A is given as:

$$A = \begin{bmatrix} 0.2 & 0.1 & 0.3 & 0.4 \\ 0.5 & 0.6 & 0.2 & 0.7 \\ 0.3 & 0.4 & 0.1 & 0.2 \end{bmatrix}$$

Calculate the context vector for each output element using the attention mechanism. [4][CO2, CO3]

- ii. You have two bounding boxes, A and B, in an image.

Bounding box A has the following coordinates: Top-left corner: $(x_1, y_1) = (20, 30)$, Bottom-right corner: $(x_2, y_2) = (120, 150)$.

Bounding box B has the following coordinates: Top-left corner: $(x_{1B}, y_{1B}) = (50, 40)$, Bottom-right corner: $(x_{2B}, y_{2B}) = (160, 170)$.

Calculate the Intersection over Union (IoU) between bounding boxes A and B. [4][CO2, CO3]

Q.3 Attempt any two questions:

- How does a Vision Transformer (ViT) use patches for feature extraction in image data? [4][CO3, CO4]
- How does the loss function in GANs reflect the minimax game nature of the model? [4][CO3, CO4]

- What is the purpose of the "latent space" in GANs, and how is it related to the generator? [4][CO2, CO3]

Q.4 Attempt any two questions:

- Explain the concept of deformable convolution in the context of convolutional neural networks (CNNs). What are the limitations of traditional convolutional layers that necessitate the use of deformable convolution? Provide insights into how deformable convolution addresses these limitations. [4][CO1, CO3]
- Explain the concepts of short-term and long-term temporal features in Temporal Difference Networks (TDN) and describe how TDN improves upon Temporal Segment Networks (TSN) in modeling temporal information for video analysis. [4][CO2, CO3]
- How does Mask R-CNN handle multiple object instances of the same class within an image? [4][CO3, CO4]

Q.5 Attempt any two questions:

- What are the limitations of Cross-Entropy Loss in deep learning classification tasks, and how does the Focal Loss address these limitations? [4][CO2, CO3]
- Explain the concept of "hard examples" and "easy examples" in the context of the Focal Loss, and how the Focal Loss addresses these two types of examples. Provide a mathematical formulation and

THIRD SEMESTER
M.TECH. (BIOINFORMATICS)
END TERM EXAMINATION **NOV/DEC-2023**
BT-6301 NANOTECHNOLOGY IN HEALTHCARE
Time: 3.00 Hours **Max. Marks: 50**

Note: Answer All questions. Assume suitable missing data, if any.

- Q.1 Answer all the following** **[2x5][CO- 1- 5]**
- a. Write down the two biomaterials used to prepare muscles, neurons, and the cardiovascular system.
 - b. Briefly explain the immunology of transplant rejection.
 - c. Give details on principle and lookout methods for cantilever sensing.
 - d. How tissue engineering is being implemented in diabetes treatment, explain.
 - e. What are molecular beacons explain?

- Q2. Write short notes on Any two of the following, and briefly describe their applications. [5x2][CO- 3, 4]**

- a. Bio-barcode assay
- b. Artificial retinal prosthesis
- c. Cardiac pacemaker and implantable cardioverter defibrillator (ICD)

- Q3. Attempt any TWO question out of following [5x2][CO- 3, 4]**

- a. Define biomaterials and along with its classification briefly describe the significance of cell-surface interactions in the area of regenerative medicine, briefly explain the *in-vitro* and *in-vivo* methods applied for biocompatibility testing.
- b. What is tissue engineering and how tissue engineering methods are currently being implemented in regenerative medicines, discuss strategies applied development of artificial arteries.

- c. Describe the wound healing and repair process, and briefly discuss strategies applied in skin tissue engineering.

Q4. Attempt any TWO question out of following [5x2][CO- 4, 5]

- a. Describe the process of bone remodeling and repair, and briefly discuss strategies applied in bone tissue engineering.
- b. Define the Biosensor and its components. Explain the principles and types of biosensors along with their application.
- c. What are neuroprosthetics, briefly discuss the methods applied for nerve regeneration.

Q5. Attempt any TWO question out of following [5x2][CO- 4, 5]

- a. Briefly discuss the role of nanomaterial in clinical diagnostics and treatment of cancer, what are its advantages and significance in the current scenario?
- b. Classify the infectious disease agents, and briefly discuss their mode of transmission.
- c. What are drug delivery systems? How are nano drug delivery systems used in current medical practice, briefly discuss about the new technologies being developed by researchers for nano drug delivery?

-END-

1st SEMESTER
M.Tech (BIOINFORMATICS)
END TERM EXAMINATION **NOV./DEC- 2023**
BIO-501 Introduction to Bioinformatics

Time: 3:00 Hours

Max. Marks: 40

Note : Attempt any 5 questions.
All questions carry equal marks.
Assume suitable missing data, if any.

1. (a) Suppose you have a dataset of SNP variants and gene expression profiles. How would you design a study to identify potential associations between specific SNPs and gene expression levels? Describe the steps involved.

(b) How do single nucleotide polymorphisms relate to the concept of genetic variation within a population, and why are they considered valuable for studying human genetic diversity?
[4+4] [CO# BIO-501.2]
2. (a) Given are two DNA sequences:

AAGTCACTG
AACTCTCTG

Perform a dot matrix analysis and identify potential regions of homology. Discuss the criteria and thresholds you used to determine significant matches in the plot.

(b) Compare and contrast the dot matrix and sequence alignment methods, such as dynamic programming and heuristic algorithms, in terms of their applicability and efficiency for different types of sequence comparisons.
[4+4] [CO# BIO-501.4]
3. (a) What is the significance of substitution matrices in sequence alignment? Compare and contrast BLOSUM and PAM matrices in the context of MSA.

(b) Imagine you are working with a set of highly divergent sequences. Suggest and justify the choice of specific MSA algorithms and tools to handle this challenging scenario.

[4+4] [CO# BIO-501.3]

4. (a) The Human Genome Project primarily focused on the reference genome, but human populations exhibit significant genetic diversity. How has the project contributed to our understanding of human genetic diversity, and what are the implications for personalized medicine?

(b) Explain the concept of "functional genomics" and how it relates to the Human Genome Project. How has this field advanced our understanding of gene function and regulation?

[4+4] [CO# BIO-501.2]

5. (a) How can integrated databases, such as NCBI's Entrez system, be used to extract meaningful biological insights by combining genomic, proteomic, and functional information? Provide an example of a specific research application.

(b) Define the FASTA and GenBank sequence formats. Explain their primary differences and provide examples of when each format is commonly used in bioinformatics.

[4+4] [CO# BIO-501.1]

6. Which database will be used to conduct a phylogenetic analysis to determine the evolutionary relationships among a group of species and why? Additionally, discuss the ethical implications associated with using data from this database, including issues related to data sharing, data ownership, and potential biases in the selected database.

[8] [CO# BIO-501.5]

Total No. of Pages 01

Roll no.....

IInd SEMESTER
M.Tech.**END TERM EXAMINATION**
BIO 503 ADVANCED PROTEOMICS**Nov 2023****Time: 3:00 Hours****Max. Marks: 40**

Note: Answer any 5 questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 Explain the principle behind mass spectroscopy. Describe the key steps involved in this process and discuss its significance in the analysis of biomolecules. Provide examples of biomolecules that are commonly analyzed by mass spectroscopy. [08][3]

Q.2 Explain ubiquitination and elaborate on the enzymes involved in the process. How does ubiquitination target proteins for degradation? Give an example of a disease linked to dysregulated ubiquitination. [08][3]

Q.3 Why is protein extraction important? Discuss in detail the steps involved in protein extraction from the tissue chunk. What are the various factors that affect the efficiency of protein extraction? [08][2]

Q.4 Explain with description about the following terms:
I. Genomic imprinting
II. Phylogenetic profiling
III. Gene cluster
IV. Gene neighborhood [08][4]

Q.5 What are the different techniques for protein-protein interaction studies? Explain any two techniques with proper protocol and diagram [08][5]

Q.6 Why is there a pH difference between stacking gel and resolving gel? Explain the importance of TEMED and APS in SDS gel electrophoresis. Explain the step-by-step procedure of sample preparation for Gel electrophoresis. Discuss the composition of stacking gel, resolving gel, and running buffer. [08][1]

Total No. of Pages:2

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Roll No.....

FIRST SEMESTER

M. Tech. (BIOINFORMATICS)

END TERM EXAMINATION

Nov/Dec-2023

BIO5301 DATA WAREHOUSE AND DATA MINING

Time: 3:00 Hours

Max. Marks: 50

Note: All questions are compulsory. Assume suitable missing data, if any.

SECTION A

Q1 Attempt any FIVE:

[2X5]

- a) Define Data mining? Explain about data mining on what kind of data.
- b) Describe in detail about Rule based Classification.
- c) What are eager learners and lazy learners?
- d) What is the use of Meta data in data warehouse?
- e) How can Data Mining help business analyst?
- f) What is prediction? Explain about Linear regression method.

SECTION B

Attempt any Four:

- Q2 a) Compare and contrast K-means and DBSCAN. [2X5]
- b) State K-means algorithm. Apply k-means algorithm with two iterations to form two clusters by taking the initial clusters centers as subjects 1 and 4

Subject	A	B
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	3.5	4.5

Q3 a) Briefly compare data cleaning, data transformation, refresh. [2X5]
 b) What are the principles of APRIORI algorithm? Illustrate working of A-priori algorithm for the following dataset?

Transaction ID	Items
T001	Milk, dal, sugar, bread
T002	Dal, sugar, wheat, jam
T003	Milk, bread, curd, paneer
T004	Wheat, paneer, dal, sugar
T005	Milk, paneer, bread
T006	Wheat, dal, paneer, bread

Can we design a method that mines the complete set of frequent item sets without candidate generation? If yes, explain with example table mentioned above.

Q4 a) Describe the steps involved in Knowledge Discovery in Database (KDD) process. [2X5]

b) Describe the essential features of decision trees in context of classification. What are the advantages and disadvantages of decision trees over other classification methods?

Q5 a) what do you meant by slice and dice? Give an example. [2X5]

b) How does a snowflake schema differ from a star schema? Name two advantages and two disadvantages of the snowflake schema.

Q6. a) Explain FP Growth algorithm. [2X5]

b) Explain Naïve Bayes algorithm. Show how it is used in classification.

Total No. of Pages 01

Roll no.....

IInd SEMESTER
M.Toch.

END TERM EXAMINATION

Nov 2023

BIO 5407 OMICS IN MEDICINES

Time: 3:00 Hours

Max. Marks: 50

Note: Answer any 5 questions.
All questions carry equal marks,
Assume suitable missing data, if any.

- Q.1. How omics theory is important and considered as the central dogma of life? Explain your answer with pictorial representation. [10][1]
- Q.2. How do non-coding RNAs contribute to the fine-tuning of gene expression in response to environmental cues and cellular signals? What are the different classes of ncRNAs? Explain their functional roles in regulating gene expression, and how do they contribute to cellular processes. [10][4]
- Q.3. What are the key phases involved in a clinical trial and what distinguishes each phase from the others in terms of objectives, size, and participants involved? [10][3]
- Q.4. Explain the process of risk assessment in the context of genetic disorders. Discuss the factors considered during risk assessment such as family history, genetic testing, and counseling. [10][5]
- Q.5. What are the techniques used in metagenomics? Discuss any one technique in detail. What are the applications of metagenomics and how it differs from genomics? [10][2]
- Q.6. Explain the dynamics of host-pathogen interaction. How do host characteristics influence the host-pathogen interaction and what is its evolutionary perspective? [10][2]
- Q.7. What is a monogenic disease, and how does it differ from a polygenic disease? How might advances in precision medicine impact the understanding and treatment of polygenic diseases? [10][3]

III SEMESTER

M.Tech. (BIOINFOMATICS)

END TERM EXAMINATION

Dec-2023

BIO6207 (Entrepreneurship)

Time: 03:00 Hours

Max. Marks: 50

Note : All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1 What methods or tools can be used to effectively allocate resources in a project? Discuss their advantages and limitations. [10][CO3]
- Q.2 What are the legal differences between sole proprietorships, partnership, LLC and corporations? [10][CO5]
- Q.3 How do business incorporate risk assessment into budgeting decisions? Discuss the techniques for risk analysis in investment projects. [10][CO2]
- Q.4 What are the key performance indicators (KPI) used to monitor project progress and performance? [10][CO4]
- Q.5 What are the challenges faced by SSIs in complying with regulatory policies and how can government streamline these processes? [10][CO1]

Total No. of Pages: 02

Roll No.

3rd SEMESTER

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M.Tech. (BIO)

Nov-2023

END TERM EXAMINATION

BIO 6401 Drug Design and Discovery

Time: 3:00 Hours

Max. Marks : 40

Note : Answer any 5 questions from questions
Assume suitable missing data, if any.

Q.1 Write short notes on the following:

(CO# 2,3,)

- a. Competitive enzyme inhibitors
- b. Lead design
- c. Molecular docking
- d. QSAR

Q.2 a. Explain the different phases of clinical trials. What is placebo?
b. Explain the importance of randomization in cohort design.
c. Explain how nanotechnology can be used for drug delivery?

(CO# 4)

Q.3 a. Explain how pharmacophore modelling is useful in drug design.
Support your answer with a suitable case study.

- b. What is peptidomimetics? How can it aid in designing better drugs, explain using suitable examples.
- c. What is the difference between tachyphylaxis and tolerance?

CO# 3, 5)

Q.4. a. Using suitable case study, describe how computer aided drug design can hasten the serendipitous traditional drug design methods.

b. What are the essential characteristics that define a receptor? A receptor ligand pair that exhibits variable affinities of binding in different saturation levels cannot be explained by Law of Mass Action. Discuss how activation aggregation theory can explain such interactions.

c. How does formulation of a drug determine its bioavailability in the tissues for optimal activity?

(CO #1, 2, 5)

Q5. a. Enumerate the factors influencing the selection of drug delivery route.

b. What are the steps involved in filing of patents in India? What is a PCT application?

c. Trademark violations are based on perception of an impressionable market for a product and may even find credibility despite a very popular trademark not having been registered. Comment using appropriate examples. (CO# 4)

Q6. In each of the following cases, comment on whether patent shall be granted or not and give appropriate reasons for the same. (CO# 4)

- a. A drug company which already holds a patent on a drug now makes variations in side chains and files patents for each such variant.
- b. New usage of the variant drugs in the above case are reported by mixing them together. Hence the company files patent for the mixture
- c. The circuit design for a new horticulture machine with 200% efficiency has been filed for patent.
- d. The above machine itself is being claimed for patenting since no similar machine with 200% efficiency has been reported in the field.
- e. A company has tried to patent a component of a traditional anti-cancer medicinal plant and both product and process patent for extraction have been claimed for patent.
- f. A new mineral was mined from Kashmir, that can be used for making semi-conductors and hence the mining firm wants to patent the mineral.
- g. A new medicinal plant useful for diabetes was artificially propagated in the lab using a novel technique. The investigator wants to patent the tissue culture technique.
- h. 2 investigators lay claim to the same drug for tuberculosis, however investigator from India had filed the application in India which was published in Indian Patent Office publications in May 2022 while the investigator from USA had filed a PCT application in June 2022.

END TERM EXAMINATION

NOV/DEC-2023

CH407 POLYMER BLENDS & COMPOSITES

Time: 3 Hours

Max. Marks: 50

Note: Attempt any Five questions

All questions carry equal marks.

Assume suitable missing data, if any.

- Q.1[A] Which thermodynamic conditions need to be fulfilled for the miscible multi-component polymer blend system? [5][CO1]
- [B] "If the reinforcements are in the form of Preforms of Fibre-fabrics, laid in the mould cavity and fluid resin is then injected into the mould cavity." Evaluate which type of Injection moulding technique you will recommend and why? What are the advantages of this particular Injection moulding technique? [3][CO5]
- [C] Enlist the objectives achieved by polymer blending. [2][CO1]
- Q.2[A] Which types of reinforcement are used in composite materials? [2][CO1]
- [B] Which coupling agents are used to increase adhesion between glass fibres and matrix and Why? [3][CO2]
- [C] How density of Composite material is determined? [2][CO5]
- [D] What is the effect of large interfacial tension between the polymer phases? How the interfacial tension can be reduced? [3][CO5]

- Q.3[A] Which fibres are used in composites to produce Bulletproof vests? Justify the properties of this fibre with respect to its chemical structure. [2][CO2]
- [B] How the voids, cracks, or defects detected in composites by X-ray technique? [3][CO4]
- [C] On blending Natural rubber and Synthetic rubber, the improvement in which properties are obtained? [3][CO3]
- [D] Which Thermo-analytical techniques are used in the characterization of Polymer Blends [2][CO5]
- Q.4[A] List the parameters needed to assess the three main properties of composites—modulus, strength and ductility. [2][CO2]
- [B] How does the blending of PVC and ABS help in achieving the new properties in the resulting blend? [3][CO3]
- [C] Explain with the help of phase diagram LCST and UCST concept related to the miscibility of binary polymer blend. [5][CO3]
- Q.5[A] What is the effect of composition and shear rate on morphology development? [5][CO1]
- [B] Using which arithmetical semi-empirical rule the property of miscible and immiscible polyblends can be predicted? Explain. [5][CO5]
- Q.6[A] What are Compatibilizers? How do these increase compatibility between polymer components in a polymer blend? [5][CO2]
- [B] How does the glass transition temperature of polymeric constituents and polyblends help to predict compatibility? [2][CO5]
- [C] Which structural components of aircraft are currently made from polymeric composites? [3][CO5]
-

Total No. of Pages 03

Roll No.

FIRST SEMESTER

M.Tech. [C&I]

END SEMESTER EXAMINATION

Nov/Dec 2023

C&I 501 System Theory

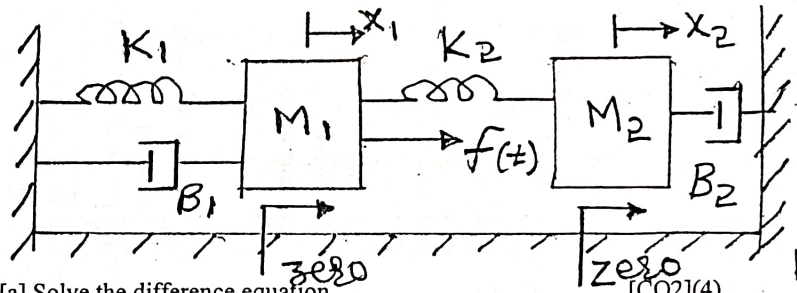
Time: 3:00 Hours

Max. Marks :40

Note: Attempt any five questions. Assume suitable missing data, if any. All Questions carry equal marks.

1 [a] Derive the state model for an Armature Controlled DC Motor. Specify all the symbols used. [CO1](4)

1 [b] Obtain the state space (State Model) representation for the mechanical system shown in figure 1. [CO1](4)



2 [a] Solve the difference equation $c(k+2) + 3c(k+1) + 2c(k) = u(k)$; $c(0) = 1$
 $c(k) = 0$ for $k < 0$. [CO2](4)

2 [b] A system is described by the following differential equation. Represent the system in phase variable form: [CO3](4)

$$\frac{d^3x(t)}{dt^3} + 3\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 4x(t) = u_1(t) + 4u_2(t) + 4u_3(t)$$

Outputs are

$$y_1(t) = 4 \frac{dx(t)}{dt} + 3u_1(t)$$

$$y_2(t) = \frac{d^2x(t)}{dt^2} + 4u_2(t) + u_3(t)$$

- 3 [a] For a system represented by the state equation $\dot{X}(t) = AX(t)$ [CO3](4)

the response of

$$X(0) = \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \end{bmatrix} \text{ when } X(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$$

And

$$X(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix} \text{ when } X(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

Determine the system matrix A and state transition matrix.

- 3[b] Derive the transfer function from the data given below for continuous system. [CO3](4)

$$A = \begin{bmatrix} -3 & 1 \\ 0 & -1 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, C = [1 \quad 1], D = 0$$

- 4 [a] Discuss the need of state variable theory. [CO1](4)

- 4 [b] Find the z transform of the output for the LDS described by $c(k+2) + 6c(k+1) + 5c(k) = 4r(k+2) + 3r(k+1) + 2r(k)$. [CO2](4)

- 5[a] Discuss the sampled data control system with the help of neat diagram. Discuss the need of sampler and zero order hold devices. [CO2](4)

- 5[b] Consider the dynamics of a non-homogeneous system as [CO3](4)

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

where $u(t)$ is the unit step function occurring at $t=0$.

$$y(t) = [1 \quad 0]X(t)$$

and the initial condition $X(0) = [1 \quad 0]^T$

Determine the solution of state equation using Laplace inverse transform technique.

- 6[a]. Obtain the state transition matrix of the following discrete time system

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} \quad [\text{CO4}](4)$$

- 6[b]. Determine the stability of the following characteristic equation using Bilinear Transformation. [CO2](4)

$$Z^3 - 0.2Z^2 - 0.25Z + 0.05 = 0$$

7. A discrete time system is described by state equation [CO4](2×4)

$$y(k+2) + 5y(k+1) + 6y(k) = u(k)$$

$$y(0) = y(1) = 0; T = 1 \text{ sec.}$$

- Derive the state model in phase variable form
- Derive the state model in canonical form
- Find the STM
- For unit step input $u(k)=1$ for $k \geq 0$, find output $y(k)$.

Note: Answer any five questions. All questions carry equal marks.
Assume suitable missing data, if any.

Q.1) (a) Explain working of photo-emissive cell, photoconductive cell, and photovoltaic cell.

(b) A resistance strain gauge with gauge factor 2 is fastened to a steel rod, subjected to a stress of 500 kg/cm^2 . If modulus of elasticity of steel is $2 \times 10^6 \text{ kg/cm}^2$, find the change in resistance of the strain gauge element due to applied stress. [5+3][CO4]

Q.2) (a) Explain working of Hall Effect sensor.

(b) A Capacitance type transducer has two plates surface area 400 mm^2 ($20 \times 20 \text{ mm}$) each. The distance between the plates is 2 mm. The value of capacitance of the set-up is 10 Pico farad without any external pressure on the plate. Find out the change in capacitance when a pressure of 2×10^5 Newton per square meter is applied on the plate due to which the distance between the plates is reduced to 1.5 mm. [4+4][CO4]

Q.3) (a) The four arm of a bridge are:

Arm ab: an imperfect capacitor C_1 with an equivalent series resistance of r_1 .

Arm bc: a non-inductive resistance R_3 .

Arm cd: a non-inductive resistance R_4 .

Arm da: an imperfect capacitor C_2 with an equivalent series resistance of r_2 in series with a resistance R_2 .

A supply of 450 Hz is given between terminals a and c and the detector is connected between b and d. At balance:

$R_2 = 4.8 \Omega$, $R_3 = 2000 \Omega$, $R_4 = 2850 \Omega$ and $C_2 = 0.5 \mu F$ and $r_2 = 0.4 \Omega$. Calculate the value of C_1 and r_1 and dissipation factor for this capacitor.

(b) What are the applications of Wein Bridge, write the formula used for measurement of frequency in the bridge. [5+3][CO2]

Q.4) (a) Explain working of Q-meter for measurement of a high impedance component in the parallel connection circuit. [5][CO3]

(b) A Thermistor has a resistance of 3980 ohm at the ice point ($0^\circ C$) and 794 ohm at $50^\circ C$. The resistance temperature relationship is given by: $R_T = aR_0 \exp(b/T)$. Calculate the constants a and b . Calculate the range of resistance to be measured in case the temperature varies from $40^\circ C$ to $100^\circ C$. [3][CO4]

Q.5) (a) Explain Working of successive approximation DVM.

(b) The coil of a moving coil voltmeter is 40mm long and 30mm wide and has 100 turns on it. The control spring exerts a torque of 240×10^{-6} N-m when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is 1.0 Wb/m^2 , estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of the voltmeter coil may be neglected. [5+3][CO3]

Q.6) The GPIB bus structure has eight control lines subdivided into Handshake lines and Interface Management lines, Explain each of them in detail. [8][CO5]

Q.7) Explain in detail working of Function Generator with block diagram representing basic elements of it. [8][CO5]

Total No. of Pages 02

M.Tech (C&I)

End Term Examination

C&I 5303 NON-LINEAR CONTROL THEORY

Time: 03 Hours

Roll No.

FIRST SEMESTER
(Dec.-2023)

Maximum Marks : 50

Note : Question No. 1 is compulsory. Answer any FOUR questions from remaining. Write your name and roll no. on question paper and answer sheet.
Assume suitable missing data, if any.

- 1[a] Determine the Describing Function of nonlinear element, whose input (x) vs output (y) characteristic is described as:

$$y = x^3.$$

- [b] The Jacobian Matrix of a simple pendulum equation is given by

$$J = \begin{bmatrix} 0 & 1 \\ -10\cos x_1 & -1 \end{bmatrix}$$

Determine the eigen values at equilibrium states (0,0) and (π , 0) of the system and state whether equilibrium points are Center, node, focus or saddle points.

- [c] Write the P matrix for following scalar function and find sign of definiteness.

$$V(x) = x_1^2 - 2x_1x_2 + 2x_2^2$$

- [d] Sketch the phase plane portrait for different initial state of the following system and discuss stability of equilibrium point.

$$\dot{x}_1 + x_1 = 0 \quad \dot{x}_2 + 2x_2 = 0$$

- [e] Analyze the stability of singular point of the following second order nonlinear system using Lyapunov first method (Linearization method).

$$\dot{x}_1 = x_1^2 + x_2; \quad \dot{x}_2 = x_1 + x_2^2$$

2x5

- 2 [a] Using Krasovskii's method construct a suitable Lyapunov function and assess the stability of nonlinear system described as:

05

$$\dot{x}_1 = -6x_1 + 2x_2$$

$$\dot{x}_2 = 2x_1 - 6x_2 - 2x_2^3$$

- [b] Consider the following scalar function

$\dot{x} + x^2 = 0$ and $x(0) = -1$, Find the solution $x(t)$ and show that this system has finite escape time.

05

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3. The motion of a constant mass attached to a nonlinear spring which become relatively stiffer with increase in displacement is described by the following equation

$$\ddot{x} + 25(1 + 0.1x^2)x = 0$$

Find the phase plane solution curve for this system by using Delta method with the initial condition $x(0)=3, \dot{x}=0$;

10

4. The circuit shown in Fig.1 contains a nonlinear inductor and is driven by a time dependent current source. Suppose that the time dependent current is described by $i_L = L\phi_L + \mu\phi_L^3$ where ϕ_L is magnetic flux of the inductor and L and μ are positive constants.

(a) Use ϕ_L and v_c as state variables and write state space representation this system.
(b) Find all equilibrium points when $i_s = 0$



Fig. 1

5. Linearize the following nonlinear system about $x=0$ and use the Lyapunov direct method to construct suitable Lyapunov function to determine the stability of the system

10

$$\dot{x}_1 = x_2^2 + x_1 \cos x_2$$

$$\dot{x}_2 = x_2 + (x_1 + 1)x_1 + x_1 \sin x_2$$

10

6. Use Variable gradient method to construct a Lyapunov function for the system described as:

$$\dot{x}_1 = x_2; \dot{x}_2 = -x_2 - x_1^3$$

Show that the origin is a globally stable equilibrium state of the system.

10

7. Consider the Nonlinear system shown in Fig.2, check if a limit cycle is predicted. If limit cycle exists assess its stability and determine its amplitude and frequency. Also, derive the describing function for the nonlinear element.

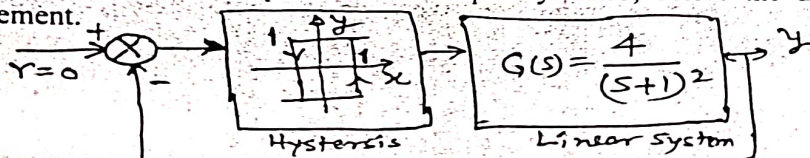


Fig. 2

10

END TERM EXAMINATION

Nov-2023

COURSE CODE: C&I 5401

COURSE TITLE: Analog and Digital Electronics

Time: 3:00 Hours

Max. Marks: 40

Note : If necessary, make appropriate assumptions and approximations and state them.

You must solve all the questions and their parts in the serial order

Q.1 Attempt any FIVE.

[2X5=10]

- (a) Draw the circuit diagram of a Schmitt trigger with inverting transfer characteristics. [CO#2]
- (b) What is the input and output voltage current offsets? [CO#1]
- (c) State the limitations of ideal integrator. [CO#2]
- (d) Plot the transfer characteristics of the circuit shown in the Figure 1. [CO#2]

The op-amp saturates at $\pm 12V$.

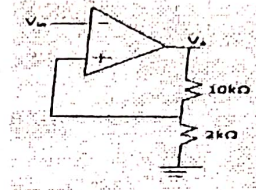


Fig. 1

- (e) For an op-amp having a slew rate of $SR = 2 V/\mu s$, what is the maximum closed-loop voltage gain that can be used when the input signal varies by $0.5 V$ in $10 \mu s$? [CO#1]
- (f) Write the properties of negative feedback. [CO#1]

Q2. Attempt any TWO:

[4X2=8]

- (a) A Schmitt trigger with the upper threshold level $V_{UT} = 0V$ and hysteresis width $= 0.2V$ converts a $1 KHz$ sine wave of amplitude $4V_{pp}$ into a square wave. Calculate the time duration of the negative and positive portion of the output waveform.

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- (b) Explain general impedance converter (GIC). Draw the circuit diagram of GIC as a capacitor. [CO#3]
 (c) What is the use of level shifter stage? Draw its circuit diagram. [CO#2]

Q3. Briefly explain any THREE of the following: [4X3=12] [CO#3,4]

- (a) Input and Output Swing Limitation in Op-Amp.
 (b) Different Compensation Techniques.
 (c) Dynamic Limitation of Op-Amp.
 (d) Static Limitation of Op-Amp.

Q4. Answer the following questions: [5X2=10][CO#5]

- (a) Explain how dynamic CMOS design technique achieves power savings compared to static CMOS design technique during the input transitions.
 (b) "NMOS transistor cannot pass strong logic 1". Justify the statement.
 (c) What logic equations do the following schematics implement in Figure 2?

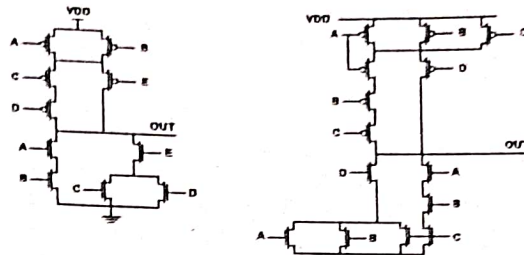


Figure 2

- (d) What is the output function of the following circuit show in Fig. 3?

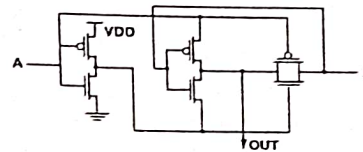


Figure 3

- (e) Differentiate TSPC latch with C²MOS latch.

END TERM EXAMINATION

NOV/DEC-2023

C&I-6309 ADVANCED CONTROL SYSTEM DESIGN

Time: 3:00Hours

Maximum Marks : 50

Note : Answer any FIVE questions.
Assume suitable missing data, if any.

1[a] Prove that if system is completely state controllable then there exist a matrix k that will place the closed loop poles at the desired location. [CO1] (5)

[b] Prove that in dead beat control, any non zero error vector will be driven to origin in at most n sampling period if magnitude of scalar control $u(k)$ is unbounded. [CO1] (5)

2[a] Discuss a more general approach to determine the observer feedback gain matrix K for full order observer. [CO2] (5)

[b] The Dynamics of the system is

$$\dot{X} = GX + HU \text{ and output is } Y = CX$$

$$\text{Where } G = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \quad H = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$C = [1 \ 0 \ 0]$$

By using state feedback control $u = -KX$, it is desired to have the closed loop poles at $s = -2 \pm j2\sqrt{3}$ and $s = -10$. Determine the state feedback gain matrix K . [CO2] (5)

3[a] Discuss the designing of sliding mode controller for single input plant. [CO3] (5)

[b] Consider the following model of dynamical system

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ 1 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U \quad \text{which is to be controlled to}$$

minimise the performance index

$$J = \int_0^\infty [X_1^2 + \frac{1}{2}X_2^2 + \frac{1}{4}U^2] dt$$

Find (i) the solution to the ARE corresponding to the linear state Feedback optimal controller.

(ii) the optimal control law

(iii) the value of performance index J for the optimal closed loop system. [CO3] (5)

4. The approximate difference equation representation for a continuous operating system is $x(k+1)=0.75x(k)+u(k)$; $k=0,1$ where $u(0)$ and $u(1)$ are to be selected to minimize the performance measure $J=u^2(0)+u^2(1)$ subjected to constraints

$$0.0 \leq x(k) \leq 6.0; k=0,1,2$$

$$\text{And } -1.0 \leq u(k) \leq 1.0; k=0,1$$

Quantize the state in to a step of 2 and control input values in to the step of 0.5. Find the optimal control values and minimum cost for each point on the state grid. Use linear interpolation. [CO4] (10)

- 5[a] Find the extremal of the functional

$$J(x) = \int_0^{\pi/4} (x_1^2 + \dot{x}_2^2 + \dot{x}_1 \dot{x}_2) dt$$

The boundary conditions are $x_1(0)=0$, $x_1(\frac{\pi}{4})=1$, $x_2(0)=0$, $x_2(\frac{\pi}{4})=-1$ [CO5] (5)

- [b] Find the extremal of the functional

$$J(x) = \int_0^1 (t \dot{x} + \dot{x}^2) dt$$

The boundary conditions are $x(0)=2$, $x(1)=\text{free}$ [CO5] (5)

- 6[a] Consider the following model of dynamical system

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U, \text{ which is to be controlled to minimise the performance index}$$

$$J = \frac{1}{2} \int_0^2 u^2 dt, \text{ Given } x_1(0) = x_2(0) = 1 \text{ and } x_1(2) = x_2(2) = 0$$

Find optimal control input u^* using Hamiltonian equation [CO4] (5)

- [b] For a linear regulator problem find optimal control input $u^*(t)$ to maintain the state vector close to the origin without an excessive expenditure of control effort. [CO5] (5)

- 7 Write short notes on following:

[CO1] (5,5)

- [a] Tracking Problem

- [b] Tuning of PID controller

C&I-6401 SCADA and Energy Management System

Time: 3:00 Hours

Max. Marks: 40

Note: Attempt FIVE questions. Assume suitable missing data, if any.

Q.1.

- (a) Explain the significance of Cyber Security in SCADA? What are the various Cyber Security measures applied in SCADA Systems? (4x2) [CO5]
- (b) Explain the various components of a data communication system. Briefly describe what are the various types Networks? With the aid of suitable diagrams describe the three Local Area Network topologies that are commonly used today. [CO1]

Q.2.

- (a) Explain the various components of RTU and the functions performed by it with the help of suitable diagrams (4x2) [CO3]
- (b) What are the different types of data reporting employed by a SCADA system? [CO2]

Q.3.

- (a) Explain the master station hardware and software components (4x2) [CO4]
- (b) Explain the dual redundant SCADA system employed for a real time process application [CO4]

Q.4.

- (a) What are the different modes of operation of a power system? Explain the standard activities carried out by the central control room of a centralized energy system. (4x2) [CO6]
- (b) Elucidate the scope of energy management programme (EMP) and list the necessary steps for its implementation. [CO6]

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Q.5. (4x2)
(a) Elaborate on the Demand Side Management (DSM) in power system. [CO6]
(b) What are the technologies used in DSM? [CO6]

Q.6. (4x2)
(a) In what way does the MTU treat an Alarm differently than it treats a status point? List the desired features of Alarms and Reports, in a typical operator interface, to make the presentation of information most effective. [CO5]
(b) Explain the features of Real Time Operating System. [CO2]
Explain the factors which affects the scan cycle at MTU?

Q.7. Write short notes on the following: - (4x2)
(a) Inductive proximity sensors [CO3]
(b) IEC 61850 Protocol [CO1]

Total no. of Pages: 02
End Term Examination
First Semester

Roll no.....
Nov-202
M.Tech. CS

Paper Code: CSE501 Advanced Database Management System

Duration: 3 Hours

Max Marks: 40

Note: All questions are compulsory.
Marks for questions are indicated alongside
Assume suitable missing data, if any.

- Q1. a) Explain attribute inheritance in ER- Diagram. [2] [CO:
b) How does the concept of an object in the OO model differs from
the concept of the entity in ER model? [2] [CO:
c) Explain all mapping cardinalities in ER – Diagram. [2] [CO:
d) Describe wait-die and wound-wait scheme of deadlock preventic
in transactions. [2] [CO:

- Q2. a) Use Armstrong's axioms to prove the soundness of the pseud
transitivity rule. [2] [CO:
b) Compute the canonical cover of the following set of function
dependencies for relation schema. [4] [CO:

$R = (A, B, C, D, E)$

$A \rightarrow BC$
 $CD \rightarrow E$
 $B \rightarrow D$
 $E \rightarrow A$

- c) What is the cost based optimization? [2] [CO:

- Q3. a) What are the causes of bucket overflow in a hash fi
organization? How it can be reduced? [2] [CO:

- b) Explain the commit protocols used in distributed database system
[4] [CO

- c) List any five Equivalence rules used in query optimization with th
help of an example. [2] [CO

[8][CO1,2,3,4]

Q4. Differentiate between (any four):

- a) Homogeneous and Heterogeneous databases.
- b) Static and Dynamic Hashing
- c) Sequential and multitable clustering file organization
- d) Interquery and Intraquery parallelism
- e) Hash and range partitioning.
- f) Clustering and secondary index

[8][CO1,2,3,4]

Q5. Define the following terms (any four):

- a) Materialization
- b) Bucket Overflow
- c) Indexing
- d) OLAP
- e) Association rules

END

Total No. of Pages:3

Roll No.....

I SEMESTER

M.Tech.(CSE)

End SEMESTER EXAMINATION (November – 2023)

CSE503

Advance Algorithm & Data Structure

Time: 3 Hours

Max. Marks: 40

Note: Answer any 8 questions. All Qs carry 5 marks each. Assume suitable missing data, if any.

Q1. (i) Solve the following recurrence relation using recursion tree

$$T(n)=3T(n/2)+n, T(n)=T(n-1) + T(n/2) +n$$

(ii) Use master method to solve recurrence relation

$$T(n)= 6 T(n/3) + n^2 \log(n), T(n)=T(n/2) + n(2- \cos(n))$$

[CO1][3,2]

Q2. (i) What are the properties of sparse matrices. Name three applications where they are used.

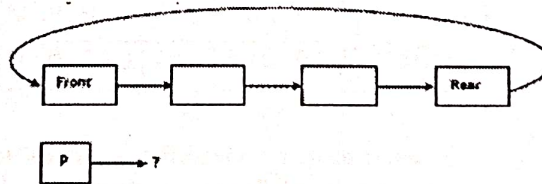
(ii) Propose any two representation of sparse matrices. Is time complexity improved using these representation. Justify your answer with suitable example for any one representation.

[CO3][2.5x2]

Q3. (i) Write down a program to store two stacks in to single array efficiently and implement stack operations.

(ii) A circularly linked list is used to represent a Queue. A single variable p is used to access the Queue. To which node should p point such that both the operations enqueue and dequeue can be performed in constant time? Write down corresponding algorithms.

[CO1] [3,2]



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Q4. (i) Suppose that we start from an empty Red-Black tree, and that we perform n insert operations, where $n > 1$. Prove that we necessarily end up with a Red-Black tree which has at least one red vertex.

(ii) Explain with example the steps of union operation on binomial heap trees. [CO3][2, 3]

Q5. Develop most efficient algorithm that finds k_{th} minimum element in given array of n elements. For example in array [4,3,13,2,12,7,23], 4th smallest is 7. Justify your answer with this example. [CO4][5]

Q6. Suppose Bellman Ford Algorithm is run on the Graph shown in Figure 1.

Draw a table showing the intermediate distance values of all the nodes at each iteration of the algorithm and Show the final shortest-path tree.

[CO2] [5]

Q7. Write any three important characteristics to solve problem using Dynamic Programming. Apply it to multiply following chain of matrices:

$A_1[30 \times 25]$, $A_2[25 \times 15]$, $A_3[15 \times 5]$, $A_4[5 \times 20]$, $A_5[20 \times 45]$

[CO4][5]

Q8. Determine the cost and structure of optimal Binary search tree for $n = 5$ keys with following probabilities:

i	0	1	2	3	4	5
p_i		0.15	0.10	0.05	0.10	0.20
q_i	0.10	0.10	0.05	0.05	0.05	0.10

[CO3][5]

Q9. What is N-Queen problem? Describe methods to solve this problem using backtracking? Illustrate steps with the help of 4 queens example. [CO2][5]

Q10. Work out the steps of Depth first search for directed acyclic graph given in Figure 2. Also write its different topological sorts [CO3][5]

Q11. What is the relationship between NP and NP-complete and Polynomial problem Give three examples of NP-complete problem. [CO3][5]

Q12. With the help of suitable example illustrate the method to show that given problem is NP-complete. How do you Solve it? [CO4][5]

Figure 1

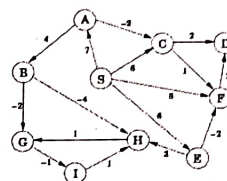
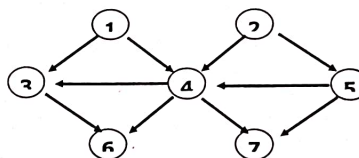


Figure 2



Total No. of Pages 02

FIRST SEMESTER

END TERM EXAMINATION

53
Roll No:.....

M.Tech. (CSE)

NOV/DEC-2023

CSE-5307 Parallel Computer Architecture

Time: 3:00 Hours

Max. Marks : 50

Note : Answer any FIVE questions.
Assume suitable missing data, if any.

Q.No.1

- (a) Explain pipelining by calculating the speedup that may be achieved through pipeline versus base scalar machine. Using a diagram show that how deliberate delay insertion in a pipeline could improve the throughput of the machine.
- (b) Explain Flynn's classification of computer system architecture with neat diagram and suitable examples.

Q.No.2

- (a) Describe the branch effect and branch prediction in detail. And also define the performance degradation factor due to branch prediction.
- (b) Are Amdahl's law and Gustafson's law are special cases of fixed memory mode. Justify your answer.

Q.No.3

- (a) Differentiate between implicit and explicit parallelism and also discuss Hardware and Software parallelism with suitable examples.
- (b) Discuss grain packing and scheduling with suitable examples and also discuss node duplication example in a static multiprocessor system.

Q.No.4

- (a) Describe Tomasulo's and scoreboarding techniques for dynamic scheduling in details.
- (b) Compare the PRAM model with physical model of parallel computers in which PRAM variant can be best model SIMD machines and how?

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Q.No.5

- (a) What do mean by Dynamic Instruction Scheduling? How it is different from static instruction scheduling?
- (b) Explain the various network properties and differentiate between static and dynamic inter connection. And also discuss 16X16 baseline network.

Q.No.6

(a) Consider the following pipeline reservation table:

	1	2	3	4	5
S1	X			X	
S2		X			X
S3	X		X		
S4				X	X

- What are the forbidden latencies?
 - Draw the state transition diagram
 - List all the cycles indicating simple and greedy cycles if any.
 - Determine the minimal average latency.
 - Let the pipeline clock period is 10 ns. Determine the throughput of the pipeline.
 - Redraw the reservation table and explain briefly how you could improve the latency.
- (b) Draw and define the architecture and instruction format of a VLIW processor.

Q.No.7

Write short notes on any two:

- Data Flow Vs Control Flow Computers.
- Harmonic Mean Speedup.
- Internal Data Forwarding process.

rewards and estimated Q-values for these actions are: North (Reward: 2, Q-value: 5), South (Reward: -1, Q-value: 1), East (Reward: 0, Q-value: 3), and West (Reward: 3, Q-value: 4). Calculate the V-value (Value Function) of State S based on these Q-values and explain how these Q-values might influence the agent's policy in choosing the action that maximizes its long-term reward. Further, write Bellman Equation for the State-Value Function and explain each term. [2+2] [CO1, CO3]

5[a] Consider a numerical problem involving a Markov Decision Process (MDP) with value iteration. The MDP has three states: S_1 , S_2 , and S_3 . The actions available from each state are as follows: from S_1 , action "a" leads to S_2 with a reward of +10, and action "b" returns to S_1 with no reward. From S_2 , action "c" leads to S_3 with a reward of +5, and action "d" returns to S_1 with a reward of +2. In S_3 , there is only one action, "e", which ends the process and grants a reward of +20. Assume a discount factor (γ) of 0.5 and start with initial values of $V(S_1) = 0$, $V(S_2) = 0$, and $V(S_3) = 0$. Perform one iteration of value iteration and calculate the updated values for $V(S_1)$, $V(S_2)$, and $V(S_3)$, applying the value iteration update rule. Note that environment is deterministic i.e. each action is leading to a known state with probability 1. [4] [CO1, CO3]

[b] Consider a 4x4 grid world, where each cell represents a state, and the states are numbered 1 through 15, with 'G' representing the goal state. The agent can move up, down, left, or right in this grid but is not allowed to move diagonally. The agent starts at state 1, and the episode ends when it moves into the goal state 'G' from state 15. The agent receives a reward of +0.5 for each transition it makes, except for transitions into the goal state, which yield a reward of +1. The agent follows a fixed policy π , moving through the states in the order: $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 8 \rightarrow 12 \rightarrow 11 \rightarrow 15 \rightarrow G$. Using the Temporal Difference (TD) learning method (TD(0)), with a learning rate (α) of 0.1 and a discount factor (γ) of 1, calculate the updated value of state 1 after the agent completes the first full episode, starting with all state values initialized to 0. [2+2] [CO1, CO3]

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	G

Fig. 3

---Best of Luck---

Total No. of Pages: 04

FIRST SEMESTER

Roll No.

M.Tech. (CSE)

END SEMESTER EXAMINATION Nov-Dec, 2023

CSE5401 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Time: 3:00 Hours

Max. Marks: 40

Note: Answer ALL questions.
Assume suitable missing data, if any.
CO# is course outcome(s) related to the question.

1. Answer any TWO of the followings

- Assume you have been engaged by a healthcare organization to explore the feasibility of integrating artificial intelligence (AI) solutions (excluding robotic implementations) into their services. You are presented with a list of primary healthcare activities, including Patient diagnosis, Treatment planning, Medical imaging analysis, Patient health monitoring, and Drug discovery. For each activity: [2+2] [CO1, CO2]
 - Determine which of these activities can be effectively automated or enhanced using AI technologies.
 - Critically analyze the benefits and potential limitations of applying AI in these activities. [Maximum two sentences for each task]
- Conduct a depth-first search (DFS) and a breadth-first search (BFS) on the tree shown in Fig. 1. The start node is 'S' and the goal node is 'G'. Which nodes are explored first in DFS and BFS? [2+2] [CO1, CO2]

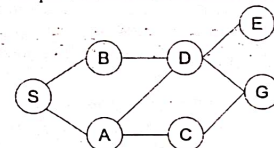


Fig. 1

- Let, now it is decided to use iterative deepening depth-first search (IDDFS) instead of DFS or BSF. Assume that the maximum depth of the tree is 3. In what order are the nodes visited? Compare the number of nodes visited by DFS, BFS, and IDDFS. Which algorithm visits the fewest nodes in this case? [2+2] [CO1, CO2]

2[a] A delivery drone needs to navigate through a 4x4 city grid from the bottom left corner (0,0) to the top right corner (3,3), avoiding no-fly zones at (1,1), (2,2), (0,3), and (3,0). Each move costs one unit of battery, and due to prevailing winds, Using the A* algorithm with the Euclidean distance as a heuristic, find the most efficient route for the drone, considering its movement preference and no-fly zones. Note: In case of same cost (f) and nodes are generated simultaneously, the drone prefers flying east or west over north or south. Also, if nodes have equal f values, previously generated node is expanded first. [4] [CO2]

[b] Consider the drone navigation problem in 2[a]. Apply the uniform-cost search to find the optimal path from the initial state to the goal state. Show the order in which the nodes are expanded. Compare the performance of A* search to uniform-cost search on this problem. Which algorithm is more efficient and why? [3+1] [CO2]

3. Answer any TWO of the followings

[a] Imagine a smart energy management system that oversees a 3x3 grid of office spaces in a building. Each office space can be in one of three states: requires heating (H), requires cooling (C), or is at a comfortable temperature (T). The system's task is to maintain optimal temperature across the grid for energy efficiency and occupant comfort. The system uses a heuristic function to evaluate the overall state of the office grid, defined as follows:

Heuristic Function: +10 points for each office at a comfortable temperature (T), +5 points for each office needing cooling (C) but adjacent to a comfortable office, +3 points for each office needing heating (H) but adjacent to a comfortable office, -2 points for each office that needs heating or cooling but is isolated from comfortably tempered offices.

Given the current state of the office grid in Fig., use the Steepest-Ascent Hill Climbing algorithm with the above heuristic function to find the next state.

H	C	T
C	H	C
T	H	C

Fig. 2

The heuristic used is the Manhattan distance. (Which is the distance measured along axes at right angles. That is the total number of

horizontal and vertical moves required to go from one point to another, without diagonal movement. [4] [CO1, CO3]

[b] Consider a game tree of depth 4 for two players MAX and MIN. The tree is structured as follows: Level 1 (Root, MAX): Node: A, Level 2 (MIN): Nodes: B, C, D (Children of A), Level 3 (MAX): Nodes: E, F, G (Children of B), Nodes: H, I (Children of C), Node: J (Child of D) Level 4 (Leaf Nodes, Scores assigned): Nodes: K, L, M (Children of E) with Scores: 2, 4, 6 Nodes: N, O (Children of F) with Scores: 8, 7, Nodes: P, Q, R (Children of G) with Scores: 1, 7, 7, Nodes: S, T (Children of H) with Scores: 0, 9, Nodes: U, V (Children of I) with Scores: 10, 7, Nodes: W, X, Y (Children of J) with Scores: 12, 13, 14. Here symbol '?' denotes unknown values. Is it possible to find minimax value and optimal strategy to play the game for MAX players? Also, calculate alpha and beta cut-offs if possible. Explain each step neatly in concise manner. [2+2] [CO1, CO3]

[c] Two competing bakeries, A (MAX) and B (MIN), are deciding on pricing strategies for a new specialty bread. Bakery A can choose Low, Medium, or High pricing, followed by Bakery B's similar choice. The game's outcomes are quantified by scores reflecting Bakery A's profit against Bakery B's market share loss. The scores are as follows: for matching strategies (Low/Low, Medium/Medium, High/High), the score is 0; Low/Medium: +1, Low/High: +2, Medium/Low: -1, Medium/High: +1, High/Low: -2, High/Medium: -1. Apply the minimax algorithm to determine the optimal pricing strategy for both bakeries. Explain the rationale and steps leading to your solution.. [4] [CO2]

4[a] Suppose, you are an investor analyzing two distinct investment opportunities, Investment X and Investment Y, each with its own set of potential outcomes based on market performance. Investment X presents a scenario where there is a 60% probability of earning a return of ₹10,000, and a 40% chance of earning ₹5,000. On the other hand, Investment Y offers a 70% probability of a return of ₹8,000, and a 30% chance of yielding ₹15,000. Your objective is to determine which investment to choose in order to maximize your expected return. Apply the expectimax algorithm to calculate the expected returns for both Investment X and Investment Y, and decide which investment is more favorable based on these expected values. [4] [CO2]

[b] An AI agent is navigating a grid and is currently in State S, where it can take one of four actions: North, South, East, or West. The immediate

Total No. of Pages:3

THIRD SEMESTER

END SEMESTER EXAMINATION

CSE-6205 ADVANCES IN INTERNET AND WEB TECHNOLOGY

Time: 3:00 Hours

Roll No.....

M. Tech.

November-2023

Max. Marks: 50

Note: Attempt any Five (5) questions. Assume suitable missing data, if any.

Q.1 (a) Explain the importance of using semantic HTML elements in web development. Provide examples of at least three semantic elements and describe how they enhance both the structure and accessibility of a web page. [5] [CO-1,2]

(b) Briefly discuss three key features introduced in HTML5 that were not present in previous HTML versions. Provide an example of how one of these features can be implemented in a web page and explain its impact on user experience. [5] [CO-1,2]

Q.2 (a) Describe the CSS box model and how it influences the layout of web pages. Explain the difference between box-sizing: content-box and box-sizing: border-box and provide a scenario where each would be appropriate. [4] [CO-2]

(b) Choose either Flexbox or Grid and discuss its advantages in creating responsive and flexible layouts. Provide an example of a layout problem that can be efficiently solved using the chosen technique and explain your implementation. [3] [CO-2]

(c) Illustrate through examples showcasing different specificity levels, such as: [3] [CO-2,3]

- i. An element selector (p) vs. a class selector (.highlight).
- ii. A class selector (.btn) vs. an ID selector (#submitBtn).
- iii. An inline style vs. a rule in an external stylesheet

Q.3 (a) Define multithreading and expound upon its distinctions from single-threading. Elaborate on the manner in which multithreading augments resource utilization in contrast to multiprocessing, elucidating the nuanced advantages it presents in the realm of concurrent program execution. [5] [CO-3,4]

(b) Elucidate upon the intricacies of state management in the domain of server-side scripting. Discuss into the strategic utilization of sessions and cookies as sophisticated mechanisms to perpetuate and seamlessly preserve user states across a continuum of multiple requests within the dynamic landscape of web development. [5] [CO-4]

Q.4 (a) Discuss the conceptual distinction between information retrieval and data retrieval in the context of digital systems. How do these processes diverge in their objectives and methodologies? Provide examples to illustrate their respective applications and highlight the significance of their roles in managing and extracting meaningful content from large datasets. [4] [CO-4]

(b) Explain the basics of the Hypertext Transfer Protocol (HTTP) used on the web. What are its main goals, and how does it work in connecting browsers and servers? Describe the key methods it employs for communication. [3] [CO-5]

(c) Illustrate the concept of statelessness in the context of HTTP. How does this characteristic influence the design and implementation of web applications? [3] [CO-4]

Q.5 (a) Discuss the evolving landscape of search engine architectures, considering the impact of artificial intelligence and machine learning in refining search algorithms and enhancing user experience. [5] [CO-6]

(b) Examine the Model-View-Controller (MVC) architecture in web development, delineating its fundamental principles and the distinctive roles played by each of its components. Explicate how the separation of concerns within MVC contributes to maintainability, scalability, and code

reusability. Illustrate through examples of scenarios where employing MVC proves advantageous in the design and development of robust and modular Web applications. [5] [CO-5]

Q.6 (a) Construct a stylized and semantically meaningful HTML form for user registration. Include fields for the user's name, email address, password, and a dropdown menu for selecting their country. Implement proper form validation for the email and password fields using HTML attributes. Apply CSS styling to enhance the visual presentation of the form, ensuring a cohesive and user-friendly design. Additionally, incorporate a responsive layout that adapts gracefully to various screen sizes. [5] [CO-3,6]

(b) Create an HTML and CSS-based image gallery that showcases a set of images with a responsive grid layout. Implement a lightbox effect to enlarge and navigate through the images when clicked. Ensure that the gallery maintains visual coherence and functionality on various screen sizes. [5] [CO-3,6]

Q.7 Write short note on (Any five)

- | | |
|-----------------------------|------------|
| (a) Sentiment Analysis | [2] [CO-6] |
| (b) Content-based Filtering | [2] [CO-6] |
| (c) Dark Web | [2] [CO-2] |
| (d) Client-side rendering | [2] [CO-4] |
| (e) Heuristic Cache | [2] [CO-4] |
| (f) Social Media Analytics | [2] [CO-6] |

Total no. of Pages:

Roll no..... 57

III SEMESTER

M.Tech.

END TERM EXAMINATION

Nov/Dec-2023

CSE6301- Natural Language Processing

Time: 03:00 Hours

Max. Marks: 50

Note : All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 [a] Difference between lexicon and dictionary.

[b] Discuss WordNet and ConceptNet.

[10] [CO1]

Q.2 Consider the following four documents (each document is just one sentence).

1. Rahul is a boy.
2. Kitty sat and ate a rat.
3. Rats eat cheese.
4. A rat is moving.

(a) If we do a morphological analysis of the words in the documents which words will have a morphological break-up and what is it?

(b) What will be the part-of-speech tags for each word in each document? Clearly indicate your PoS tag set.

(c) What will be the content of each document after “stop” word removal?

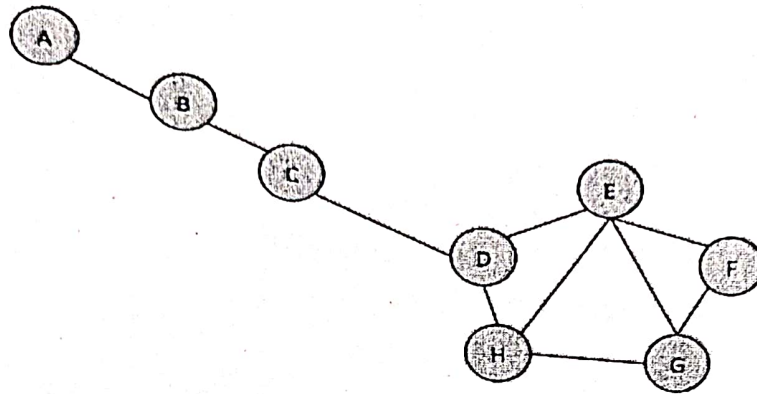
(d) What will be the content of each document after “stemming” each word in the document after stop word removal?

(e) What will be the content of each document after “lemmatization” each word in the document after stop word removal?

[10] [CO2]

Q.3 [a] What is Lesk algorithm for word sense disambiguation? Explain with illustration. [5] [CO3]

[b] Calculate the betweenness and degree centralities for vertex E of graph shown in figure (assume weight of each edge equal to one) [5] [CO3]



Q.4 [a] Explain MRR and how to use it for question-answering evaluation. [5] [CO4]

[b] Discuss the BLEU and ROUGE score with illustration [5] [CO4]

Q.5 What is Query Expansion (QE)? Explain graph based methodology for QE with illustration. [10] [CO4]

OR

What challenges are typically associated with the use of slang terms in communication? Discuss a methodology to handle slang terms in informal text. [10] [CO4]

Total no. of Pages:2

Roll no.....

III SEMESTER

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M.Tech

END TERM EXAMINATION

Nov/Dec-2023

COURSE CODE CSE6401

COURSE TITLE Pattern Recognition

Time: 03:00 Hours

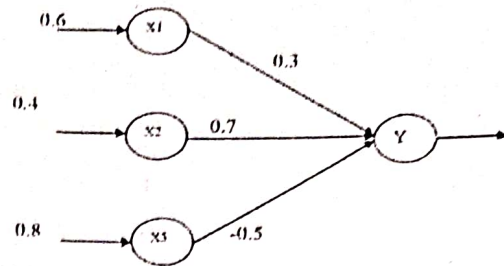
Max. Marks: 40

Note : All questions carry equal marks. Attempt all questions.
Assume suitable missing data, if any.

- Q.1 Differentiate between the following: [4x2=8][CO2]
a) Bias and Variance
b) Reinforcement Learning and Supervised Learning
c) RBFN and BPNN
d) Gaussian Activation function and Sigmoid Activation function
- Q.2 a) What is the significance of entropy in a decision tree? Explain with an example. [4][CO1]
b) Mention any two limitations of Multilayer Perceptron model. Suggest how they may be addressed. [4][CO3]
- Q.3 Write a confusion matrix of your choice. Explain and calculate the Accuracy, Error, Specificity, Sensitivity, False Positive Rate, False Negative Rate, True Positive Rate, True Negative Rate, F1 Measure and Recall for the same. [8][CO3]
- Q.4 a) What is Gini index? Mathematically derive and justify the min and max values of impurity measure computed by it. [4][CO4]
b) Which scenario would you prefer to apply Naïve Bayes over KNN and why so. Discuss the limitations of both the methods. [4][CO4]

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- Q.5 a) Explain receiver operating characteristics with the help of an example. [4][CO1]
b) For the network shown in figure, calculate the net input to the output neuron Y. [4][CO2]



CAD501 System Modelling Simulation and Analysis

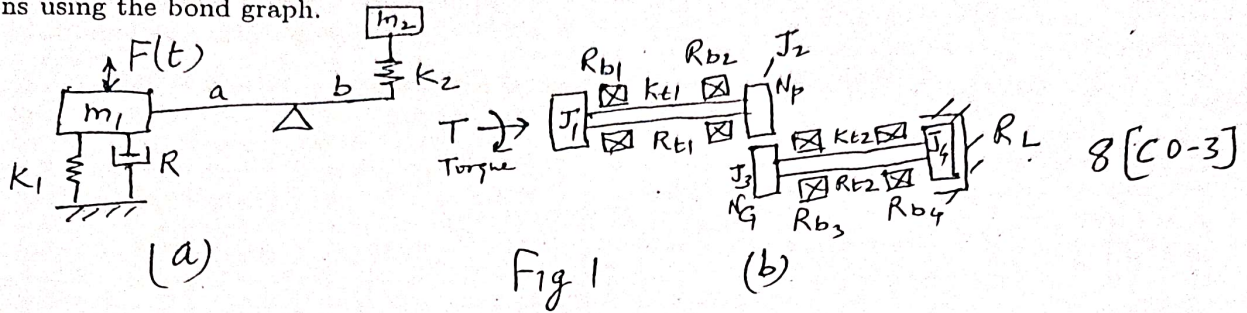
Time: 3 hr

Max Marks : 40

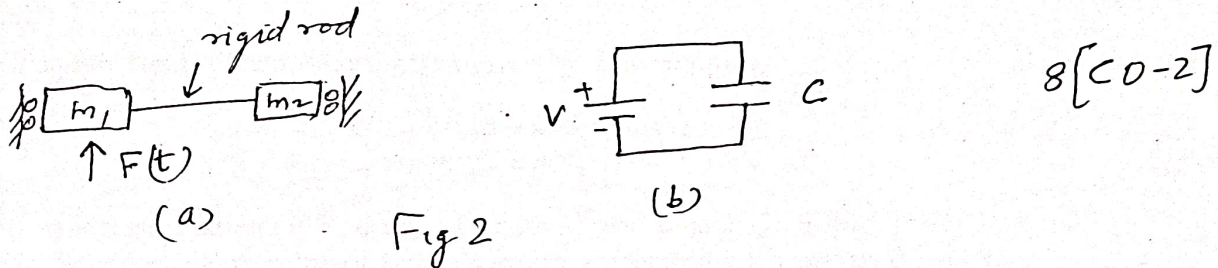
Note: Answer any five questions.

Assume suitable missing data, if any.

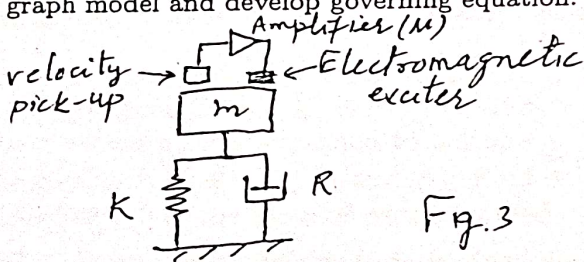
1. Draw bond graph models of the systems shown in Fig. 1. Also develop governing equations using the bond graph.



2. What are differential causality and integral causality? Explain them using two systems shown in Fig. 2. Derive governing equations using bond graph.



3. What is an activated bond? Explain its use for the system shown in Fig. 3. Draw bond graph model and develop governing equation.



4. For a four-bar chain, draw the bond graph model.

- 5(a). Discuss central limit theorem and how it is used to estimate population mean.

- 5(b). Describe lumping, linearity and stationarity with respect to a spring-mass system.

6. Discuss free response, time-constant and stability of a first-order system defined by the equation : $\frac{d}{dt}x(t) = \alpha x(t)$ and initial condition: $x(0) = x_0$.

Total No. of Pages 2
FIRST SEMESTER
END SEM EXAMINATION

Roll No.
M.Tech.(CAAD)
 Nov, 2023

CAD-503 Computational Mechanics of Materials

Time: 3 hr

Max Marks : 50

Note: Answer any five questions.

Assume suitable missing data, if any.

All questions carry equal marks.

1. Tensor representation for v_i is \underline{v} and for $p_{,i}$ is $\text{grad } p$ or ∇p . Give tensor notation for the following:

- (i) $p_{,ii}$
- (ii) $v_{i,j}$
- (iii) $v_{i,i}$
- (iv) σ_{ij}
- (v) $\sigma_{ij,j}$
- (vi) ϵ_{ijk}
- (vii) $\theta_{,i}$
- (viii) $(\rho v_i)_{,i}$
- (ix) $(\rho v_i)_{,j}$
- (x) $S_{ij}T_{ij}$

[CO-1]

2(a). Consider the uniform deformation given by the mapping

$$x_1 = 0.25(18 + 4X_1 + 6X_2)$$

$$x_2 = 0.25(14 + 6X_2)$$

[CO-2]

Find deformation gradient $\underline{\underline{F}}$ and right Cauchy-Green tensor $\underline{\underline{C}}$. Find Green's strain tensor $\underline{\underline{E}}$. What is scalar value of Green's strain associated with material vector (1,0)?

2(b). What is polar decomposition theorem? Find tensors $\underline{\underline{R}}$ and $\underline{\underline{U}}$ for the deformation given in Q2(a). Explain physical significance of Green's strain.

3(a). A material element transforms from undeformed shape of a unit cube to a parallelepiped having sides as $\underline{g}_1 = 1.3\underline{E}_1 - 0.05\underline{E}_2$ and $\underline{g}_2 = 1.78\underline{E}_1 + 1.27\underline{E}_2$. The base vector \underline{E}_3 has deformed to become $\underline{g}_3 = 1.5\underline{E}_3$. Find $\underline{\underline{F}}$. Find stretches of fibers originally in directions \underline{E}_1 and \underline{E}_2 . Find $\det(\underline{\underline{F}})$ and new volume of element. Find area vectors of the faces of parallelepiped.

[CO-2]

3(b). A pure shear deformation is given by

$$x_1 = X_1 + \gamma X_2$$

$$x_2 = X_2$$

$$x_3 = X_3$$

Find $\underline{\underline{F}}$ and $\underline{\underline{C}}$. Find the principal stretches.

4(a). A deformation of a body is described by:

$$\begin{aligned}x_1 &= -6X_2 \\x_2 &= 0.5X_1 \\x_3 &= 0.33X_3\end{aligned}$$

The Cauchy stress tensor for a certain point in the body is given by $\sigma_{22} = 50\text{MPa}$ and other stresses as zero. Determine First and Second Piola-Kirchhoff stresses. Determine the Cauchy traction vector \underline{t} and the first Piola-Kirchhoff traction vector \underline{T} acting on a plane, which is characterized by the outward unit normal $\underline{n} = \underline{e}_2$ in the current configuration.

[CO-3]

4(b) Derive expressions for First- and Second Piola-Kirchhoff stresses. Why is First Piola-Kirchhoff stress called a nominal stress? Why is second Piola-Kirchhoff stress called a pseudo-stress?

5(a). For a pure ccw rotation of angle α about \underline{E}_3 , write \underline{Q} tensor. For $\alpha = 90^\circ$, write \underline{F} tensor. Using $\underline{E} = \frac{1}{2}(\underline{C} - \underline{I})$, derive $E_{ij} = \frac{1}{2}(u_{i,j} + u_{j,i} + u_{k,i}u_{k,j})$. For above \underline{F} , find infinitesimal strain tensor. Also find Cauchy-Green strain tensor. Which one do you find physically appealing for above situation?

[CO-4]

5(b). What are hyperelastic materials? Discuss consequences of frame-indifference and thermodynamic restrictions to find their constitutive law.

6(a). What are a frame-indifferent vector field and a frame-indifferent tensor field? Give examples of invariant tensors, frame-indifferent tensors, and those tensors that are neither of the two.

[CO-4]

6(b). Physical laws are independent of frame of reference. Balance of forces is frame indifferent. Expended power is frame indifferent. Discuss with relevant equations.

7(a). Discuss principle of virtual work with equations for both current geometry and reference geometry.

[CO-4]

7(b). Derive equations of balance of linear momentum for current geometry as well as reference geometry. Also discuss corresponding boundary conditions.

Note: Attempt ALL FIVE questions. Assume suitable missing data, if any.

- (1) (b) If $u = \frac{4x^3y^3}{z^4}$ and errors in x, y, z be 0.001, compute the relative maximum error in u when $x=y=z=1$ [4][CO1]

- (b) Use Doolittle method of LU decomposition to solve the following system of linear equations. [6][CO2]

$$3x_1 - x_2 + x_3 = 1$$

$$2x_1 + 3x_2 + x_3 = 4$$

$$3x_1 + x_2 - 2x_3 = 6$$

- (2) a) Find the eigenvalues of matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$ [2][CO2]

- (b) Use Newton divided difference formula to derive interpolating polynomial for the data points (0, -1), (1, 1), (2, 9), (3, 29), (5, 29) and hence compute the value of point $y(4)$. [8][CO3]

- (3) (a) Using expression $\lambda_i = \int_0^n \frac{s(s-1)\dots(s-i+1)(s-i-1)\dots(s-n)}{(-1)^{n-i} i! (n-i)!} ds$ and $I = \sum_{i=0}^n f(x_i) \lambda_i$

Derive expression of Integration (I) for Simson 3/8 Rule of numerical integration. [4][CO3]

- (b) Find $f'(1.1)$ and $f''(1.1)$ from the following table :

X :	1.0	1.2	1.4	1.6	1.8
f(x) :	0.0	0.128	0.554	1.296	2.4320

[6][CO3]

You can use following expression

$$f'(x) = \frac{1}{h} \left[\Delta f(x_0) + (2s-1) \frac{\Delta^2 f(x_0)}{2} + \frac{(3s^2-6s+2)}{6} \Delta^3 f(x_0) + \frac{(2s^3-9s^2+11s-3)}{12} \Delta^4 f(x_0) + \dots \right]$$

$$f''(x) = \frac{1}{h^2} \left[\Delta^2 f(x_0) + (s-1) \Delta^3 f(x_0) + \frac{6s^2-18s+11}{12} \Delta^4 f(x_0) + \dots \right]$$

- (4) (a) Find the Laplace transform of $e^{-2t} \cos^2 t$ [4][CO4]
 (b) Find Discrete Fourier Transform of the sequence $\{d_k\} = \{1, 2, 3, 4\}$ [6][CO4]

- (5) (a) Given $\frac{dy}{dx} = y - x$, where $y(0) = 2$, find $y(0.1)$ by Euler's method. [4][CO4]
 (b) using the method of least squares, fit a straight line to the four points given
 $(-1.3, 0.03)$, $(-0.1, 1.099)$, $(0.2, 0.808)$ and $(1.3, 1.9=897)$ [6][CO4]
 --END--

Total no. of pages: 3
FIRST SEMESTER
END Semester Exam
CAD-5401

Roll No. _____
M. Tech (CAAD)
NOV 2023
Advanced Vibration and Control

Time: 3:00 Hr.

Max. Marks: 40

Note: 1. Attempt any all questions.
2. Assume missing data , if any

Q-1 (a) Derive the expression of work done by a harmonic force on a harmonic motion. [2] [CO1]

(b) Discuss the different types of isolators and mounts. [2] [CO4]

(C) Represent the periodic motion given in Fig.-1 by a harmonic series. [4] [CO1]

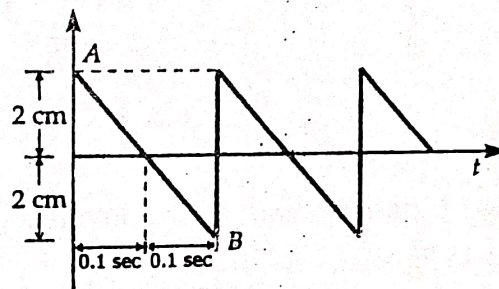


Fig.-1

Q-2 (a) A flywheel having a mass of 30 kg is allowed to swing as shown in Fig.-2. If the measured period of oscillation is 1.50 seconds, determine the moment of inertia of the flywheel about its geometric axis [4] [CO1]

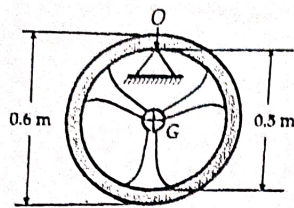


Fig.-2

(b) Find the natural frequencies and mode shapes for the torsional system as shown in Fig.-3. [4] [CO2]

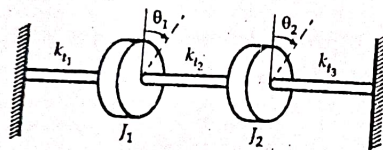


Fig.-3

Q-3 (a) Determine the natural frequency of the system as shown in Fig.-4. [4] [CO3]

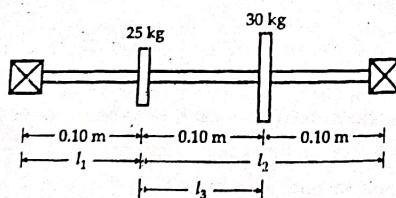


Fig.-4

(b) Define the orthogonal principle and derive the equations, which define the orthogonal principle. [4] [CO3]

Q-4 (a) Explain the working of Frahm Vibration absorber. Discuss the resonant and frequency response curves. [4] [CO4]

(b) Derive the expression of force transmissibility. [2] [CO4]

(c) Define the energy curves and Jump phenomenon. [2] [CO5]

Q-5 (a) A uniform string of length l and a large initial tension S , stretch between two supports, is displaced laterally through a distance a_0 at the centre, and is released at $t=0$. Find the equation of motion for the string. [6] [CO5]

(b) What is non-linear vibration? Give two examples of non-linear vibration. [2] [CO6]

Q-6 (a) (b) Determine the equation for natural frequency of a uniform rod in torsional oscillation with one end fixed and other end free. [4] [CO5]

(c) Derive the expression of time period for hard spring and draw the phase-plane plot. [4] [CO6]

Total No of Pages...Two.....
First Semester
End Semester Examination
CDN – 5203

Paper Code
Time: 03 Hrs.

Note : In total attempt Five Questions.

Question No. 1 is Compulsory.

Attempt four Questions more from the rest of the Question Paper.
Assume missing data, if any.

Roll No..... 70
M Tech [CDN]
(November – 2023)
Smart Structures and Materials

Title of the Subject

Max Marks. 40

- Q No 01** Differentiate between. (2x04=08)
(i) – Conventional and Mechatronic Design. CO 01
(ii) – Ferro Electricity and Piezoelectricity.
(iii) – Amplification and Filtering.
(iv) – Hydraulic and Pneumatic actuators.
- Q No 2(a)** Giving example, explain what are the characteristics of Smart materials, in brief? (04)
CO 04
- Q No 2(b)** What are various Signal conditioning processes? Discuss in brief. (04)
CO 02
- Q No 3(a)** What is Piezoelectricity? Discuss its various applications in brief. (04)
CO 03
- Q No 3(b)** What is difference between Direct and Converse Piezoelectric effect? Explain in brief. (04)
CO 02
- Q No 4(a)** Mentioning some commonly used Piezoelectric materials, discuss about characteristics of any of these materials, in brief. (04)
CO 01
- Q No 4(b)** Which class of smart materials is able to exchange energy between the magnetic and elastic states? Giving example of any two such fluids, discuss their properties and applications in brief. (04)
CO 04

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- Q No 5(a) Discuss various types of Shape memory effects in brief. (04)
CO 0
- Q No 5(b) Describe about any four engineering applications of Shape Memory Alloys in brief. (04)
CO 0
- Q No 6(a) Explain the mechanism which makes ER fluids suitable for actuation purpose. Also mention the desired characteristics of the ER fluids. (04)
CO 03
- Q No 6(b) What do you understand by Magnetorheological fluids? Discuss about properties and applications of any two such fluids. (04)
CO 02
- Q No 7(a) Explain how photovoltaic effect can be utilized for actuation purpose in Mechatronic systems. Also mention about any two materials, which are very suitable for this purpose along with their applications. (04)
CO 04
- Q No 7(b) Explain the principle on which Electrostatic actuators work. Also discuss the working and applications of Electrostatic actuators in brief. (04)
CO 02
- Q No 8 Write Short Notes on any Two of the following. (2x04=08)
CO 01
- (i) – Magnetic Anisotropy
 - (ii) – Pyroelectric Materials
 - (iii) – Mechatronic control
 - (iv) – MEMS

Time: 3:00 Hours

Note: Answer ANY FIVE questions. All questions carry equal marks.
Assume suitable missing data, if any.

Q1 (i) A committee of 3 persons is to be constituted from a group of 2 men and 3 women. In how many ways can this be done? How many of these committees would consist of 1 man and 2 women? [5][CO1]

(ii) In a small village, there are 87 families, of which 52 families have at most 2 children. In a rural development programme, 20 families are to be chosen for assistance, of which at least 18 families must have at most 2 children. In how many ways can the choice be made? [5][CO3]

Q2 In my town, it's rainy one third of the days. Given that it is rainy, there will be heavy traffic with probability $1/2$, and given that it is not rainy, there will be heavy traffic with probability $1/4$. If it's rainy and there is heavy traffic, I arrive late for work with probability $1/2$. On the other hand, the probability of being late is reduced to $1/8$. If it is not rainy and there is no heavy traffic. In other situations (rainy and no traffic, not rainy and traffic) the probability of being late is 0.25. You pick a random day.. [10][CO4]

- a) What is the probability that it's not raining and there is heavy traffic and I am not late
- b) What is the probability that I am late?
- c) Given that I arrived late at work, what is the probability that it rained that day?

Q3 (i) Draw the following graphs and determine how many edges each has.

- i) K_4
- ii) $K_{3,2}$
- (iii) $K_{1,5}$

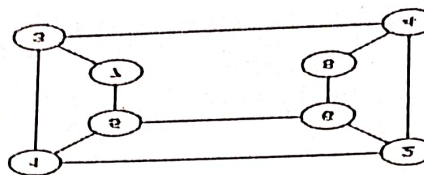
[5][CO5]

(ii) The complement of a graph, G , of order n , denoted \bar{G} , has the same vertex set as G with $E(\bar{G}) = E(K_n) - E(G)$. If every vertex of G has an odd degree, except for one, how many vertices have odd degree in \bar{G} ? [5][CO1]

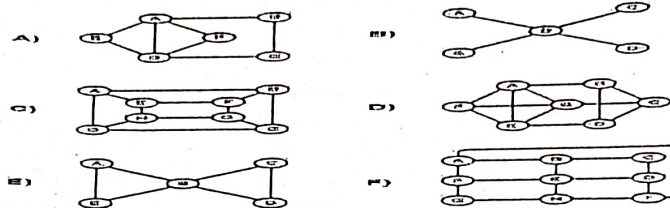
Q4. (i) I toss a coin repeatedly. The coin is unfair and $P(H) = p$. The first time that two consecutive heads (HH) or two consecutive tails (TT) are observed, I win if HH is observed and lose if TT is observed. For example if the outcome is HTHTT, I lose. On the other hand, if the outcome is THHTHH, I win. Find the probability that I win. [5][CO2]

(ii) According to a survey, 73% of Kashmiris actually like apples, while around 65% of them like oranges. Determine the percentage of Kashmiris who like both apples and oranges. [5][CO3]

Q5. (I) Is the following graph a bipartite graph? [5][CO4]



(ii) Which of the following is / are Hamiltonian graphs? [5][CO4]



Q6. (i) Explain following : [5][CO4]

a. Machine learning. b. Data mining. c. Software engineering

(ii) Find the rank of the word SUCCESS, If all possible permutations of the word SUCCESS are arranged in dictionary order. [5][CO3]

Q7. What is principal component analysis. Compute the principal component of following data. [10][CO2]

CLASS 1 : $X = 2, 3, 4$ $Y = 1, 5, 3$
CLASS 2 : $X = 5, 6, 7$ $Y = 6, 7, 8$

Table: Students

StudentID	Name	Major
1	Alice	Math
2	Bob	Physics
3	Charlie	Chemistry
4	Dana	Math

Table: Courses

CourseID	Title	Department
C101	Calculus	Math
C102	Algebra	Math
C201	Mechanics	Physics
C202	Thermodynamics	Physics

Operations:

(1+1+2+1) (CO 4)

- 1) Select all students majoring in math.
- 2) Project the names and majors of all students.
- 3) Perform a cartesian product of 'Students' and 'Courses'.
- 4) Select all courses from the Math Department.

Total No. Of Pages: 4
FIRST SEMESTER
END SEMESTER EXAMINATION

Roll No.....
M. TECH (DSC)
NOV/DEC 2023

DSC503 DATA MANAGEMENT AND ETHICS

Time 3:00 hours

Max. Marks: 40

Note: Attempt any 8 questions. Assume suitable missing data, if any.
CO# indicates Course Outcome Number.

Q1. Suppose we have two relations in a database:

1. Students (SID, Name, Age, Major)
2. Enrollments (SID, CourseID, Grade)

Write a relational algebra expression to find the names of students who are majoring in 'Computer Science' and have received a grade of 'A' in any of their courses.

(5) (CO1)

Q2. Consider a database system where two transactions, T1 and T2, are executing concurrently. T1 and T2 are accessing two data items, A and B. The schedule of operations is as follows:

1. T1 reads A.
2. T1 writes A.
3. T2 reads B.
4. T2 writes B.
5. T1 reads B.
6. T2 reads A.
7. T1 writes B.
8. T2 writes A.

Assuming no other transactions are running, determine if the given schedule is serializable. If it is not, explain why and propose a method to make it serializable.

(5) (CO2)

h7

Q3. Discuss a case study where ethical issues arose in the collection and use of academic data. How were these issues addressed? (5) (CO3)

Q4. What should be included in the code of ethics for a Database Administrator (DBA)? (5) (CO3)

Q5. A) A company collects personal data from its customers for improving its services. Discuss the ethical responsibilities of the company in ensuring the privacy and security of this data.

B) Explain the difference between conflict serializable and view serializable schedules in database transactions. (2.5+ 2.5) (CO3)

Q6. In a database system, consider two transactions, T1 and T2, which are operating on two accounts, A and B. Initially, account A has \$1000, and account B has \$500. The transactions are defined as follows:

- T1 transfers \$200 from account A to account B.
- T2 withdraws \$150 from account B.

The operations in the transactions are executed in the following sequence:

1. T1 reads A.
2. T1 subtracts \$200 from A.
3. T1 writes A.
4. T2 reads B.
5. T2 subtracts \$150 from B.
6. T2 writes B.
7. T1 reads B.
8. T1 adds \$200 to B.
9. T1 writes B.

Assuming no other transactions are running and no failures occur, calculate the final balances in accounts A and B after both transactions have completed. (5) (CO2)

Q7. In a database management system (DBMS), four transactions T1, T2, T3, and T4 are running concurrently. They are requesting and holding locks on resources R1, R2, R3, and R4. The following diagram represents the current state of resource allocation and requests:

...
T1 --> holds R1; requests R2
T2 --> holds R2; requests R3
T3 --> holds R3; requests R4
T4 --> holds R4; requests R1
...

Represent this scenario using a wait-for graph. Is the system in deadlock or not. If a deadlock is detected, suggest methods to resolve it. (5) (CO4)

Q 8. What is a Deadlock? What are the conditions required to detect a deadlock in the system? (1+4) (CO4)

Q 9. Given the following tables, 'Students' and 'Courses', perform the specified relational algebra operations and show the resulting table.

Total No. of Pages: 1

Roll No.....

**THIRD SEMESTER
END-SEM EXAMINATION**

**M.TECH. (ENE)
DEC - 2023**

ENE-5301 ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY

Time: 03 Hours

Max. Marks: 40

*Note: Attempt any five questions
Assume suitable missing data if any*

1. a) Describe the concept and components of aquatic chemistry. 4[CO1]
b) Briefly discuss unique properties of water and their environmental significance. 4[CO1]
2. a) What are heavy metals? What are the environmental problems associated with heavy metals? Discuss. 4[CO2]
b) Define surfactants. Why are the surfactants of environmental concern? Explain. 4[CO2]
3. a) Explain the mobility and fate of pesticides in environment. 4[CO2]
b) Discuss the chemistry of CFCs and their role in catalytic destruction of ozone. 4[CO3]
4. Write short notes on
a) Eutrophication 4[CO2]
b) Thermal inversion 4[CO3]
5. a) Compare the aerobic and anaerobic microbial transformation of carbon. 4[CO4]
b) Briefly discuss acclimatisation of waste. 4[CO4]
6. a) Describe the key phases of microbial growth and dynamics. 4[CO5]
b) Discuss the role of fungus in lignin degradation. 4[CO5]
7. a) What is green house effect? Define green house gases. What are the environmental consequences of global warming? Discuss. 4[CO3]
b) What are biofilters? Explain the working and environmental benefits of biofilters. 4[CO5]

Total no. of Pages 02

Roll no.....

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M.Tech.

END TERM EXAMINATION

Nov.-2023

EN5401 - INDUSTRIAL WASTEWATER TREATMENT

Time: 3:00 Hours

Max. Marks: 40

Note : All questions are compulsory.
All questions carry equal marks.
Assume suitable missing data, if any.

Q 1: a) Write a short note on methods of treating Industrial Wastewaters. How is industrial wastewater treatment different from municipal wastewater treatment? 5

b) Differentiate between aerobic and anaerobic treatment of wastewater, giving major end products. Name and explain the working principle of one treatment method in each category. 5

Q 2 Explain the characteristics of wastewater generated from:

- 1) Textile Industry
- 2) Dairy Industry

Enumerate the treatment process of textile wastewater and dairy wastewater. 10

Q 3 a) Define and describe the components of:

- i) Primary treatment;
- ii) Secondary treatment; and
- iii) Tertiary treatment. 6

b) Discuss the environmental effects if textile wastewater is discharged into public sewers. 4

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Q 4 a) What is the significance of wastewater characterization study? Explain the reasons for conducting wastewater audit for industrial facilities. 5

b) What is the concept of equalization in wastewater management? Discuss the advantages and disadvantages of wastewater equalization. 5

END TERM EXAMINATION
ENE6201 HAZARDOUS WASTE MANAGEMENT

Nov/Dec-2023

Time: 03:00 Hours

Max. Marks: 50

Note: All questions carry equal marks.
Attempt any five questions.
Assume suitable missing data, if any.

- Q.1 (a) Describe the key components of risk management for hazardous waste. How can a site safety plan minimize and mitigate the risks associated with hazardous waste? Explain. [5][CO2]
- (b) Highlight the potential environmental impacts of inadequate hazardous waste management and explain how effective management practices can mitigate these impacts for safeguarding the environment. [5][CO1]
- Q.2 (a) Define radioactive waste, and what are its sources? Discuss the various approaches employed in the treatment and disposal of radioactive waste. [5][CO1]
- (b) Design a hypothetical waste management plan for a new industrial facility, emphasizing how TSDF principles can be integrated to minimize environmental impact. [5][CO3]
- Q.3 (a) What is an incineration process, and how does it work in the context of hazardous waste management? Explain. [5][CO1]
- (b) Explore the challenges and opportunities in the application of waste concentration technologies for hazardous waste. Delve into the potential environmental and safety concerns linked to these technologies. [5][CO4]

80

Q.4 (a) Compare and contrast the environmental impacts of land and sea disposal methods for hazardous waste. Consider long-term effects on ecosystems and human health. [5][CO4]

(b) Discuss the environmental benefits of using solidification and stabilization as treatment methods for hazardous waste. What is the significance of binders in the solidification and stabilization process of hazardous waste. Explain. [5][CO1]

Q5. (a) How does bioremediation effectively and sustainably mitigate the environmental impact of hazardous waste, and what are the constraints associated with this approach? Explain. [5][CO4]

(b) Briefly explain the concept of waste minimisation and reduction, and its importance in sustainable waste management. Discuss how industries can minimise waste generation, and implement safe handling procedures to promote sustainability. [5][CO1]

Q.6 Discuss briefly

(a) Wet air oxidation

[2][CO1]

(b) High level radioactive waste

[2][CO

(c) Basel convention

[2][CO4]

(d) TSDF

[2][CO3]

(e) Risk assessment of hazardous waste

[2][CO2]

Total No. of Page 3
Third Semester

Roll No.
M.Tech.

END SEMESTER EXAMINATION
November 2023

ENE – 6301 AIR QUALITY MODELING

Time: 3:00 Hours

Maximum Marks: 40

Note: Answer any 5 questions.
Question No. 7 is compulsory.
Assume suitable missing data, if any. (Calculator is allowed)

1. Just consider an assumption that a city is of approximately rectangular in shape with dimensions of 6.5 miles by 5.5 miles with the effective mixing height of 2.4 miles. A particle of a certain pollutant is emitted at the south-eastern corner of the city.
 - a. Find the maximum distance taken by the particle to travel out of the box. 2 [CO3]
 - b. If the wind speed is 3.5 mph in a SE-NW direction, find the maximum time and the average time taken by a particle of the pollutant emitted from any section of the city to clear the mixing box. 4 [CO3]
 - c. If 2000 gm of the pollutant is released in bursts every 2 hours, find the maximum concentration of the pollutant at any given time. 2 [CO3]
2. For class D stability, estimate the final plume rise from a power plant stack using Holland as well as Davidson equation considering the following data: 8 [CO3]
 - i. Wind velocity is 2.55 m/s
 - ii. Air temperature is 25 °C
 - iii. Barometric pressure is 1000 millibars
 - iv. Stack gas velocity is 14.75 m/s
 - v. Stack gas temperature is 140 °C

- 3 a. Explain the role of those meteorological parameters in the dispersion of air pollutants that represent the characteristics of any location. 4 [CO2]
- b. Analyse the conditions and stages of the recently implemented emergency action plan that has been taken by Delhi Government to tackle the severe air pollution scenario in the capital city of India. 4 [CO4]
4. a. PM emission from passenger cars, if $V_{ph} = 5000$ & distance travelled per day is 80 km and $E_r = 0.0301$ g/km-hr 2 [CO2]
- b. Standard deviation of vertical plume concentration, if $a = 104$, $c = 40$, $x = 3$, $d = 0.9111$ and $f = -9.6$ 3 [CO2]
- c. Standard deviation of horizontal plume concentration, if $a = 120$, $b = 0.68$, $c = 65$, $x = 6$, $d = 0.42$ and $f = -7$ 3 [CO2]
5. a. Show the diagrammatic representation of the effect of lapse rate on the following plume with very brief description: (i) fumigation (ii) neutral (iii) fanning (iv) trapping 4 [CO1]
- b. Mention the ranges of Indian AQI along with associated health risks. 4 [CO1]
6. Write short notes on any two of the followings? 8 [CO1]
 - a. Wind rose
 - b. Mixing height
 - c. Wet precipitation

7. Sulphur dioxide is emitted from an industry at the rate of 2.5 g/s at 170 °C through a stack of 150 m height and 2 m inside diameter. The stack velocity is 6.0 m/sec. Wind speed at 10 m above the ground is 2.5m/sec. The atmospheric pressure and temperature is 1000 millibars and 30 °C respectively along with F class atmospheric stability. Calculate the ground level centreline concentration at 2 and 4 km downwind distances.

Distance (km)	Stability classes and σ_y values						Stability classes and σ_z values					
	A	B	C	D	E	F	A	B	C	D	E	F
0.6	135	99	66	43	32	22	173	63	38	21	15	9
0.8	174	128	85	56	41	28	295	86	50	27	18	12
1.0	213	156	104	68	50	34	450	110	61	31	22	14
2.0	396	290	193	126	94	63	1953	234	115	51	34	22
4.0	786	539	359	235	174	117		498	216	78	51	32
8.0	1367	1001	667	436	324	218		1063	406	117	70	42
16	2540	1860	1240	811	602	405		2274	763	173	95	55

THIRD SEMESTER
M.Tech.(Env. Engg.)

Roll No.....

83

END-TERM EXAMINATION

Nov.-2023

ENE- 6401 Environmental Impact Assessment

Duration: 3 Hours

Maximum Marks: 50

Note: Attempt *ANY FIVE* questions.

All questions carry equal marks.

Marks CO

Assume suitable missing data, if any.

- | | | | |
|---------------|--|---|---|
| Q.1(a) | What does the statement, "Evaluation of EIA is possible only if EIA report is reliable", Discuss? | 5 | 3 |
| (b) | What are major objectives of EIA notification 2006? Enlist a few differences between EIA notification 1994 and 2006. | 5 | 1 |
| Q.2(a) | Describe EIA as an Environmental Management tool. | 5 | 2 |
| (b) | Illustrate the importance of Initial Environmental Examination (IEE) in EIA process. | 5 | 1 |
| Q.3(a) | What is meant by Environmental Auditing? Explain the Environmental auditing process. | 5 | 1 |
| (b) | Discuss the role of mitigation and monitoring process for Environmental Impact Assessment in India. | 5 | 2 |
| Q.4(a) | Explain briefly about baseline information on socio-economic environment. | 5 | 4 |
| (b) | Enlist criteria for selection of EIA methodologies. Discuss Adhoc methods briefly. | 5 | 4 |

- Q.5(a)** Explain Environmental clearance process with help of a flow chart. Who gives the clearance for foresting projects? 5 1
- (b)** Describe the environmental impacts of hydro power projects, with suitable examples. 5 2
- Q.6(a)** Explain about Strategic Environment Assessment (SEA) process? What is the advantage of SEA? 5 1
- (b)** What are the public participation requirements in the protocol for EIA. 5 1
- Q.7** Write Short note on
- (a)** Expert Appraisal Committee (EAC) 5 3
- (b)** Terms of Reference (TOR) 5 1

Total no. of pages: 03

Roll No.....

Ist SEMESTER

M.Tech (GEOTECHNICAL ENGG)

End Term Examination

Nov/Dec-2023

GTE-501 ADVANCED SOIL MECHANICS

Time: 3hr

Max Marks: 40

Note: Attempt the questions as per instruction. Assume the data suitably, if any. Use of semi log paper is permitted.

1. Attempt all of the following questions:

- (a) Mathematically prove that for two layered soils, the coefficient of permeability in the direction parallel to bedding plane is more than that in the direction perpendicular to bedding plane. (2) (CO-2)
- (b) Explain X rays diffraction technique for the identification of minerals. (2) (CO-1)
- (c) How the degree of consolidation is determined when the variation of pore pressure is sinusoidal. (2) (CO-4)
- (d) What are the applications stress path? (2) (CO-5)

2. Attempt any two questions out of the following:

- (a) Describe the structure of any three chief clay minerals with neat sketches. Explain differential thermal technique. (4) (CO-1)
- (b) What are the empirical relations developed by various researchers for finding the coefficient of permeability of clayey soils.

For normally consolidated clay the following data is given:

Void ratio	Permeability (cm/sec)
1.14	3.02×10^{-8}
0.96	1.11×10^{-8}

Determine hydraulic conductivity of clay at a void ratio 0.65. (4) (CO-2)

(c) Derive the relation used for finding the discharge through earth dam. Explain graphical solution proposed by Schaffernak. (4) (CO-3)

3. Attempt any two questions out of the following:

- (a) Discuss numerical analysis of seepage in following conditions- (4) (CO-3)
- On the boundary of permeable and impermeable layer
 - Seepage in the layered soils
- (b) Discuss safety of hydraulic structures against heaving. (4) (CO-3)
- (c) Discuss how coefficient of consolidation is determined by following methods- (4) (CO-4)
- Rectangular hyperbola method
 - Su's maximum slope method

4. Attempt any two questions out of the following:

(a) Determine the degree of consolidation at a depth of $H/3$ measured from the top of the layer, when an initial excess hydrostatic pore pressure is constant with depth (i.e. $u_i = u_0$). Assume time factor as 0.4. (4) (CO-4)

(b) Explain the concept of sand drain. Discuss the following conditions of sand drain

- Free strain case without smear
- Free strain case with smear (4) (CO-4)

(c) A sub soil consists of 3.8 m thick sand underlain by clay layer 2.5m thick. The void ratio of clay is 0.9 and liquid limit is 37%. Two footings each 2m x 2m and 4.5m apart centre to centre, are placed at a depth of 1m in sand and carries weight of 600kN each. The unit weight of sand and clay are 19.5 kN/m³ and 17.5 kN/m³ respectively. The water table is at the base of footing. Find the consolidation settlement of clay layer, both total and differential, if any. (4) (CO-4)

5. Attempt any two questions out of the following:

(a) What are true cohesion and true angle of friction as proposed by Hvorslev. How they are determined. (4) (CO-5)

(b) Derive an expression for unconfined compressive strength q_u in terms of C' and ϕ' . Take $B=1$ and initial capillary tension $=u$. Hence deduce the ratio of c_u/p for NC soil, where p is pre consolidation pressure. (4) (CO-5)

(c) What are the limitations of direct shear test.

In a direct shear test on dry sand, the normal and shear stresses at failure are 2.0 kg /sq cm and 0.9 kg /sq cm respectively. Determine the orientations of principal planes at failure. (4) (CO-5)

Total no. of Pages: 02

Roll no.....

1st Semester

M. Tech

87

END TERM EXAMINATION

December-2023

COURSE CODE: GTE 503

COURSE TITLE: ADVANCE FOUNDATION ENGINEERING

Time: 3:00 Hours

Max. Marks: 40

Note: All questions are compulsory
All questions carry marks as indicated
Assume suitable missing data, if any
All questions must be answered in the sequence of their appearance

- Q1. a) How do you experimentally estimate bearing capacity factors?
How can N_y be obtained graphically? (4; CO1 & CO2)
- b) Elaborate how skin friction and end bearing influence the load carrying capacity efficiency of pile and pile group is separately extracted from the data of pile load test? (4; CO3)
- c) Describe with neat sketches of at least three different failure mechanism for pile foundation proposed [Terzaghi (1943); De Beer (1948); Vesic (1963)] (4; CO4)
- d) Compare the SPT and CPT with pile load test in context of load carrying capacity of pile and pile group. (4; CO5)

Q2. The dimensions of a foundation in loose sand is restricted to $5 \times 3 \times 1.5$ m. The unit weight of soil is 16 kN/m^3 and has effective angle of internal friction $\phi = 35^\circ$. Compute the net ultimate bearing capacity if

SC

$$N_q = e^{\pi \tan \phi} \tan^2 \left(45^\circ + \frac{\phi}{2} \right)$$

$$N_c = (N_q - 1) \cot \phi$$

(6; CO2)

$$N_\gamma = 1.8 (N_q - 1) \tan \phi$$

Q3. A reinforced concrete pile weighing 30 kN (inclusive of helmet and dolly) is driven by a drop hammer weighing 40 kN and having an effective fall of 0.8 m. The average set per blow is 1.4 cm. The total elastic compression is 1.8 cm. Assuming the coefficient of restitution as 0.25 and a factor of safety of 2, determine the ultimate bearing capacity and the allowable load for the pile. (6; CO3)

Q4. Design a frictional pile group to carry a load of 3000 kN including the weight of pile cap at a site where the soil is uniform class of geomaterial to a depth of 20 m, underlain by a rock. The average unconfined compression strength of the geomaterial is 70 kN/m². The geomaterial may be assumed to be of normal sensitivity and normally loaded with a liquid limit of 60%. A factor of safety of 3 is required against shear failure. (6; CO4)

Q5. Describe with neat sketch

- Experimental setup for application of torque and measurement of angular movement of pile cap
- Complex set of forces acting on the well foundations
- Components of well foundation
- Well sinking

(6; CO5)

Total No. of Pages 03

FIRST SEMESTER

END SEMESTER EXAMINATION

GTE 5303

Time: 3 Hours

Roll No.

M.Tech. GTE

(November-2023)

STABILITY ANALYSIS OF SLOPES

Max. Marks: 50

Note: Answer all questions

Assume suitable missing data, if any

1. What are the different failure mechanisms of slope and failure mode? Explain with suitable sketches ? [10] [CO1]

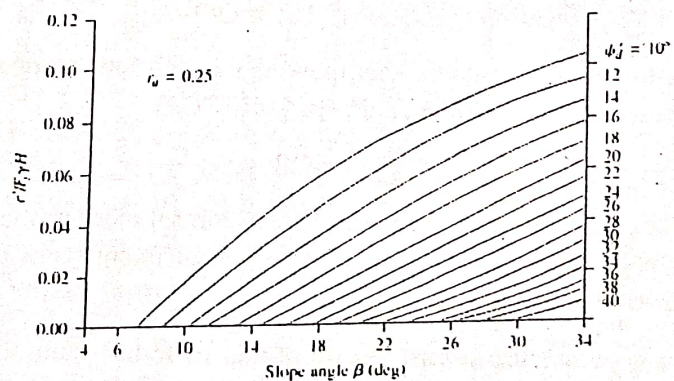
OR

A slope with $\beta=45^\circ$ is to be constructed with a soil that has $\phi=1^\circ$ and $c = 20 \text{ kN/m}^2$. The unit weight of the compacted soil will be 19.1 kN/m^3 .

a. Find the critical height of the slope.

b. If the height of the slope is 12 m, determine the factor of safety with respect to strength. [10] [CO2]

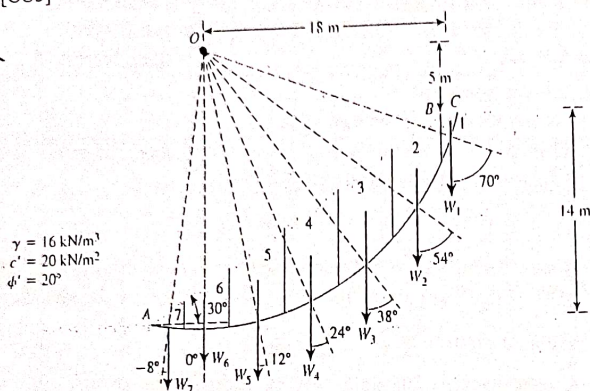
2. A given slope under steady-state seepage has the following: $H = 21.62 \text{ m}$, $\phi = 25^\circ$, slope: 2H:1V, $c = 20 \text{ kN/m}^2$, $\gamma = 18.5 \text{ kN/m}^3$, $r_u = 0.25$. Determine the factor of safety, F_s , using Spencer's solution. [10] [CO3]



OR

68

90



OR

OR

5. What is landslides hazard zonation map of India? How it is prepared?
Prepare the landslides hazard zonation map of India. [10] [CO4]

What is rainfall induced landslides? Explain warning system? Explain the different sensor and their architecture which can be used for developing the early warning system. [10] [CO3]

Total no. of Pages: 02

Roll no..... 91

1st SEMESTER
M.Tech. (GTE)

END TERM EXAMINATION

Nov/Dec-2023

GTE5401 Geo-Environmental Engineering

Time: 3:00 Hours

Max. Marks: 50

Note : Answer any FIVE.

All questions carry equal marks.

Assume suitable missing data, if any.

- Q.1 a) What is waste? Explain waste containment. [5][CO1]
b) What is subsurface contamination? List the different effects on soil due to contamination by water and other agents. [5][CO2]
- Q.2 a) What is leachate? How the quantity of leachate can be estimated?
b) Explain with a neat sketch the various components of a sanitary landfill and its functions. [5+5][CO2+CO3]
- Q.3 a) What is soil water contaminant interaction and explain the key ways of the interaction. [5][CO3]
b) Why landfill monitoring is important and how monitoring is done? Explain key indicators which signify the improper monitoring of landfill operation. [5][CO4]
- Q.4 a) Describe the effects of pollutants in soil on:
a) Index properties
b) Shear strength [5][CO4]
b) Explain with neat sketches the classification of landfill liners based on the type of material. [5][CO5]
- Q.5 a) What are the waste production challenges faced by the healthcare and pharmaceutical sectors, and how can these industries minimize biomedical waste? [5][CO5]
b) How is the cover system helpful in protecting the environment from harmful effects of mine waste? [5][CO6]

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Q.6 Write note (any two):

- a) Stabilization of subsurface contamination
- b) Waste management
- c) Compacted clay liners

Total no. of Pages: 01

Roll no.....

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SEMESTER

B.Tech./B.Des./BBA/BAE/M.Sc./M.Des./M.Tech./MBA/Ph.D/ B.Tech.

END TERM EXAMINATION

Nov/Dec-2023

COURSE CODE : HU-703

COURSE TITLE: ECONOMETRICS

Time: 03:00 Hours

Max. Marks: 60

Note : All questions carry equal marks.

Assume suitable missing data, if any.

Answer any 4 out of 5 questions.

- Q.1 Explain the effect of having correlated predictors in a multiple regression model. Discuss its practical consequences and suggest the remedial measures. [15 Marks]
- Q.2 What is the difference between Stationary and non-stationary data? Why is it important that stationary data is used in a vector autoregression model? [15 Marks]
- Q.3 Show that the relationship between the disturbance term leads to autocorrelation. Discuss the causes, consequences and remedial measures. [15 Marks]
- Q.4 What is the problem of heteroscedasticity and how does its presence affect the OLS estimators? Explain the method of GLS to correct the problem of heteroscedasticity. [15 Marks]
- Q.5 (i) A random sample with a mean of 67.2 is drawn from a normal population with a standard deviation $\sqrt{7.056}$, test the hypothesis that the population mean is 69 at 1% level of significance.

Given that: $p(0 < Z < 2.58) = 0.495$

(ii) Differentiate between type-I and type-II errors and specify which is more dangerous and why? [15 Marks]

Total no. of Pages:1

Roll no.....

FIRST SEMESTER
Ph.D Course Work

END TERM EXAMINATION

Nov./Dec-2023

HU-708 Gender and Technology

Time: 03:00 Hours

Max. Marks: 50

Note: All questions carry equal marks.
Answer any five questions
Assume suitable missing data, if any.

- Q.1 What do you mean by Gender? How use of ICT has changed workplace environment? Discuss with examples [4+6=10][CO#1 and 3]
- Q.2 Is artificial intelligence is gender neutral? Give examples in support of your answer. [10][CO# 3]
- Q.3 Discuss significance of a diverse and inclusive team for innovation. [10] [CO# 2]
- Q.4 What may be reasons for low participation of women in engineering education in India? Discuss. [10] [CO#2]
- Q.5 What do you mean by Gender equity and Gender equality? Why it is important to have 'Gender Equality' for inclusive growth? [4+6=10][CO#2 and 3]
- Q.6 Discuss difference between sex and gender? What do you mean by 'Gendered Technology'? Discuss with examples. [4+6=10] [CO#1 and 3]
- Q.7 Discuss issue and significance of Gender in achieving SDGs by 2030. [10][CO#3]

Total No. of Pages: 03
FIRST SEMESTER

END SEMESTER EXAMINATION

Roll No. _____
M.Tech. (ISV)
NOV./DEC.-2023

ISV-5409 IMAGE ANALYSIS

Time: 03 Hours

Max. Marks: 40

Note: All questions carry equal marks
Attempt any FIVE questions.
Assume suitable missing data, if any.

Question No. 1

[4x2=8]

Consider a colour digital image of resolution 1920×1080 pixels, which is transmitted through WI-FI channel of the rate 30 frames per second. Determine the followings:

[a] Bandwidth of the channel.

[b] Original image is scaled by $1/2$, then determine the percentage reduction of the original image. [CO1]

Question No. 2

[4x2=8]

[a] Consider a colour image with a resolution of 1200×900 pixels, which corrupted by both salt and paper noise. The salt noise affects 3% of the pixels by setting them to the maximum intensity value, while the paper noise affects 7% of the pixels by setting them to the minimum intensity value. After applying the median filter, the image still has 2% of its pixels affected by noise.

I. Calculate the total number of pixels affected by salt noise and paper noise.

II. Calculate the remaining number of noisy pixels after applying the median filter. [CO2]

[b] Consider a grayscale image with pixel intensities ranging from 50 to 200 and you have to perform contrast stretching to enhance the image's visual appearance. The goal is to stretch the intensity values to cover the full range from 0 to 255. The original image has a resolution of 600×400 pixels.

I. Calculate the slope and intercept for the linear stretching function.

II. An original image pixel value is 120 and calculate its new intensity value after contrast stretching. [CO2]

Question No.3

[3+3+2=8]

Consider a digital image $f(x, y) = \begin{bmatrix} 6 & 7 & 3 \\ 5 & 2 & 4 \\ 1 & 2 & 3 \end{bmatrix}$, in this image the least significant bit plane has been removed. Do the followings:

[a] Represent the image after removing the plane. [CO3]

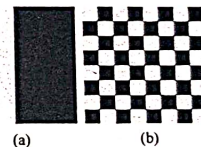
[b] Compare the original histogram of image with histogram of removed plane image. [CO3]

[c] Discuss the impact of bit-plane slicing on image quality and information. [CO3]

Question No. 4

[4x2=8]

Consider the two images (a, b) as shown in below figure, these are quite different, but their histograms are the same. Suppose that each image is blurred with an averaging mask.



[a] Would the histograms of the blurred images still be equal? Explain.

[b] If your answer is no, sketch the two histograms [CO4]

Question No. 5

[4x2=8]

[a] Consider an image $f(x, y)$, determined the high boost filtered image using averaging kernel. [CO3]

$$f(x, y) = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \\ 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 \end{bmatrix}$$

- [b] What are the various steps involved in frequency domain filtering?
Explain with the help of suitable diagram. [CO2]

Question No. 6

[4x2=8]

Consider a point transformation which maps the input image $f[m, n]$ into an output image $g[m, n]$ through the transformation T . The input and output of the images are defined as follows:

Input image $f[m, n] = r$, where $0 \leq r \leq 1$.

Output $g[m, n] = s = T(r)$, where $0 \leq s \leq 1$.

The transformation is given by $T(r) = ar + b$.

Determine the values of a and b in terms of mean and variance of r . Assume that mean and variance are $0.5m_r$ and $0.25\sigma_r^2$. [CO5]

CO: Course Outcome

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Total no. of Pages: 01

Roll no.....

____ SEMESTER

M.Tech.

END TERM EXAMINATION

NOV-2023

COURSE CODE: ISY-6321

MALWARE ANALYSIS

Time: 3 Hours

Max. Marks: 40

Note : All questions are compulsory.
All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1 Explain the following in brief: [4x2][CO1,CO2]
a) What is Resource Hacker?
b) Explain Packing Obfuscates Strings.
c) What is HashCalc?
d) Explain Backdoor Malware
- Q.2 [4x2][CO1,CO2]
a) Explain packet sniffing in Wireshark.
b) Explain Reverse engineering of X86 Architecture in detail.
- Q.3 [4x2][CO2,CO3]
a) Design Incident Response for Trojan Horse Attack on Linux System.
b) Design Rootkit for Linux System.
- Q.4 [4x2][CO3, CO4]
a) Design a procedure based on the TaintDroid-Framework that reports information leakage in the Android Operating System.
b) Explain abstract program execution in Android OS and Dynamic Analysis of Malicious Apps.
- OR**
- Q.5 [4x2][CO4, CO5]
a) Explain PE file headers and Sections.
b) Explain OS security concepts and OllyDbg.

Total no. of Pages: 02

Roll No.....

3rd SEMESTER
M.Tech. (ISY)

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Nov/Dec-2023

END TERM EXAMINATION

ISY6413 Mobile Computing

Max. Marks: 40

Time: 3:00 Hours

Note: All questions are compulsory. Kindly check the paper code before starting your exam.

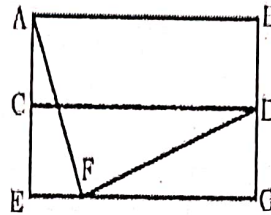
All questions carry equal marks. Assume suitable missing data, if any.
[M]: Marks allocated to the question. [CO#]: Course Outcome number.

Q. No.	Question Description	[M] [CO#]
Q.1	(a) Explain GSM architecture and its services with the help of a neat diagram. (b) What are the major vulnerability points of the RSA algorithm? How are private and public keys generated in the RSA algorithm? (c) Briefly explain the WAP application environment. Discuss QOS in ad-hoc networks and important applications.	[3] [CO1] [3] [CO1] [2+2] [CO2]
Q.2	(a) Define different division multiple access techniques considering their features, advantages, and disadvantages. (b) Determine the transfer time of a 44 KB file with a mobile data network (a) with a transmission rate of 20 Kbps and (b) repeat the same for 802.11 WLAN operating at 4 Mbps. (c) What is the length of the file that WLAN can carry in the time that mobile data service carried a 30 KB file? (d) What do you infer from the answers to the above questions?	[4] [CO2] [6] [CO2]

- Q3. (a) What do you mean by Digital cellular standards? Discuss the important major digital cellular standards. Discuss some important measures of cellular telephone in mobile computing in detail.
- (b) What do you mean by an ad-hoc network? What are the advantages and key challenges of ad-hoc networks (Write in clear points)?
- (c) Discuss Satellite technology in detail and how the antenna system works to transmit and receive signals with the help of a suitable diagram.

[CO1]
[2] [CC]
[3] [CC]
[2] [CO]
[3] [CO]

- Q4. (a) What are the different components of the Mobile IP?
- (b) For a given network shown below, the routing tables of the four nodes A, E, D, and G are shown. Suppose that F has estimated its delay to its neighbors, A, E, D, and G as 8, 10, 12, and 6 msec respectively, and updates its routing table using the distance vector routing technique.



Routing Table of A	
A	0
B	10
C	14
D	17
E	21
F	9
G	24

Routing Table of D	
A	20
B	3
C	30
D	0
E	14
F	7
G	22

Routing Table of E	
A	24
B	27
C	7
D	20
E	0
F	11
G	22

Routing Table of G	
A	21
B	24
C	22
D	19
E	22
F	10
G	0

- (c) Discuss DSR, AODV, and TORA in brief.
- (d) Write a short note on GSR and DSDV.

[2.5] [CC]
[2.5] [CC]

Total No. of Pages 03

Roll no....

M Tech Industrial Engineering and Management

END SEMESTER EXAMINATION

Nov-2023

IEM 501: Data Analytics

Time: 3:00 Hours

Max. Marks : 40

1. Question ONE is compulsory. Attempt any THREE from the remaining Questions.
2. Use of Statistical Tables Permitted.

- 1
 - a) Distinguish between Linear Regression, Logistic Regression and Poisson Regression. Give one example of each indicating the applications of these methods in predictive analysis. [16][CO1,CO5]
 - b) Explain Wald's Test, Likelihood ratio test and Pseudo R- Square test to validate the Logistic regression model.
 - c) What do you understand by Confusion Matrix? Explain the terms- Sensitivity or recall, Specificity, Precision and F- Score and calculate the same for the following confusion matrix.
 - d) Explain Youden's index and cost based approach as the methods of finding optimal classification cut off.

True Level	Bad Credit	85	6
	Good Credit	120	89
		Bad Credit	Good Credit
		Predicted Label	

- 2a Forty percent of the homes constructed in NCR include a security system. Three homes are selected at random: What is the probability that all three selected have a security system? [4][CO2,CO3]

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What is the probability that none of the three selected have a security system?
What is the probability that atleast one of the selected has a security system?

- 2b The quantity of the juice in tetrapack at XYZ [4][CO3]
manufacturing plant follows a normal distribution with a mean of 210ml and standard deviation of 4ml. The label quantity is given as 200ml.

What proportion of packs actually weigh less than the amount claimed on the label?

The Chief Operating Officer is considering two proposals to reduce the proportion of packs below the label quantity. He can increase the mean quantity from 210ml to 215ml or reduce the standard deviation from 4ml to 3ml. Which change would you recommend?

- 3 Write null hypothesis and alternate hypothesis for the following research questions? [8][CO2, CO3, CO4]

Is the Delivery time of the new method less than the existing method?

Is the three fertilizers have the same effectiveness on the yield of the crop?

Is the skill of the two operators same?

Whether, in cricket, winning a toss ensure the winning of the match also?

Also write the appropriate test statistic in each case.

- 4a According to a recent survey, the university students get a mean of 8 hours of sleep. A random sample of 50 students from a particular university revealed that the mean number of hours slept last night was 7.8 hours with a standard deviation of 0.8 hours. Is it reasonable to conclude that the students of this university sleep less than the typical university students? Compute the p-value also. [4] [CO2,CO3]

- 4b The following sample observations were randomly selected. Determine the coefficient of correlation and the coefficient of determination. Intertret the results. [4] [CO2]

X	5	3	6	3	4	4	6	8
Y	13	15	7	12	13	11	9	5

- 5a Explain the purpose of plotting the following charts with the help of IPL auction price dataset: [4][CO2,CO3]

- a) Box plot
- b) Scatter diagram
- c) Heat map
- d) Histogram

- 5b Write brief notes on Principal Component Analysis and Bayes Theorem [4] [CO1]

- 6a Difference between Supervised learning and unsupervised learning [2][CO1]

- 6b Explain the following 'distance measures' in identifying the outliers (influential observation) [6][CO1,CO3]

Z-score
Cook's distance
Leverage value

Total No. of pages (03)

Roll No.

FIFTH SEMESTER

M.Tech. (IEM)

END-TERM EXAMINATION

November-2023

IEM-503 Production & Operations Management

Time: 3:00 Hours

Max. Marks: 50

Note: Answer any FIVE questions.
Assume suitable missing data, if any.
Use of Statistical Table is permitted.

1. (a) Differentiate the Product Layout and Process Layout. [4] (CO1)
(b) An assembly line is to operate 8 hours per day with the desired output of 160 units per day. The following table contains information on this product's task times and precedence relationship: [6] (CO1)

Task	Task time (Seconds)	Immediate predecessor
A	60	-
B	80	A
C	20	A
D	50	A
E	90	B, C
F	30	C, D
G	30	E, F
H	60	G

- i. Draw the precedence diagram.
ii. Find the workstation cycle time.
iii. Balance the line using the longest time.
iv. Calculate the efficiency of the line balance.
2. (a) Differentiate Quantitative Forecasting and Qualitative Forecasting in terms of advantages and limitations. [4] (CO2)
(b) Mr. John owns a company that manufactures sailboats. Actual demand for John's sailboats during each of the past four seasons was as follows: [6] (CO2)

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SEASON	YEAR			
	1	2	3	4
Winter	1,400	1,200	1,000	900
Spring	1,500	1,400	1,600	1,500
Summer	1,000	2,100	2,000	1,900
Fall	600	750	650	500

John uses linear regression for yearly forecasting. Based on this data and the multiplicative seasonal model, what will the demand for 5th year and the demand level for John's sailboats in the different seasons of year 5?

3. (a) Using the graph between volume and variety, discuss the ABC analysis of inventory materials. [4] (CO3)

(b) Bharat Plastics is a large manufacturer of injection moulded plastics. An investigation of the company's manufacturing facility yields the information presented in the table below. How would the plant classify these items according to an ABC classification system? [6] (CO3)

ITEM CODE	AVERAGE INVENTORY (UNITS)	VALUE (\$/UNIT)
1289	400	3.75
2347	300	4.00
2349	120	2.50
2363	75	1.50
2394	60	1.75
2395	30	2.00
6782	20	1.15
7844	12	2.05
8210	8	1.80
8310	7	2.00
9111	6	3.00

4. (a) Discuss the Chasing and Levelling strategies of Aggregate Production Planning. [4] (CO4)

(b) A roofing manufacturer wishes to consider yet a different planning strategy to maintain a constant workforce of eight people and uses overtime whenever necessary to meet demand. Use the information found in the following Table. Assume

beginning and ending inventories are equal to zero. Calculate the total cost of Production. [6] (CO4)

Inventory carrying cost	\$ 5 per unit per month
Subcontracting cost per unit	\$ 20 per unit
Average pay rate	\$ 10 per hour (\$80 per day)
Overtime pay rate	\$ 17 per hour (above 8 hours per day)
Labor-hours to produce a unit	1.6 hours per unit
Cost of increasing daily production rate (hiring and training)	\$300 per unit
Cost of decreasing daily production rate (layoffs)	\$600 per unit

MONTH	PRODUCTION DAYS	FORECAST DEMAND THIS MONTH
Jan.	22	900
Feb.	18	700
Mar.	21	800
Apr.	21	1,200
May	22	1,500
June	20	1,100

5. As the production planner for Alpha Products, Inc., you have been given a bill of material for a bracket that is made up of a base, two springs, and four clamps. The base is assembled from one clamp and two housings. Each clamp has one handle and one casting. Each housing has two bearings and one shaft. There is no inventory on hand.
- Design a product structure noting the quantities for each item and show the low-level coding.
 - Determine the gross quantities needed of each item if you are to assemble 50 brackets.
 - Compute the net quantities needed if there are 25 of the base and 100 of the clamp in stock. [10] (CO5)

6. Write Short Notes on the following topics [2.5×4]

- Factors influencing the operational strategies (CO1)
- SDE and FSN analysis of inventory (CO6)
- Wage incentives (CO6)
- Single and Double Sampling Plans (CO6)

Total no. of Pages: 01

Roll no.....

1st SEMESTER
M. Tech

END TERM EXAMINATION

NOV-2023

IEM 5205 PRINCIPLES OF MANAGEMENT

Time: 03:00 Hours

Max. Marks: 50

Note: Answer any FIVE questions.
All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1 (a) Explain various level of Management. [5] [CO1]
(b) Define 'Management'. Explain significance of Management. [5] [CO1]
- Q.2 (a) Explain the various guiding principal of organisation. [5] [CO2]
(b) Differentiate a strong cultured organization from a weak cultured organization. Also explain how to establish and maintain a strong organizational culture? [5] [CO 2]
- Q.3 (a) Compare motivation and satisfaction. [5] [CO3]
(b) Compare and contrast Maslow, Herzberg and McClelland theory of motivation. [5] [CO3]
- Q.4 (a) Explain the process of decision making under uncertainty. [5] [CO4]
(b) Classify the different types of decisions. Also discuss the decision-making process. [5] [CO4]
- Q.5 (a) Explain in detail about the various types of leadership with its different styles. [5] [CO5]
(b) How would you interpret the results of Ohio state studies, university of Michigan studies, and Blake and Mouton-Managerial grid on leadership theories? [5] [CO5]
- Q.6 (a) Discuss the major functions of communication in organization by elucidating the barriers to effective communication. Also give a guideline for effective communication [5] [CO2]
(b) Do you agree with the statement that "communication through electronic media is helpful for effective business"? [5] [CO6]
- Q.7 (a) Compare and contrast the utilisation approach with the moral rights approach to ethical decision making. Which do you believe is the best for managers to follow? Why [5] [CO6]
(b) What is control? What are its steps? What are the techniques of control? [5] [CO6]

Total No. of Pages -4 Roll No.
1ST SEM M.TECH Industrial Engineering and Management
END SEMESTER EXAMINATION NOV/DEC 2023

IEM 5305 TOTAL QUALITY MANAGEMENT

Time: 3.00 Hours

Max. Marks: 50

Note: Answer ANY 5 questions

Assume suitable missing data, if any.

Use of Statistical control charts allowed

Q.1 A Travel agency is attempting to enter a market where several competitors currently exist. What are the various customer needs that they should address? How will quality be measured? As the company strives to improve its market share, discuss the impact on the various categories of quality costs. (10) [CO:1]

Q.2 Describe the following in connection with TQM

(i) Zero Defect Concept (ii) Design for disassembly

(iii) JIT manufacturing (iv) Benchmarking (10) [CO:2]

Q.3 The level of dissolved oxygen in water was measured every 2 hours in a river where industrial plants discharge processed waste. Each observation consists of five samples. From which the sample mean and range of the amount of dissolved oxygen in parts per million are calculated. The following Table 1 shows the results of 15 such observations. Discuss the stability of the amount of dissolved oxygen. Revise the control limits, if necessary, assuming special causes for the out-of-control points. Suppose that environmental standards call for minimum of 5ppm

of dissolved oxygen. Are these standards being achieved?
 Discuss. (10) [CO:3,4]

Table 1

Observation	Average level of dissolved Oxygen	Range
1	7.4	2.1
2	5.6	1.4
3	7.8	1.9
4	5.5	1.1
5	7.2	2.2
6	6.3	1.2
7	4.3	2.6
8	5.8	1.4
9	8.2	1.8
10	8.1	2.4
11	6.7	1.5
12	5.5	2.4
13	5.8	1.7
14	6.7	1.7
15	5.8	2.1

Assume(select) suitable value from following Table 2.

Table 2

(n)	(A2)	(D3)	(D4)
2	1.88	0	3.27
3	1.02	0	2.27
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2.00
7	0.42	0.08	1.92
8	0.37	0.14	1.86

Q.4 The Table 3 gives the number of missing rivets noted at aircraft final inspection: Determine the trail limits and plot suitable chart and state whether the process is in control. (10) [CO:3,4]

Table 3

Air Plane No.	No. of missing rivets	Air Plane No.	No. of missing rivets
1	10	11	11
2	17	12	9
3	26	13	10
4	18	14	6
5	11	15	28
6	13	16	11
7	6	17	13
8	11	18	2
9	1	19	15
10	25	20	14

Q.5 In a double sampling plan, $N=5000$; $n_1=100$; $c_1=0$, $n_2=200$, $c_2=2$.

- Use poisons Table 4 to compute the probability of acceptance of a 2% defective lot.
- Assume that a lot rejected by the sampling plan will be 100% inspected. What will be the AOQ if the submitted product is 2% defective? Considering both the inspection of rejected lots, what will be the average number of articles inspected per lot if the submitted product is 2 % defective.

Assume (select the suitable) the following (Poisson's 1000 x probability of c)

(10) [CO:2,3]

Table 4

c'or np'	0	1	2	3	4	5
1.00	368	736	920	981	996	999
2.00	135	406	677	857	947	983
3.00	050	199	423	647	815	916
4.0	018	092	238	433	629	785

Q6. Write Short notes on (10) [CO:6]

- Six Sigma
- Benefits of ISO 9000 series standards

Note: Answer any five questions. All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1 (a) What is break even charts. How it is used to improve the Profit performance? (4) (CO6)
- Q.1 (b) Given the following data: (4) (CO6)
- | | |
|----------------|--------------------|
| Sales | Rs. 2,00,000 units |
| Variable costs | Rs. 1,50,000/- |
| Fixed Overhead | Rs. 15,000/- |
| Net Profit | Rs. 35,000/- |
- Evaluate: (i) Net profit from sales of Rs. 3,00,000?
(ii) Required sales for the net profit of Rs. 70,000?
- Q.2 (a) What do you mean by Design communication? How does drawing and visual aids help the design engineer to share his ideas? (4) (CO5)
- Q.2 (b) Draw a Bath tub curve and explain the phases involved. (4) (CO7)
- Q.3 (a) During writing a technical report, what point should be kept in mind for easy and impactful communication. (4) (CO5)
- Q.3 (b) Write down the guidelines for Design of Manufacturing and Design for Safety. (4) (CO4)
- Q.4 (a) Discuss the role of computer in Product Design and its development. (4) (CO4)
- Q.4 (b) Given the following information (4) (CO6)
- | | |
|-------------|--------------|
| Net sales | Rs. 1,00,000 |
| Fixed Costs | Rs. 15,000 |
| Net Profit | Rs. 35,000 |
- Draw the profit volume chart and find the break even point.

- Q.5 (a) To protect an automobile head-on crash, design an inflatable bag. The parameters involve are (i) instantaneous inflation, which is achieved through a switch A (ii) quick deflation which is achieved through natural elasticity of bag material or a big exhaust port opened by switch A. Assume (4) (CO3)
- (i) Probability of Switch A=0.95
 - (ii) Probability of bag material=0.50
 - (iii) Conditional probability of exhaust port and switch A = 0.90
 - (iv) Probability of exhaust port= 0.90
- Estimate the probability of achieving success in the design of inflatable bag.
- Q.5 (b) What is the importance of Anthropometry in Design? Plot man-machine interface cycle. (4) (CO2)
- Q.6 (a) What is the law of Reliability? Prove that $R(t) = e^{-\lambda t}$. (4) (CO7)
- Q.6 (b) The components A and B are connected in parallel, which is connected to component C in series. Components A and B have an average life of 15 hours, While C has an MTBF of 1000 minutes. Find the reliability of the system for 25 hours. (4) (CO7)

Total no. of Pages: 02

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3rd Semester
M. Tech.

Roll no.....

Dec-2023

End Term Examination

(IEM-6201) - E-Commerce

Max. Marks-50

Time: 3 Hour

Note: - Answer all Five questions.
All Questions carry equal marks.

Ques. 1

- a) What are the key strategies and technologies that businesses can implement to effectively manage and optimize their e-commerce operations in a competitive online market? [6] CO3
- b) What is headless e-commerce and what are the advantages of adopting a headless e-commerce approach, and how does it affect scalability? [4] CO2

Ques. 2

- a) How can businesses leverage net-centrism in their digital design strategies to create more efficient and user-friendly e-commerce platforms? [6] CO3
- b) Describe and explain e-commerce auctions and explain their key characteristics [4] CO2

Ques. 3

- a) Define and explain the concept of channel conflict in e-commerce. Discuss strategies that e-commerce businesses can employ to minimize or resolve these conflicts. [6] CO3
- b) Compare the advantages and disadvantages of using both direct and indirect distribution channels in e-commerce. [4] CO2

Ques..4

- a) How abuse and netiquette influence the channel conflict, particularly when resolving disputes and maintaining productive relationships between different sales and distribution channels? [6] CO3
- b) Discuss the role of 'Security and Encryption' in channel conflict management [4] CO2

Ques.5

- a) What do you understand by cross-border e-commerce? Explain the benefits of cross-border e-commerce and the challenges of cross-border e-commerce. [6] CO3
- b) Explain the various important legal issues in Global e-commerce. [4] CO2

Ques.6

- a) Explain various types of e-commerce fraud and list some best practices for fraud detection and prevention [5] CO3
- b) Elaborate: [5] CO3
- i. Electronic Highway Robbery
 - ii. Software Intellectual property

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Third SEMESTER
M.Tech.(Mechanical)

END TERM EXAMINATION

Nov/Dec-2023

IEM6303 Knowledge Management

Time: 03:00 Hours

Max. Marks: 50

Note : All questions carry equal marks. Attempt any Five Questions
Assume suitable missing data, if any.

Q.1 What is knowledge Management? Explain Nonaka Model of Knowledge Management with example.

[10][CO1]

Q.2 Explain different types of Knowledge, illustrate these with suitable example

[10][CO1,2]

Q.3 Explain why same set of data can be considered useful information by some and useless by others? Could this useful information be termed as knowledge?

[10][CO3]

Q.4 Explain how Knowledge Management impacts Performance of organization? Explain briefly important elements.

[10][CO4]

Q.5 Describe briefly various knowledge capturing technologies in a organization

[10][CO5]

Q.6 How assessment of Impact of Knowledge Management can be done in a organization, Explain briefly.

[10][CO4,5]

Q.7 Identify issues which you consider are important for future of Knowledge Management. Explain in detail the most critical among them and Justify ?

[10][CO3,5]

END-TERM EXAMINATION

NOV/DEC-2023

IEM-6405 ADVANCE OPERATION RESEARCH

Time: 3:00 Hours

Max. Marks: 40

Note: Answer any five questions. Assume suitable missing data, if any.

1. (a) Discuss applications of Operation Research in health care sector.
[4](CO # 1)
- (b) Define a stochastic programming problem and give two practical examples.
[4](CO#2)
2. Obtain the optimal point of U and check its nature, where
$$U = 4xyz - x^2yz - xy^2z - xyz^2$$

[8](CO#2)
3. (a) Write the procedure of solving a single variable unconstrained non-linear problem using quadratic interpolation method.
[4] (CO#2)
- (b) Explain the method of grid search technique to solve an unconstrained multi-variable non-linear problem.
[4] (CO#3)
4. (a) What is separable programming problem. Explain the procedure of solving a NLP by separable method.
[4] (CO#3)

- (b) Formulate the necessary conditions for the solution by following quadratic programming method: [4] (CO#3)
- Maximize $f = 4x_1 + 6x_2 - x_1^2 - x_2^2$
 Subject to: $x_1 + x_2 \leq 2$; $x_1, x_2 \geq 0$
5. Use Gomory's cutting plane algorithm to solve the following all-integer programming problem: [8] (CO#4)
- Maximize: $Z = 2x_1 + x_2$
 Subject to:
 $2x_1 + 5x_2 \leq 17$; $3x_1 + 2x_2 \leq 10$; $x_1, x_2 \geq 0$ and integer
6. (a) What are the advantages and disadvantages of nature inspired techniques. [4] (CO#2)
- (b) Explain the procedure for any one of the nature inspired technique from GA/SA. [4] (CO#2)
7. Write short notes on any two topics out of the following: [4X2] (CO#1)
- [a] Geometric Programming
 - [b] Karmakar method
 - [c] Neural network
 - [d] Multi-objective optimization methods

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END TERM EXAMINATION

NOV/DEC-2023

ITY501 LINEAR ALGEBRA AND PROBABILITY

Time: 3 Hours

Max. Marks: 50

Note: Assume suitable missing data, if any.

Attempt any five questions.

1. Compute an LU factorization of

[8 marks][CO1]

$$A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \end{bmatrix}$$

Determine set of basic and free variables. Find the Null space and rank of A ?

2. Find the eigenvalues and eigen vectors of the following matrix ?

$$A = \begin{bmatrix} 2 & 5 & 0 \\ 5 & 2 & 0 \\ -3 & 4 & 6 \end{bmatrix}$$

[8 marks][CO1]

3. Apply the Gram-Schmidt procedure to following vectors

$$a = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, b = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, c = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix},$$

[8 marks][CO2]

and write the result in the form of $A = QR$.4. a. Find the projection matrix P_1 onto the line through $a = (1, 3)$ and also the matrix P_2 that projects onto the line perpendicular to a .

[4 marks][CO3]

b. State and prove Cauchy-Schwarz inequality.

[4 marks][CO3]

5. Find the projection of b onto the column space of A [8 marks][CO4]

$$A = \begin{bmatrix} 1 & 1 \\ 2 & -1 \\ -2 & 4 \end{bmatrix}, b = \begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix}$$

6. Find the distribution and density function of transformed random variable $Y = aX + b$

when X is $N(0,1)$. Find mean and variance of Y ? [8 marks][CO5]

7. Suppose X is a discrete random variable with following probability mass function: where $0 \leq \theta \leq 1$ is a parameter.

X	0	1	2	3
$P(X)$	$2\theta/3$	$\theta/3$	$2(1-\theta)/3$	$(1-\theta)/3$

8.

The following 10 independent observations were taken from such a distribution: (3,0,2,1,3,2,1,0,2,1). Using method of moments, find estimate of θ . [8 marks][CO6]

example.

[CO1][3]

[CO2][3]

- c) In a binary tree with 63 nodes, determine the following:
- Minimum and Maximum heights of the tree
 - The tree degree if the tree is a complete binary tree
 - Parent of node 45.

Total No. of Pages-4

FIRST SEMESTER

END TERM EXAMINATION

Roll No.

M.Tech.(IT)

NOV 2023

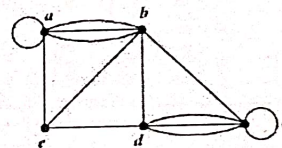
ITY503-Advance Data Structure and Algorithms

Time: 3 Hours

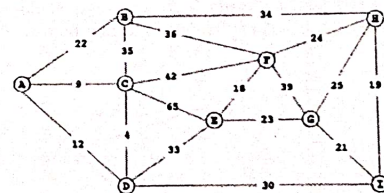
Max.Marks:40

Note: Attempt any five questions.
All questions carry equal marks.
Assume suitable missing data, if any.

- a) State Master Theorem. Determine if the Expression $T(n) = 3T(n/2) + \sqrt{5}n^3$ can be solved for the runtime $T(n)$ with the Master Theorem. [CO3][3]
 - b) Differentiate between Radix sort and Quick sort. [CO4][2]
 - c) Verify the Handshaking theorem for the given graph: [CO5][3]



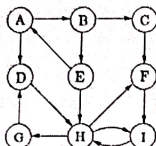
- a) Build and compare minimum spanning tree using prism and kruskal's algorithm. Assume we start from vertex A, also, list the edges that get added to the tree in the order in which the algorithm adds them. [You can denote an edge by its two adjacent vertices, e.g., (A, B)]. [CO6][6]



b) What is the time and space complexity of the following code? [CO1][2]

```
def fun(N,M):
    arr=[]
    counter=0
    for i in range(N):
        arr.append(i)
    for i in range(M):
        counter+=1
    print(counter)
```

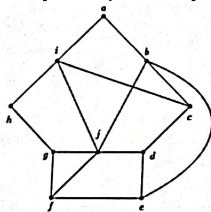
3) Create adjacency list and adjacency matrix for the given graph. Perform Depth-first-search on the following graph starting from vertex A; whenever there is a choice of vertices, pick the one that is alphabetically first. Give the Depth First Tree as your answer. [CO5][8]



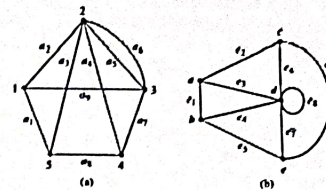
4) Write pseudo code for radix sort. Given the array of numbers, show the elements of the array after each iteration of radix sort. Since there are 4 digits, there will be 4 iterations. The algorithm will sort the array in increasing order. [CO4][8]

i	1	2	3	4	5	6	7	8	9	10	11	12
x[i]	5497	2273	6335	5329	1871	0914	9426	5248	0963	7194	3789	8117

5) a) Define planer graph? Is the graph given in Figure below planar? If so, give a planar drawing of it. If not, explain why it is non-planar. [CO5][5]

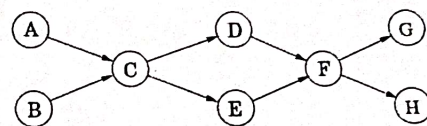


b) Determine if the two graphs below are isomorphic. Justify your answer. [CO5][3]

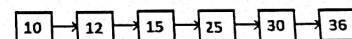


6) a) Write pseudo code for quick sort. Illustrate with an example. [CO4][4]

b) What is topological sort? Run the DFS-based topological ordering algorithm on the following graph. Whenever you have a choice of vertices to explore, always pick the one that is alphabetically first. [CO4][4]



7) a) Consider the following link list and following linked list representation : [CO1][2]



```
struct node {
    int data;
    struct node *next; } *start NULL;
What will be the value of following statement?
Start->next->next->next->data.
```

b) Differentiate between Binary search and linear search with a suitable

Total No. of Pages 02

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Roll No.

FIRST SEMESTER

M.Tech (ITY)

END SEM EXAM

Nov-2023

ITY 5301 ARTIFICIAL INTELLIGENCE

Time: 3:00 Hours

Max. Marks : 50

Note : Answer any two questions.
Assume suitable missing data, if any.

- Q. 1 a) Write the First Order Logic (FOL) statements corresponding to all five English statements: (10) [CO#3]
1. *John is a king*
 2. *Only kings wear crowns while those who are not kings don't wear crowns.*
 3. *The brother of a king is not a king*
 4. *John and Richard are brothers*
- (Test statement to prove): *Richard does not wear a crown*
- b) Describe the different steps for Resolution. (5) [CO#4]
- c) Perform Resolution for the FOL in part (a) demonstrating all constituent steps in detail. (10) [CO#4]
- Q. 2 a) Construct the Bayesian network for the English statements (Assume your own conditional probability values for the different events): (10) [CO#5]

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1. *John is a king*
2. *Some kings wear crowns.*
3. *The brother of a king may not be a king*
4. *John and Richard are brothers.*

b) Define the chain rule of probability and its role in Bayesian inferencing. (5) [CO#5]

c) Perform Bayesian inferencing for the statement "*Richard does not wear a crown*" showing all constituent steps in detail. (10) [CO#5]

Q. 3 a) Construct the semantic network for the following English statements and demonstrate how to use the inheritance algorithm by taking any suitable example associated with this semantic network. (10) [CO#4]

1. *John is a king*
2. *Kings wear only one crown while those who are not kings don't wear crowns.*
3. *Kings have two legs.*
4. *Brothers of kings have two legs.*
5. *John and Richard are brothers*

b) In the Wumpus world example, write the FOL statements corresponding to : "*Agent is at square (1,1) and he encounters a breeze there. This implies that there is a pit in one of the surrounding rooms*". (5) [CO#3]

c) Explain in detail how diverse artificial intelligence tools have helped to counter the COVID-19 pandemic. (10) [CO#6]

NST-502

ANALYTICAL TECHNIQUES

Time: 3:00 Hours

Max. Marks: 40

Note: Answer Any FIVE questions.
Assume suitable missing data, if any

1. Answer all the questions.

[2 x 4]

- [a]. Explain characteristic and continuous radiation of X-rays. (CO1)
- [b]. Show that the structure factor is independent of shape and size of unit cell in simple cubic (SC) structure. (CO1)
- [c]. Briefly, explain energy dispersive X- rays (EDX) spectroscopy. How EDX is beneficial for characterization of materials? (CO2)
- [d]. Calculate also the corresponding thickness of Fe-17 mass % Cr alloy (density: $7.76 \times 10^6 \text{ g/m}^3$ for Mo-K α). (CO1)
- 2[a]. What is X-ray photoelectron spectroscopy (XPS)? How it is helpful for characterization of materials? Discuss the basic principle and instrumentation of X-ray Photo Electron Spectroscopy. Write the different characteristics studied/ analyzed by XPS. (CO3)[5]
- [b]. Using relation of X-ray intensity vs absorption coefficient, determine the transmission factor of 1 mm lead screen for MoK α and CrK α radiations, with mass absorption coefficient values, $141 \text{ cm}^2/\text{gm}$ and $585 \text{ cm}^2/\text{gm}$, respectively, for these targets and density of lead is 11.34 gm/cm^3 . (CO1) [3]
- 3[a]. Discuss the principle and working of Fourier transform infrared spectroscopy (FTIR) using a suitable diagram. Write down the wave-numbers of stretches: C \equiv N, C-O, C=O, C=C. (CO3) [5]
- [b]. How many electrons per second can directed at the given area of specimen, for a beam of electrons generated by thermionic emission

at high temperature of 2700 K and applied potential 40 kV? if the work function of filament material is 4.5 eV. (CO4) [3]

- 4[a]. Distinguish between optical and electron microscope. Describe the principle and working of scanning electron microscope (SEM). What are the applications of SEM in material characterization? (CO4) [5]
 [b]. How scanning electron microscopy is different from transmission electron microscopy? By drawing ray-diagram, explain imaging and diffraction mode of transmission electron microscope (TEM). (CO2) [3]

- 5[a]. Discuss about magnetic force microscope (MFM). Drawing a proper diagram, explain the cantilever and tip interaction with the specimen to measure magnetic force using MFM. (CO4) [5]
 [b]. Define peizo sensitivity in AFM, if a cantilever travels a distance of 40 nm during adhesion force measurement for a deflection of 5.0 V signal, calculate the sensitivity of peizo crystal. (CO4) [3]

- 6[a]. Explain the principle, working and application of Differential thermal analysis (DTA). Discuss about the exothermic and endothermic reaction taking place during the DTA process. (CO5) [5]

- [b]. A mixture of CaCO_3 and CaO is analyzed using TGA technique. TGA curve of the sample indicates that there is a mass change from 145.3 mg to 115.4 mg between 500–900 °C. Calculate the percentage of CaCO_3 in the sample. (CO5) [3]

7. Discuss briefly any *FOUR*. [4X2]

- [a]. Atomic force microscopy (AFM) (CO4)
 [b]. Scanning Tunnelling Microscopy (STM) (CO3)
 [c]. Polarization Factor (PF) (CO1)
 [d]. Thermogravimetric Analysis (TGA) (CO5)
 [e]. RMS and Average roughness measurement by AFM (CO4)
 [f]. Differential scanning calorimetry (DSC) (CO5)

Total No. of Pages: 1
ODD SEMESTER
END SEMESTER EXAMINATION

Roll No...
Ph.D.
Nov-Dec 2023

NST504: Design and Synthesis of Nanostructures

Time: 3:00 Hours

Max. Marks: 40

Note: Answer all questions
Assume suitable missing data, if any

- Q1. Compare the nanoparticle synthesis methods namely physical, chemical and biological, and discuss their advantages and disadvantages. [7]
- Q2. How sol-gel process is different from the colloidal method? Explain with suitable examples. Also, explain xerogel, aerogel and cryogel processes and point of zero charge. [7]
- Q3. Discuss the laser ablation method of production of nanoparticles. Which common laser is used in this method and why? [6]
- Q4. Discuss chemical vapour deposition (CVD) and low-pressure chemical vapor deposition (LPCVD) methods in detail and compare the LPCVD with other CVDs. [10]
- Q5. Write short notes on any Two of the following. [5×2=10]
(a) Bottom-up and Top-down approaches
(b) Ball milling method
(c) Sputtering method
(d) Electrospinning method

Total no. of Pages: 01

Roll no.....

1st Semester
Ph.D

END TERM EXAMINATION

NOV/DEC-2023

PTE-5307 GREEN POLYMERS

Time: 3:00 Hours

Max. Marks: 50

Note: Be brief. Question No. 1 is compulsory. In addition to Question 1, answer any four questions from Question No. 2 to 9.

1. Write your name and roll number clearly. What is Green Chemistry, sustainability and Green polymers, mention five natural polymers. (10 marks) CO-1
2. What is Bio-catalysis, and the advantages of bio-catalytic synthesis? Why do you think that pharmaceutical industry requires enantiopure medicine/molecules? (10 marks) CO-3
3. What are Bioplastics, how can you make a plastic biodegradable, what are the factors that contribute towards biodegradability? (10 marks) CO-2
4. What are PHA's, write a note on these polymers. (10 marks) CO-3
5. What are Biomimetic & Multifunctional reagents? Give one example to explain your answer. (10 marks) CO-4
6. What are the 12 principles of Green Chemistry? Explain any one principle in details. (10 marks) CO-1
7. What combinatorial chemical synthesis, and the applications of this technique/method. (10 marks) CO-5
8. What is sustainable development. Explain "Atom Economy" & "E-factor" terms used in Green Chemistry Metrics. (10 marks) CO-6
9. What are green solvents, and why do we need green solvents. Support your answer with different green solvents. (10 marks) CO-6

GOOD LUCK

END TERM EXAMINATION

Nov-2023

PES-501 Modeling of Electrical Systems

Time: 3 Hours

Max. Marks : 40

Note : Attempt any 5 questions.
All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1a Explain different types of reference frames. [4][CO#1]
- b. Considering a two mesh electrical system with resistive network, explain how conversion from one set of reference mesh currents to another set of reference branch currents and suitable transformation. [4][CO#1]
- Q.2a Discuss the stator equations for synchronous machines with suitable and relevant diagram. [4][CO#2]
- b. Explain the transformations involved in modelling of machines. Also, explain their significance. [4][CO#2]
- Q.3a Show how a set of three phase balanced voltages $100/0^\circ$, $100/120^\circ$ and $100/-120^\circ$ can be converted to equivalent α β components. Also illustrate with suitable plots what happens if the voltages are unbalanced. [4][CO#3]
- b. Depict the rotor model of the synchronous machine [4][CO#2]
- Q.4a A 20kVA, 6.6kV, three phase alternator is connected to a three phase transmission line. The positive, negative and zero sequence impedances of the alternator are $0.1j$, $0.1j$, and $0.04j$. The neutral of the alternator is connected to the ground through inductive reactance of $0.05j$. The pu positive, negative and zero sequence impedance of the transmission line are $0.1j$, $0.1j$, $0.3j$. All the unit values are based on machine ratings. An L-G fault takes place at the far end of the transmission line on one phase. Compute the fault current in pu as well as in Ampere during fault conditions. [4][CO#3]

- b. Discuss the model of DC-DC buck converter with suitable diagram, design equations and relevant example. [4][CO#4]

Q.5a A transmission line feeds two sets of balanced loads- one set is connected in star configuration, value $30+40j$, the delta connected loads is $60-45j$. All the loads are identical. Using $V_s=207.85V$ per phase voltage 'a' find the following: (i) I (ii) P (iii) Q drawn from the supply (iv) line voltage at load terminals. [4][CO#3]

b. A 230V, 50Hz one pulse SCR is triggered at 40° firing angle and the load current extinguishes at 210° . Find the average output voltage and average load current if $R=5\Omega$, $L=2mH$ and $E=110V$. [4][CO#4]

Q.6 Write short notes on any two:

- (i) PWM inverters
 - (ii) Impedance Matrix
 - (iii) Self inductance calculation for synchronous machine
 - (iv) Modeling of induction motor
- [4X2][CO#1,2,3,4]

Total Number of Pages 3

M.Tech POWER ELECTRONICS SYSTEMS
END SEMESTER EXAMINATION

Roll No.....
I SEMESTER
(Nov- 2023)

PES-503-POWER ELECTRONIC CONVERTERS

Time: 3:00 Hours

Maximum Marks:40

Note: Question No. 1 and 2 are compulsory
Answer any other **THREE** questions from the remaining
Assume suitable missing data, if any
Attempt all parts of a question at one place

- 1 Giving reasons explain briefly, why? 126
- [a] Quasi square waveform does not include 3rd harmonic components.
 - [b] Inverter switched with bipolar PWM require large input filter.
 - [c] Non-isolated Ćuk converters are not advocated for DC microgrid.
 - [d] 12 pulse thyristorised converters are preferred choice for high power DC transmission.
 - [e] Boost PFC converters operate with zero dead zone for current.
 - [f] DC bus of grid coupled-VSI need to be of much higher value than line to line voltage at its terminal for transaction of real power.
 - [g] Ćuk and Sepic converter outperform buck-boost converter.
 - [h] PWM inverters improve current quality, whereas, multi-level inverters work on improving voltage quality. 1x8
- 2 [a] Using approximation, derive the equation for the variation of the duty cycle for Bipolar and Unipolar switching of Inverter for SPWM at fundamental frequency. 3
- [b] Using fourier analysis derive the equation of the voltage output of a thyristorised full converter feeding to RL load, where L is quite large. 3
- [c] Derive the expression for the power factor of a single phase voltage regulator feeding RL load. 2
- 3 [a] Design a buck converter for continuous conduction having specifications: $V_{in}=24$ V (in a range of [20V- 28 V]), $V_{out}=12$ V, and $P_{out}=50$ W (in a range [12W - 120 W], operated at the switching frequency of 100 kHz. Assume 85% efficiency. 4
- [b] For a single-phase Voltage Source Inverter (VSI) bridge operating with both types of PWM switching (unipolar and bipolar) scheme one by one feeding into resistive load with terminal voltage of $223V_{rms}$. The bridge configuration has the top two semiconductor as IGBT switches and bottom switches connected in each leg to be MOSFET switches. For the Unipolar PWM, the two top switches are switched with the fundamental frequency of 50Hz and the

lower two with the switching frequency f_s , while, Bipolar switching all the switches are operated at for switching frequency f_s . The active power transacted by the VSI is 5kW. Furthermore DC bus voltage is kept at 400V, filter inductor components $L_f=4\text{mH}$, $C_f=5\mu\text{F}$ and $f_s=20\text{kHz}$. Calculate the RMS currents of the IGBTs and the MOSFETs for each scheme of switching.

- 4 [a] Design a SEPIC converter for the following specifications:

$V_{in}[3\text{V}-5.7\text{V}]$; $V_{out}=3.3\text{V}$; $P_{out}=8.25\text{W}$; $f_s=330\text{kHz}$

Assume 100% efficiency, voltage drop of 0.5V on diode during conduction, same current ripple for both the inductors (40% of maximum averaged inductor current), 10% ripple across coupling capacitor and 1% ripple at output voltage.

- [b] A full-wave thyristorised converter operating as an inverter is used to transfer power from a wind generator to a single-phase 240-V rms 50-Hz ac system. The generator produces a dc output of 150V and is rated at 5000W. The equivalent resistance in the generator circuit is 0.6Ω . Determine

- (a) The converter delay angle for rated generator output power,
(b) The inductance required to limit the current peak-to-peak ripple to 10% of the average current.

- 5 [a] Derive the condition for elimination of triplen harmonics from the output of single-phase inverter with one pulse per half cycle.

- [b] For a two-source multilevel inverter derive the conditions for chopping angle to each level of square waveforms such that the 3rd harmonics are eliminated. Sketch the output voltage waveform.

- [c] The battery charger realized with a three-phase thyristor bridge rectifier fed from 415V, 50 Hz AC source with series RL impedance ($R=20\Omega$; $L=200\mu\text{H}$) on DC side connected in tandem with 8 units of 12V 62Ah lead acid battery packs. The nominal cell voltage is 2V, whereas, under deep discharge, the cell voltage reaches 1.8V and end of the constant current charging is marked by 2.267V per cell. Determine the change in the angle of triggering for the thyristors so the load current is held constant during charging of the battery pack. For the minimum battery voltage, the angle of triggering (α) for the thyristors is kept at $\alpha = 45^\circ$ to realize charging @C/4.

- 6 [a] A single-phase AC-AC voltage converter having two thyristors in antiparallel connection are driven by 220V, 50Hz voltage from source side to feed into a resistive load ($R=3.2\Omega$) at $16\frac{2}{3}\text{Hz}$ and by reducing the rms output voltage to 40.82 % of rated rms voltage. Calculate the angle of firing of thyristors and the power transferred to the load, when during the positive(+ve) half of waveform (@output side frequency) only the thyristor meant for the +ve side of input side (@fundamental frequency) is fired and correspondingly for negative(-ve) half

of waveform (@input frequency) only the thyristor meant for the -ve side of input side (@fundamental frequency) is fired. Draw a neat diagram of the output waveform.

- [b]. In a Ćuk converter operating at 50 kHz, $L_1 = L_2 = 1\text{mH}$, $C_1 = 5\text{pF}$ and the output capacitor (C_2) is sufficiently large to yield a constant output voltage. Assume $V_{in} = 10\text{V}$ and the output is regulated to be constant at 5 V while supplying 5 W to a load. If a constant voltage across C is maintained, identify the mode of operation (Continuous/ Discontinuous).

--G--

- Q1 For a 5KW wind turbine with rated wind speed of 12m/s. find the radius of turbine blades, gear ratio of the turbine for a slip variation of +0.3 to -0.3. assume tip speed ratio as 8.1 and density of air as 1.225kg/m³. 07
- Q2 Discuss any one of the maximum power point tracking algorithm for energy extraction from Wind turbine. 07
- Q4. Draw the following characteristics 07
- Solar PV panel
 - I-V characteristic for different irradiance
 - P-V characteristic for different irradiance
 - Wind Turbine
 - Turbine output power vs turbine speed for different wind speed
 - Turbine output power vs wind speed for different turbine speed.
 - C_p vs wind speed for different turbine speed.
- Q5. A boost converter is required to have an output voltage of 8 V and supply a load current of 1 A. The input voltage varies from 2.7 to 4.2 V. A control circuit adjusts the duty ratio to keep the output voltage constant. Select the switching frequency. Determine a value for the inductor such that the variation in inductor current is no more than 40 percent of the average inductor current for all operating conditions. Determine a value of an ideal capacitor such that the output voltage ripple is no more than 2 percent. Determine the maximum capacitor equivalent series resistance for a 2 percent ripple. 08
- Q6. A wind turbine having cut in speed =4m/s, rated speed=14m/s. cut out speed=25m/s and the average wind speed=10m/s. with a Rayleigh distribution function, find the probability of useful wind speed for generating electricity. 07

- Q7. In cities we do not have to go to a large height turbine while in ocean a large height turbine is required for a substantial increase in wind speed. Justify. Take friction coefficient as 0.05 and 0.4 for ocean and cities respectively. 07
- Q8. Design a PV array for a 40 kW peak power capacity with standard operating conditions. Each cell has an open circuit voltage (V_{oc}) of 0.5 V to 0.62 V and short circuit current (I_{sc}) of 4A. Calculate how many series and parallel cell are required to attain peak power with an open circuit voltage of 474V. 07

Total no. of Pages:

130 Roll no.....

1st SEMESTER
M.Tech.(PES)

MID TERM EXAMINATION

DEC-2023

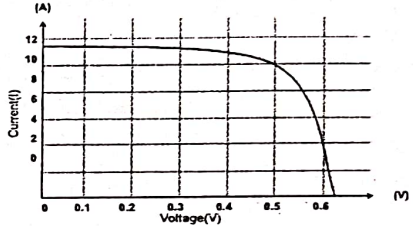
COURSE CODE PES5307 COURSE TITLE POWER ELECTRONICS
FOR PHOTOVOLTAIC AND WIND ENERGY SYSTEMS

Time: 3:0 Hours

Max. Marks: 60

Note : Attempt any five.

Assume suitable missing data, if any.

- Q.1 What should be the structure of a diversified energy sector that is fully resilient to the energy crisis? How the cogeneration of solar and wind energy may be helpful in meeting the growing energy demand from India's perspective. [12]
- Q.2 (a) Discuss the role of inertia in grid stability. How the large penetration of renewables may impact the overall stability of a given system? Please explain with the help of suitable example/case study. [6]
(b) Discuss the role of power electronics in harvesting the energy from intermittent renewables. How the ill effect of large penetration of renewables can be effectively managed by these power electronics devices? [6]
- Q.3 (a) List the different types of MPPT algorithm used in solar PV system. Explain Perturb and observe (P&O) algorithm based MPPT of such system with flow chart. [6]
(b) For the given I-V curve, calculate the power to be drawn by the different values of load resistance $R_L = 0.02\Omega$, 0.05Ω and 0.10Ω . Also determine the values of voltage and current at which maximum power will drawn while considering above load resistances. [6]
- 
- Q.4 (a) A photovoltaic panel has four modules connected in series, each module having an open-circuit voltage (V_{oc}) of 10V and short-circuit current (I_{sc}) of 2A. What should be the voltage axis intercept of the I-V characteristics of the series system? [6]
(b) Write a short note on stationary reference frame as well as synchronously rotating reference frame. [6]
- Q.5 (a) Discuss the different building blocks of Wind Energy Conversion Systems (WECS). List the various factor on which wind out power depends and also derive the expression for the same. [6]
(b) Calculate the energy of a wind turbine during 3h of continuous operation, with a blade length of 10m and efficiency of 40%, when the wind speed is 15kph and the air pressure and temperature are 10143.25 hPa and 15°C. [6]
- Q.6 Write Short Note on any of the two [2x6]
(a) Betz's Limit
(b) Types of WECS configuration
(c) Partial Shading

END TERM EXAMINATION

NOV/DEC-2023

PES5405 Switch Mode Power Converters

Time: 03:00 Hours

Max. Marks: 40

Note : All questions carry equal marks.
Answer any 5 questions
Assume suitable missing data, if any.

- Q.1 (a) Draw and explain the static and dynamic characteristics of DC-DC voltage regulators.
(b) What are the basic topologies of linear voltage regulators?
(c) A voltage regulator has $R_L=10\ \Omega$, $V_{in}=10V$, $V_o=5V$ and $\eta=90\%$. Find the dc input resistance. [4+2+2 marks] [CO1]
- Q.2 (a) Draw the circuit diagram along with labelled inductor/capacitor voltage and current waveforms of SEPIC converter. Find its voltage gain in continuous current mode (CCM). Write the expression of voltage and current stresses of each element in tabular form.
(b) The controlled switch of the ideal SEPIC converter operating in CCM is turned on and off for 0.02ms in a periodic manner. For an input voltage of 12V and load resistance of $5\ \Omega$, find out the output voltage and switching frequency of the converter. [6+2 marks] [CO2]
- Q.3 (a) Draw the circuit diagram along with labelled waveforms of inductor/capacitor voltage and current waveforms of a non-ideal buck converter. Find the voltage gain, voltage ripple, conduction and switching losses.
(b) A buck converter has $V_{in}=22$ to $32\ V$, $V_o=14\ V$, $I_o=0.2$ to $2\ A$ and $f_s=40kHz$. Find the minimum inductance, L required to maintain the converter operation in CCM. [5+3 marks] [CO2]

- Q.4 (a) Explain the concept of ringing in a flyback converter. Find the expressions of ringing current and ringing voltage of switch. Explain one method to reduce it by drawing suitable circuit diagram. Draw labelled waveforms.
- (b) Design a universal dc-dc converter for laptop computers (flyback converter) that accepts a rectified single phase voltage from 90 to 265 Vrms, $V_o=15V$, $I_o=0$ to 2 A and output voltage ripple is <1 percent of the output voltage. The switching frequency is 100kHz. Calculate the value of capacitance. Mention the voltage and current ratings of the components used in this converter. Assume missing data. [4+4 marks] [CO3]
- Q.5 (a) Draw the circuit diagram of the non-ideal half-bridge converter and explain its operation with respect to continuous current mode. Draw the labelled waveforms of current/voltage through/across the controlled switch, inductor and capacitor in all operating modes.
- (b) Design a PWM half bridge converter operating in CCM to meet the following specifications: $V_{in\max}=160V$, $V_{in\min}=127V$, $V_{o\max}=187V$, $V_o=5V$, $I_{o\min}=4A$, $I_{o\max}=40A$ and output voltage ripple is <1 percent of the output voltage. The switching frequency is 100kHz. [4+4 marks] [CO3]
- Q.6 (a) Mention the advantages of soft-switching DC-DC converters over hard-switching DC-DC Converters.
- (b) Explain the modes of operation of ZVS buck converter with equivalent circuit and labelled waveforms. Compare switch voltage and switch current waveform of ZVS buck and PWM buck converter. Write the differences in tabular form. [2+6 marks] [CO4]
- Q.7 (a) Explain the significance of controller design in the DC-DC converter.
- (b) Write assumptions to develop large and small signal model of a forward converter. Find voltage gain and control to output voltage transfer function for non-ideal forward converter. [2+6 marks] [CO5]

Note: All the questions are compulsory.

1. Consider the following dataset: [10] [CO2]

71 87 82 64 72 75 81 69 76 79 65 68 80 73 85 71 70 79 63 62
81 84 77 73 82 74 74 73 84 72 81 65 74 62 64 68 73 82 69 71

- a.) Construct a box- and -whisker plot for these data.
b.) Discuss the shape of the distribution from the plot.
c.) Are there outliers?

2. A.) The amount of time, in hours, that a computer functions before breaking down is a continuous random variable with probability density function given by

$$f(x) = \begin{cases} \lambda e^{-x/100}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

What is the probability that a computer will function between 50 and 150 hours before breaking down? What is the probability that it will function less than 100 hours? [5] [CO1]

- B.) Explain the classification of Data based on (i) type of Data & (ii) the level of measurement with suitable examples? [5] [CO1]

3. A clothing company produces men's jeans. The jeans are made and sold with either a regular cut or a boot cut. In an effort to estimate the proportion of their men's jeans market in Oklahoma City that prefers boot-cut jeans, the analyst takes a random sample of 212 jeans from the company's two Oklahoma City retail outlets. Only 34 of the sales were for boot-cut jeans. Construct a 90% confidence interval [Refer Table I] to estimate the proportion of the population in Oklahoma City who prefer boot-cut jeans. [10] [CO3]

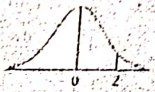
4. According to a report, the average cost of bariatric (weight loss) surgery is about \$22,500. You think this information is incorrect. You randomly select 30 bariatric surgery patients and find that the average cost for their surgeries is about \$21,545 with a standard deviation of \$3015. Is there enough evidence to support your claim at $\alpha = 0.05$? Use a P-value. [10] [CO4]
[Refer Table 1]

5. A.) In real-world data, tuples with missing values for some attributes are a common occurrence. Describe various methods for handling this problem. [5] [CO5]

- B.) Discuss the issues to consider during data integration [5] [CO5]

Reference: You may refer the following table (Table 1) for Question 3 & 4.

Areas of the Standard Normal Distribution


 The entries in this table are the probabilities that a standard normal random variable is between 0 and z (the shaded area).

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319
0.1	.0198	.0138	.0178	.0217	.0257	.0296	.0336	.0375	.0414
0.2	.0793	.0733	.0771	.0810	.0848	.0887	.0926	.0964	.1003
0.3	.1179	.1117	.1155	.1193	.1231	.1268	.1306	.1343	.1380
0.4	.1534	.1471	.1508	.1544	.1581	.1617	.1654	.1690	.1726
0.5	.1915	.1850	.1885	.1920	.1954	.1988	.2021	.2054	.2088
0.6	.2157	.2191	.2224	.2257	.2289	.2321	.2354	.2386	.2417
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535
1.7	.4554	.4561	.4573	.4582	.4591	.4599	.4608	.4616	.4625
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761

[Table 1]

Total no. of pages: 02

135

Roll No.....

**3rd SEMESTER
M.Tech. (PES)**

END TERM EXAMINATION

Nov/Dec-2023

PES-6305 Optimization Techniques in Electrical System Design

Time: 3 hr.

Max. Marks: 50

Note: Q.1 is compulsory.

Attempt any four questions from the remaining questions.

Assume suitable missing data if any.

Q. 1 Solve the following transportation problem.

To

From		D	E	F	G	Availability
	A	11	13	17	14	250
	B	16	18	14	10	300
	C	21	24	13	10	400
Requirement		200	225	275	250	

[CO2] (10)

Q.2 (a) Compare the intervals of uncertainty (L_n/L_0) obtainable in Fibonacci and Golden section methods for 5 number of experiments:

[CO3] (4)

(b) Find the minimum of the following function in the interval [0,5] by Fibonacci method using $n = 4$

$$f(x) = x^5 - 5x^3 - 20x + 5$$

[CO3] (6)

Q.3 (a) Explain the quadratic interpolation method for one dimensional minimization problems.

[CO3] (4)

(b) Minimize the following function using univariate method

$$f(x) = 2x_1^2 + 2x_1x_2 + x_2^2 + x_1 - x_2$$

starting from the point $X_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$. Take probe length $\epsilon = 0.01$. Perform two iterations.

[CO4] (6)

Q.4 (a) What is a descent method? Why is the steepest descent direction not efficient in practice, although the directions used are the best directions? [CO4] (4)

(b) Minimize the following function using steepest descent method

$$f(x) = 6x_1^2 - 6x_1x_2 + 2x_2^2 - x_1 - 2x_2$$

starting from the point $X_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$. Perform two iterations.

[CO4] (6)

Q. 5 (a) What are the roles of exploratory and pattern moves in Hook and Jeeves method. [CO4] (4)

$$f(x) = x_1^2 + x_2^2 - 2x_1 - 4x_2 + 5$$

starting from the point $X_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$. Take probe length $\epsilon = 0.1$. Perform two iterations. Take $\Delta x_1 = \Delta x_2 = 0.8$.

[CO4] (6)

Q.6 (a) Express mathematically a nonlinear constrained problem. Explain the approach of penalty function method. [CO5] (4)

(b) Minimize

$$f(x) = (2x_1 - x_2)^2 + (1 + x_2)^2$$

s.t.

$$x_1 + x_2 = 10$$

using penalty function method with classical method of unconstrained minimization.

[CO5] (6)

Q.7 Explain *any two* of the following methods of optimization in detail. Also draw their Flow Chart.

- i) Particle Swarm Optimization
- ii) Genetic Algorithm
- iii) Ant Colony Optimization
- iv) Teaching Learning based Optimization

[CO6] (10)

XXXXXX

Note: Answer ANY FIVE questions and all carry equal marks. Write the ANSWERS IN A SEQUENCE. Assume any data if missing and clearly mention the assumption.

Q(1). (a) Find all fixed points for $\dot{x} = x^2 - 1$ Find the analytical solution and classify their stability

(b) A resistor R and a capacitor C are in series with a battery of a constant DC voltage V_0 shown in Fig.1. Suppose that the switch is closed at $t = 0$, and that there is no charge on the capacitor initially. Let $Q(t)$ denote the charge on the capacitor at time $t \geq 0$ and draw the $Q(t)$ versus \dot{Q} and also classify their stability.

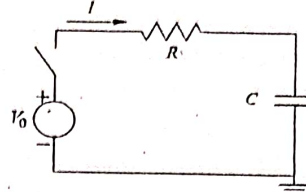


Fig.1

[4+4=8M][CO1]

Q2. (a) What is a nonlinearity? Explain what you mean by nonlinearity. Include simple examples with the physical meaning of nonlinear systems. Make a list of nonlinearities you meet during your daily life.

(b) By using linear stability analysis determine the stability of fixed point, analytical solution, and find the potential function $V(x)$ for the following nonlinear dynamical system

- i. $\dot{x} = \sin x$
- ii. $\dot{x} = x - x^3$
- iii. $\dot{x} = e^x \sin x$

[4+4=8M][CO2]

Q3. The nonlinear dynamical system is represented by $\dot{x} = \{\lambda - x\} - \frac{1}{x}$ $\lambda \in \mathbb{R}$. (i) Find the potential functions and plot them together with the functions in phase space. (ii) What are interesting values of λ , i.e. values where bifurcation occurs (iii) Draw a bifurcation diagram for the system (iv) Classify the bifurcation in terms of the basic types

[8M][CO3]

Q4. For the two-dimensional system $\dot{x} = f(x, y) = y - y^3 = y(1 - y^2)$, $\dot{y} = g(x, y) = -x - y^2$ or in matrix form

$$\dot{x} = \begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} y^3 \\ y^2 \end{pmatrix}$$

a) Find all fixed points at $\bar{x}_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$, $\bar{x}_{2,3} = \begin{pmatrix} -1 \\ \pm 1 \end{pmatrix}$ and classify them. b) Calculate the eigenvalues and where appropriate eigen vectors. [8M][CO3]

Q(5) (a) Explain the Voltage Mode Control? And implement the voltage mode control on the Buck Converter and also draw the waveforms?

(b) Explain the Current Mode Control? And implement the Current mode control on the Boost Converter and also draw the waveforms? [4+4=8M][CO4]

Q(6) Explain about bifurcation modeling approaches

(a) Continuous-time averaging approach

(b) Discrete-time iterative mapping approach [4+4=8M][CO4]

Q(7) Explain and derive the Ad Hoc Derivation of the discrete-time iterative map for the Boost Converter? [8M][CO4]

Q(8) Explain about bifurcation modeling approaches

(a) Continuous-time averaging approach

(b) Discrete-time iterative mapping approach [4+4=8M][CO4]

Q(9)(a) Explain the following terminology and describe their properties and behavior. (i) State variable or state vector (ii) State space or phase space (iii) Trajectory (iv) Attractor.

(b) Explain about Bifurcation? And types of Bifurcation with diagrams? [4+4=8M][CO1,2,3]

Course Code: STE501

Course Title: Structural Dynamics

Time: 3:00 Hours

Maximum Marks: 40

Note: Answer ALL questions.
Assume suitable missing data, if any.

Q.1 Answer ALL parts of the following:

- (a) What is Modeling of Structure in structural dynamic analysis? Write its three stages. [2][CO-1]
- (b) Describe the Vibration Management. [2][CO-4]
- (c) What do you understand by Equivalent Viscous Damping? Also determine the Equivalent Viscous Damping for Coulomb Damping. [2][CO-2]
- (d) Draw the response of a undamped SDOF system at resonance condition. What is Beating phenomenon? [2][CO-3]

Q.2 Answer any TWO parts of the following:

- (a) Describe the Logarithmic Decrement method for measuring the damping. [4][CO-2]
- (b) A vibrating system consisting of a mass of 2.267 kg and a spring of stiffness 17.5 N/cm is viscously damped such that the ratio of any two consecutive amplitudes is 1.00 and 0.98. Determine (I) the natural frequency of the damped system (II) the logarithmic decrement (III) the damping factor, and (IV) the damping coefficient. [4][CO-2]
- (c) A SDOF system has an undamped natural frequency of 5 rad/s and a damping factor of 20%. It is given the initial conditions $x_0 = 0$ and $\dot{x}_0 = 0.5$ m/s. Determine the damped natural frequency and expression for the motion of the system for $t > 0$. [4][CO-2]

Q.3 Answer any TWO parts of the following:

- (a) An SDOF system is exerted by a sinusoidal force. At resonance, the amplitude of the displacement was measured to be 5 cm. At an exciting frequency of one-tenth the natural frequency of the system, the displacement amplitude was measured to be 5 mm. Determine the damping ratio of the system. [4][CO-3]
- (b) Prove that the Transmissibility of force transmitted to foundation is identical of response to support motion. [4][CO-3]
- (c) A spring mass damper system consist of mass weighing 100 N and spring with stiffness of 2000 N/m. From frequency response plot to harmonic excitation, the frequency bandwidth has been observed to be 100 rpm. If the such a system is subjected to excitation of $F(t) = 25\cos\omega t$ N, Determine the amplitude of vibration after $\frac{1}{4}$ cycle and 2.5 cycles. [4][CO-3]

Contd.....2

Q.4 Answer any TWO parts of the following:

(a) A portable eccentric mass shaker is used to evaluate the in situ dynamic properties of a structure, using two different frequencies and measuring the displacement amplitudes as well as the phase angles. A test was carried out on a single story building and the following responses were recorded:

(1) $\omega_1 = 18.3 \text{ rad/s}$, $F_{o1} = 837 \text{ kN}$, $X_1 = 0.139 \times 10^{-3} \text{ m}$, $\Theta_1 = 8^\circ$

(2) $\omega_2 = 60.99 \text{ rad/s}$, $F_{o2} = 9300 \text{ kN}$, $X_2 = 0.332 \times 10^{-3} \text{ m}$, $\Theta_2 = 174.29^\circ$

Determine the natural frequency and damping ratio for the structure. [4][CO-4]

(b) A vertical single cylinder diesel engine of 500 kg mass is mounted on springs with $k = 200 \text{ kN/m}$ and dampers with $\xi = 0.2$. The rotating parts are well balanced. The mass of the equivalent reciprocating parts is 10 kg and the stroke is 200 mm. Determine the dynamic amplitude of the vertical motion, the transmissibility and the force transmitted to the foundation, if engine is operated at 200 rpm. [4][CO-4]

(c) Determine the response of a system shown in Fig.1 to a periodic loading shown in Fig.2. [4][CO-4]

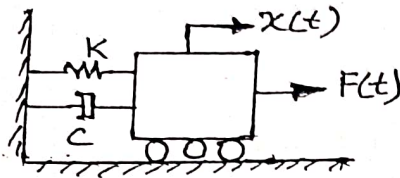


Fig.1

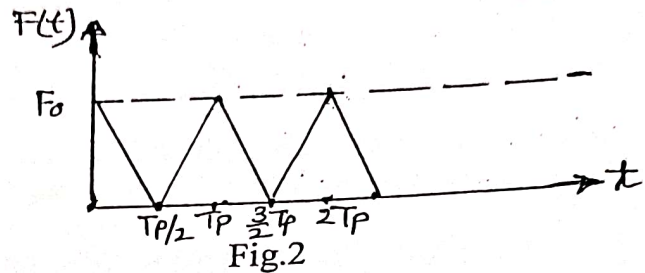


Fig.2

Q.5 Answer any TWO parts of the following:

(a) Determine the response due to harmonic excitation for the shear frame shown in Fig. 3. Take $EI = 24 \times 10^6 \text{ Nm}^2$, $M = 500 \text{ kNs}^2/\text{m}$, $F_1(t) = 0$, $F_2(t) = (10000 \sin 30t) \text{ kN}$, storey height = 3 m. [4][CO-5]

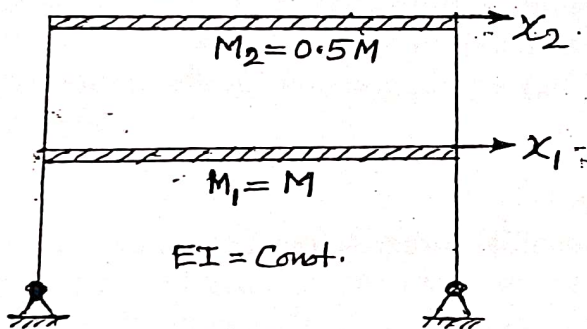


Fig.3

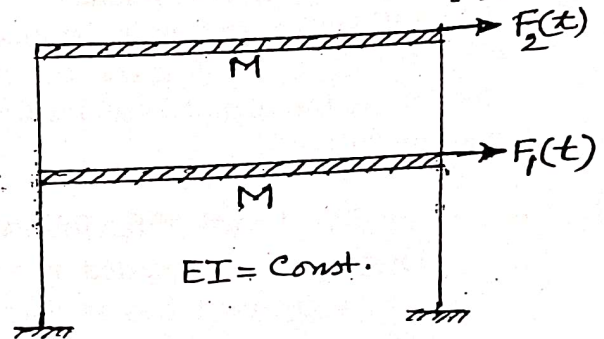


Fig.4

(b) Determine the natural frequencies and mode shapes for the shear frame shown in Fig. 4. Take $EI = 5 \times 10^6 \text{ Nm}^2$, $M = 500 \text{ kNs}^2/\text{m}$, span = 5 m. [4][CO-5]

(c) Write the equation of motion for the MDOF system shown in Fig.5. Also determine the natural frequencies and mode shapes for the system. [4][CO-5]

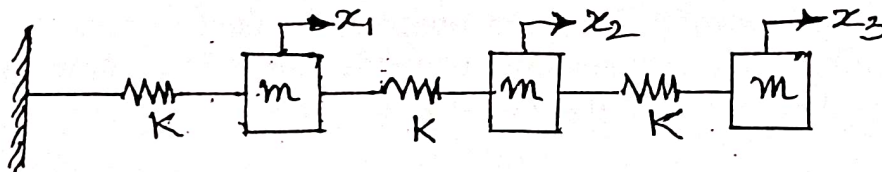


Fig.5

M.Tech./Ph.D. ISEMESTER M.Tech. (Struct.)

END SEMESTER EXAMINATION

Nov./Dec.2023

STE503: Computational Methods in Structural Engg.

Time: 3:00Hours

Max. Marks: 40

Note: Answer Any Five Questions.

Assume suitable missing data, if any.

Q.1 A contractor builds houses, duplexes, and apartment units. He has financial backing to build 250 units. He makes a profit of \$4,500 on each house, \$4,000 on each duplex, and \$3,000 on each apartment unit. Each house requires 10 man-months of labor, each duplex requires 12 man-months, and each apartment requires 6 man-months. How many of each should the contractor build if he has 2050 man-months of labor available and wishes to make a total profit of \$875,000?

[CO1][8]

Q.2(a) As a Civil Engineer you are planning to use a large parabolic arch with a shape given by:

$$y = 3x - 0.1x^2$$

where y is the height above the ground and x is in meters. Calculate the total length of the arch by using Simpson's 1/3 rule. (Divide the domain from x=0 to x=20 m into four equally spaced intervals.) The total length of the arc is given by

$$L = \int_0^{20} \sqrt{1 + \left(\frac{dy}{dx}\right)^2} dx$$

[CO2] [5]

(b) The pressure p of wind corresponding to the velocity v is given by the following data. Estimate p, when v=15

v	10	20	30	40
p	1.1	2.0	4.4	7.9

[CO2][3]

- Q.3 (a) The following data gives the velocity of a particle for twenty seconds at an interval of five seconds. Find the initial acceleration using the entire data

Time $t(\text{sec})$	0	5	10	15	20
Velocity $v(\text{m/s})$	0	3	14	69	228

[CO3][4]

- (b) If F is the force required to lift a load W , by means of a pulley, fit a linear expression $F=a+bW$ against the following data:

W	50	70	100	120
F	12	15	25	25

[CO3][4]

- Q.4(a) Given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$, $y(1) = 1$, evaluate $y(1.2)$ by modified Euler's method.

[CO4][5]

[CO5][3]

- (b) What is Swarm intelligent

- 5 (a) Find the value of $1/23$ by Newton-Rapson method. The result must be corrected to 4 decimal places.

[CO3][4]

- (b) Find the values of $y(0.1)$, $y(0.2)$ using the Runge-Kutta method of the fourth order, given that

$$\frac{dy}{dx} = xy + y^2, \quad y(0) = 1$$

[CO4][4]

[CO5][4X2=8]

Q.6 Write short notes on

- Crisp and Fuzzy Set
- Artificial Neural Network

Total No. of Pages 01
1st SEMESTER
END TERM EXAMINATION

143

Roll no.....
M.Tech. (Structural Engg.)
November/ December 2023

STE5303 Theory of Elasticity and Plasticity

Time: 3:00 Hours

Max. Marks: 50

- Note:** 1. Attempt any five questions.
2. Marks of the questions are mentioned opposite to them.
3. Assume suitable missing data, if any.

Q.1 The components of the strain tensor at a point in a body are given by $\epsilon_x = 0.005$, $\epsilon_y = 0.004$, $\epsilon_z = -0.002$, $\gamma_{xy} = 0.001$, $\gamma_{yz} = 0.0005$ and $\gamma_{zx} = 0.002$. If the modulus of elasticity, $E = 2 \times 10^5 \text{ N/mm}^2$ and the poisson's ratio is 0.25. Determine the components of the stress tensor. [10] [CO2]

Q.2 Given state of stress at a point with respect to x, y and z axes is as $\sigma_x = 100 \text{ MPa}$, $\sigma_y = 120 \text{ MPa}$, $\sigma_z = 180 \text{ MPa}$, $\tau_{xy} = -40 \text{ MPa}$, $\tau_{yz} = -20 \text{ MPa}$ and $\tau_{xz} = 10 \text{ MPa}$.

(a) Determine the principal stresses, their planes and also

(b) Determine maximum shearing stress along with its plane. [10] [CO1]

Q.3 The state of strain at a point in a body is given by the following strain tensor:

$$\begin{bmatrix} 0.002 & 0 & -0.004 \\ 0 & -0.006 & 0.001 \\ -0.004 & 0.001 & 0 \end{bmatrix}$$

Find out strain invariants of the strain tensor and spherical and deviatoric components of the strain tensor. [10] [CO3]

Q. 4 Establish relationship to determine shearing stresses in an elliptical section using Airy's stress function. [10] [CO4]

Q. 5 Drive the relationship for elasto-plastic analysis of a thick pressure vessel using Tresca yield criterion and plane strain case. [10] [CO4]

Q.6 Drive relationship for elasto-plastic yielding of a rectangular steel beam and also determine bending moments, which will cause incipient of yielding and full plastic yielding of 70 mm x 100 mm section. Additionally, determine the state of stress in the section induced by a bending moment of 34.33 kNm. Given, yield strength of the steel is 240 N/mm^2 . [10] [CO5]

Total no. of Pages:01

Roll no.....

1st SEMESTER

M.Tech.

END TERM EXAMINATION

Nov-2023

STE 5401 Design of Advanced RCC Structures

Time: 03:00 Hours

Max. Marks: 40

Note: All questions carry equal marks. Attempt any Two
 Assume suitable missing data, if any.
 IS 456:2000 is allowed

- Q.1 A column supported at 3.6 m apart with hinge and roller is loaded with 680 kN and 350 kNm of the axial and bending moment respectively. Design the column with width about 200 mm. Use M20 concrete and HYSD bars.

OR

A simply supported beam of span 6m is subjected to the following loads and specifications. $L = 6\text{m}$, $W_s = 9.4\text{ kN/m}$, $W_l = 15\text{ kN/m}$, $F_{ck} = 20\text{ MPa}$, $F_y = 415\text{ MPa}$, $B = 0.2\text{m}$, $h = 0.4\text{m}$. Design the beam by LSM subjected to the deflection limit of $L/250$. [20][CO1&2]

- Q.2 Design a cantilever retaining wall to retain soil of height 4m above the ground level. The design data is: Safe bearing capacity, $p_a = 110\text{ kN/m}^2$, $F_{ck} = 20\text{ MPa}$, $F_y = 415\text{ MPa}$, Angle of internal friction $= 30^\circ$, Unit weight of the soil $= 20\text{ kN/m}^3$, Coefficient of friction between the soil and the concrete $= 0.55$. [20][CO3]

- Q.3 A reservoir of 31ML is to be designed as a rectangular underground water tank. The soil is clayey type whose density can be taken as 16 kN/m^3 . The ground area available is $55\text{m} \times 85\text{m}$ and the top of the tank is to be 500 mm below the soil. The tank is to be designed in two equal compartments. Use $F_{ck} = 20\text{ MPa}$ and $F_y = 415\text{ MPa}$. [20][CO4]

Type of element	Live load, q (kN/m)	Span/depth, l/h ratio
	constant load	40
	50 (2.4) 100 (4.8)	40-50 32-42
	50 (2.4) 100 (4.8)	20-30 16-28
	50 (2.4) 100 (4.8)	23-32 19-24

Typical span-to-depth ratios for simply supported prestressed concrete members.

Values of f_{pu} and f_{ps}

Steel Type	f_{pu}	f_{ps}	Long-Term Losses	f_{ps}
$f_{pu} = 270 \text{ ksi}$ (1860 MPa)		k_{12} (92%)	k_{12} (92%)	k_{12} (92%)
Stainless steel	0.7 f_{pu}	170	35	135
		(1172)	(265)	(972)
Low-alloy steel	0.75 f_{pu}	150	30	117
		(1034)	(218)	(834)

Common types from CPCL Metric Design Manual

Tendon Type	Grade	Size	Nominal Dimension	Area	Mass
	f_{pu}	Designation	Diameter mm	mm ²	kg/m
Seven-wire strand	1860	9	9.53	55	0.432
	1860	11	11.13	74	0.582
	1860	13	12.70	99	0.775
	1860	15	15.24	140	1.109
	1700	16	15.47	148	1.173

Ends Type	l_n/l_m
Low relaxation steel	0.90
Stainless steel	0.15
Plain processing bars	0.15
Deformed processing bars	0.30

Cross section shape	$a \times b$	$b_1 \times b_2$
	0.50 h	0.33 h
	0.47 h	0.33 h
	0.58 h	0.49 h
	0.70 h	0.43 h
	0.76 h	0.48 h

Approximate values of flexural lever arms for preliminary service load design.

Total No. of pages 04
I SEMESTER

Roll No. _____
M.Tech. [Civil Engg.] [Structural Engg.]
END SEMESTER EXAMINATION November 2023
STE 6405 Prestressed Concrete Design

Time: 3 Hours

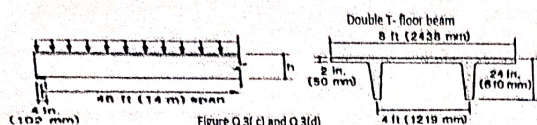
Max. Marks: 40

Note: Answer four options for Q1, choose two out of three for both Q2 and Q3. Q4 is mandatory. All questions hold equal marks. Assume missing data if needed. Students' references IS 1343:2012 and IS 456:2000 is permitted during the exam. Draw reinforcement detailing, if needed. Additional resources such as CEB-FIP/ACI code and PCI design manual data can be found on page 4.

- Q.1 Attempt any four of the following and Explain: [4 x 02 = 08]
- The design model for combined shear and torsion as per IS 1343
 - Curvature and wobbling friction losses.
 - Draw stress diagram when plastic hinge forms at the section, for a PSC beam of rectangular cross section.
 - Transmission of pre-stress in pre-tensioned beam
 - The determination of fixed end moments using method of shift.
 - The requirement for durability of concrete as per IS 1343

Q2(a): The concrete beam grade M50 has dimensions 250 mm x 250 mm and is partially prestressed and axially pre-tensioned using 2 nos. 13 mm dia 7 wire low relaxation strands having f_{pu} 1860 MPa and 4 nos. 16 mm # steel. The $f_{pbed} = 66\%$ of f_{pu} . Take $\phi = 2.4$, relaxation losses 5%. $E_p = E_s = 200000 \text{ MPa}$. Shrinkage and thermal strains as $\epsilon_{sh} = -0.4 \times 10^{-3}$; $\epsilon_{cth} = \epsilon_{sth} = \epsilon_{pth} = 0.3 \times 10^{-3}$. Predict the short term and long-term axial elastic un-cracked (Linear) response of the member when it is subjected to an axial tensile force of 350 kN. Determine strains and stresses in concrete, steel rebar and tendons. Calculate the prestressing losses at different stages.

Q2(b) Check the design of a s/s double Tee Beam shown in figure for flexural and shear strength of the section as per 1343: 2012 with bonded pre tensioned tendons with single harping point at centre of the span. Data for the design is as follows. Total udl at service load = 13.71 kN/m, location of CGC line from top = 410 mm, b_{av} web width = 244.3 mm, eccentricity of tendons at left support = 236 mm from CGC line, eccentricity of CGS from CGC line at midpoint of span = 371.5 mm, $A = 258709 \text{ mm}^2$; $y_b = 436 \text{ mm}$; $y_t = 174 \text{ mm}$; $I = 8735 \times 10^6 \text{ mm}^4$; $S_b = 20058 \times 10^3 \text{ mm}^3$; $S_t = 50194 \times 10^3 \text{ mm}^3$. $M_{ult} = 504 \text{ kNm}$, $d_p = 545.5 \text{ mm}$, $A_p = 594 \text{ mm}^2$, $f_{pu} = 1860 \text{ MPa}$, $f_{ck} = 34.5 \text{ MPa}$ and signature strain = 0.00698.



III SEMESTER

M.Tech. [Civil Engg.][Structural Engg.]

END SEMESTER EXAMINATION (NOVEMBER 2023)

STE6201 SUSTAINABLE BUILDING TECHNOLOGIES

Time: 3 Hours

Max. Marks: 50

Note: Answer all questions. All questions hold equal marks. Assume suitable missing data if any. Attempt two parts of each question and write concise explanatory notes.

Q1: Attempt any two parts:

- (a) Identify and explain relevant indicators to assess the contribution of a building to sustainability and sustainable development.
- (b) Explain the key methods to measure the sustainability of the built environment.
- (c) Comment on strategy to be followed to achieve sustainability in Civil Engineering works.

Q2: Attempt any two parts:

- (a) Embodied and operational energy of urban residential buildings in India
- (b) Low-cost housing emerging technologies
- (c) Physical properties of recycled coarse and fine aggregates and applications

Q3: Attempt any two parts:

- (a) Greenhouse gas emission resulting from land use change in built environment.
- (b) Comment on properties of bamboos, compressive strength, flexural strength, and the shear strength.
- (c) Compare the properties of concrete when Iron Ore Tailings replaces proportion of sand.

Q4: Attempt any two parts:

- (a) Constraints and rigidity faced by green rating systems.
- (b) Wall construction practices and sustainability.
- (c) Alternative roofing systems

Q5: Attempt any two parts:

- (a) Composition of C & D waste and its Management
- (b) Energy and emissions due to building technologies.
- (c) Green Building Systems

Total no. of pages:02

148 Roll No.....

III SEM M.Tech. (Structures)

END TERM EXAMINATION

NOV/DEC-2023

STE6301 Instrumentation and Rehabilitation of
Structures

TIME: 3 Hours

Max. Marks: 50

Note: Attempt any Five questions. All questions carry equal marks.

- 1(a) Discuss and compare stress strain relationships of Mild steel and HYSD reinforcements used in concrete. M5/CO1
- (b) Explain various types of exposure conditions specified in IS 456 code of practice for concrete structures. M5/CO1
- 2(a) Describe the manufacturing of ordinary Portland cement. M5/CO2
- (b) Discuss circumstances when heat of hydration released by cement may create problems in construction. Suggest a remedy for it. M5/CO2
- 3(a) Discuss how durability of an RC structure in a coastal area may be affected, giving reasons. M5/CO3
- (b) What do you understand by "Rehabilitation"? How is it different from "Repair"? M5/CO3

4(a) Discuss how fire resistance of an RCC column in an industrial building may be improved. M5/CO4

(b) What is 'Carbonation' of concrete? What are the factors responsible for it? M5/CO4

5(a) Write various advantages of using 'Fibre reinforced concrete'. M5/CO5

(b) Write a detailed note on "types of fibres used in concrete", citing material composition and advantages of each type. M5/CO5

6 Write short notes on any two of the following topics.

(a) Effect of water cement ratio on concrete strength

(b) Slump test for concrete

(c) Various methods of curing of concrete

M10/CO6

DEPARTMENT OF CIVIL ENGINEERING
DELHI TECHNOLOGICAL UNIVERSITY

156

IIIrd Semester

M.Tech. (Structural Engineering)

Max. Marks: 40

END TERM EXAMINATION

Nov. 2023

Course Code: STE 6407 Course Title: Retrofitting of Structures

Note: All questions are compulsory.

Use of IS 456:2000, IS 1893:2016, IS 13920:2016 is allowed.

Assume any missing data suitably.

- | | Marks[CO] |
|--|-----------------|
| Q 1 Under what conditions is the installation of seismic belt a solution for enhancing the lateral load capacity of wall and how does it function in Masonry construction. | 05[CO4] |
| Q 2 Which is the most popularly used methods for strengthening of building RC columns? Elaborate with the technical consideration considered for the same. | 05
[CO2/CO3] |
| Q 3 Categorize the grades of earthquake damage in load bearing masonry wall and why does the Delamination, or Partial Collapse type of damage occur in load bearing masonry? | 05[CO4] |
| Q 4 The Weaknesses in Dhajji Wall such as In-Plane Deformation is due to Lack of Adequate Bracings and their Poor Connection – COMMENT | 05[CO4] |
| Q 5 Discuss the mechanism and reason for the beam-column joint failure during seismic event. | 05[CO1] |
| Q 6 Elaborate on the Retrofitting measures of Existing Masonry Walls w.r.t. weakness in Random Rubble Walls | 05[CO4] |

15)

caused by Delamination of Wythes in thick Walls.

- Q 7 A ten storied building has a plan dimension as shown in Fig 1. Two shear walls are to be provided in each direction to resist seismic forces. The axial load on each shear wall is 8500 kN due to dead load and live load, shear force at the base is 1375.45kN and bending moment is 31595.25kNm. The height between floors is 3.0m. Design the shear wall with M25 grade concrete and Fe 415 steel. d/s between column is 6 m centre to centre. 10[CO2/CO5]

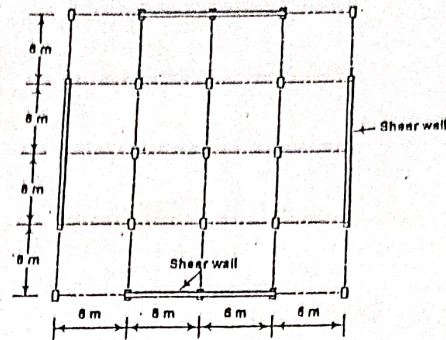


Fig 1

Total no. of Pages:01

Roll no.....

1st SEMESTER

M.Tech

END TERM EXAMINATION

Dec-2023

SPD501

ADVANCED DIGITAL SIGNAL PROCESSING

Time: 03:00 Hours

Max. Marks: 40

Note: All questions carry equal marks.
Assume suitable missing data, if any.

- Q.1 Convert the pole-zero IIR system into a lattice-ladder structure. Also, draw the lattice-ladder structure. [M=8][CO3]

$$H(z) = \frac{1 + 4z^{-1} + 4z^{-2} + z^{-3}}{1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}}$$

- Q.2 The desired frequency response of high pass filter (HPF) is given by

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & w_c \leq |\omega| \leq \pi \\ 0 & |\omega| < w_c \end{cases}$$

Design a linear-phase FIR high pass filter using Hamming window for M=7 and $w_c = 2$ rad/sample. [M=8][CO4]

- Q.3 (a) Convert the analog filter with system function

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16}$$

into a digital IIR filter by means of bilinear transformation. The filter is to have a resonant frequency $w_r = \frac{\pi}{2}$. [M=5][CO4]

- (b) Compare between impulse invariant and bilinear transformation methods for IIR filter design. [M=3][CO4]

- Q.4 (a) Compare between fixed-point and floating-point Digital Signal Processors. [M=4][CO5]

- (b) Write short note on interpolation and decimation. [M=4][CO5]

- Q.5 (a) State and verify convolution property of DFT. [M=4][CO1]

- (b) Find the inverse DFT of the given $X(k) = \{1, 2, 3, 4\}$ using DIF-FFT algorithm. [M=4][CO2]

END TERM EXAMINATION

NOV/DEC-2023

SPD503 IMAGE ANALYSIS AND PROCESSING

Time: 03:00 Hours

Max. Marks: 40

Note: All questions carry equal marks.

Assume suitable missing data, if any.

- Q.1 (a) With the help of a suitable diagram, show the basic components comprising a typical general-purpose system used for digital image processing. [2][CO1]
- (b) You are preparing a report and have to insert in it an image of size 2048×2048 pixels. (i) Assuming no limitations on the printer, what would the resolution in line pairs per mm have to be for the image to fit in a space of size 5×5 cm? (ii) what would the resolution have to be in dpi for the image to fit in 2×2 inches? [3][CO1]
- (c) Propose a single intensity transformation function for spreading the intensities of an image so that the lowest intensity is 0 and highest is $L-1$. [3][CO2]

- Q.2 (a) Suppose a 4-bit grayscale image has the histogram associated with a table of the numbers n_i of gray values:

Gray level i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
n_i	15	0	0	0	0	0	0	0	0	70	110	45	80	40	0	0

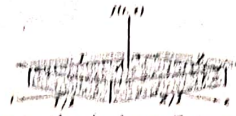
Apply the histogram equalization technique and produce the resulting histogram. Also show both the histograms. [4][CO3]

- (b) You are given a computer chip that can perform linear filtering in real time, but you are not told whether the chip performs correlation or convolution. Give the details of a test you would perform to determine which of the two operations the chip performs. [2][CO3]

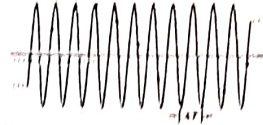
- (c) Discuss the relative advantages and disadvantages of Laplacian over Gradient operator. [2][CO3]

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- Q.3 (a) Obtain the Fourier Transform of a 2-D box function as shown below: [3][CO4]



- (b) With reference to the below figure: [3][CO4]



- (i) What is the approximate sampling rate represented by the dots?
 (ii) Approximately, what would be the lowest sampling rate that you would use so that (a) the Nyquist rate is satisfied and (b) samples look like a sine wave?
 (c) Write a short note on (i) Duality (ii) Hit-or-miss transform. [2][CO1]
- Q.4 (a) Suppose, you are given an image corrupted with salt and pepper noise (P_s and P_p have values 0.1 each). Which type of adaptive filtering technique would you like to adopt and how it works? Explain in detail. [4][CO5]
 (b) For the table given below, apply Arithmetic coding procedure to code a five-symbol sequence or message $a_1a_2a_3a_3a_4$. [4][CO5]

Source Symbol	Probability	Initial Subinterval
a_1	0.2	[0.0, 0.2)
a_2	0.2	[0.2, 0.4)
a_3	0.4	[0.4, 0.8)
a_4	0.2	[0.8, 1.0)

- Q.5 (a) A binary image contains straight lines oriented horizontally, vertically, at 45° , and at -45° . Propose a set of 3×3 masks that can be used to detect 1-pixel breaks in these lines. Assume that the intensities of the lines and background are 1 and 0, respectively. [2][CO5]
 (b) Derive the expression for LoG for the following Gaussian function:

$$G(x, y) = e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Also show the 5×5 kernel approximation to the shape of LoG. [4][CO5]

- (c) Discuss Principal Components as feature descriptors. [2][CO5]

END TERM EXAMINATION

COURSE CODE: SPD5303 Wavelets in Signal Processing

TIME: 3:00 Hours

Max. Marks: 40

Note: All questions are compulsory.
All Questions carry equal marks.
Assume suitable missing data, if any

Q1:

- (a) Estimate the original samples, using inverse discrete wavelet transform with given approximate and detailed coefficients at different decomposition levels (take Haar mother wavelet)

Approximate coefficients (2nd level): [30, 22.50]

Detailed coefficients (2nd level): [-10, -7.5]

Detailed coefficients (1st level): [0, 0, 3.53, -7.07]

- (b) Repeat part (a) by replacing detailed coefficients by zeros and comment on the reconstructed signal. Also, plot each original and reconstructed signal.

[4 Marks][CO3]

Q2:

- (a) What are the similarities and dissimilarities between wavelet and Fourier transforms?
- (b) Differentiate resolution properties of wavelet transform and short time Fourier transform (STFT).

[4 Marks][CO1]

Q3:

- (a) What is your understanding of a lossy compression and why is it important?
- (b) Why is wavelet-based compression useful?

[4 Marks][CO4]

Q4:

- (a) Describe the Coiflet wavelet using both mathematical and diagrammatic representations.
- (b) Design a one-stage wavelet analysis and synthesis transform algorithmic model capable of transforming a 1D signal to various low-pass and high-pass filter components.

[4 Marks][CO4]

Q5:

- (a) Develop the edge detection of image similarity application of wavelets.
- (b) What is the significance of using the multiscale/multiresolution technique?

[4 Marks][CO5]

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Q6: Analyze the filter banks with approximation and detail coefficients.

- (a) Analyze the filter banks with approximation and detail coefficients.
- (b) What are the vanishing moments of them?

[4 Marks][CO5]

Q7:

- (a) Name the different types of features and noises that may distort the ECG signal.
- (b) Describe the application of the decomposition of the first-level DWT to the ECG signal.

[4 Marks][CO6]

Q8:

- (a) Describe local thresholding.
- (b) Describe adaptive thresholding.
- (c) What are the two main approaches to finding the threshold in adaptive thresholding?
- (d) Describe the global thresholding technique.

[4 Marks][CO3]

Q9:

Write the abstract on the latest research trends of the application of wavelet transform with their need in the field of

- (a) Signal processing
- (b) Image processing

[8 Marks][CO6]

Ist SEMESTER

M.Tech. (SPD)

END TERM EXAMINATION

NOV/DEC-2023

SPD5407 Soft Computing

Time: 3:00 Hours

Max. Marks: 40

Note: All questions are compulsory.
Assume suitable missing data, if any.

- Q.1 Evaluate the weight matrix that is needed to store the following associative patterns (A_i with B_i for $i = 1, 2, 3$) in a bidirectional associative memory (BAM).

$$A_1 = [1 \ -1 \ -1 \ -1 \ -1]^T \quad B_1 = [-1 \ -1 \ -1 \ -1 \ -1]^T$$

$$A_2 = [-1 \ -1 \ -1 \ -1 \ 1]^T \quad B_2 = [1 \ -1 \ -1 \ -1 \ -1]^T$$

$$A_3 = [-1 \ -1 \ 1 \ -1 \ -1]^T \quad B_3 = [-1 \ -1 \ 1 \ 1 \ -1]^T$$

If an input $A^I = [1 \ 1 \ -1 \ -1 \ -1]^T$, is applied at the BAM. Find where the output of the designed BAM will converge.

[8][CO1, 2]

- Q.2 (a) A single layer perceptron (SLP) is needed to classify two set of patterns located in a 2-dimensional vector space for the following problems:

Problem	Set I	Set II
(i)	$A=[2 \ 2]^T, B=[1 \ 1]^T, C=[2 \ -2]^T$	$D=[2 \ 2]^T, E=[-1 \ -1]^T$
(ii)	$A=[1 \ 1]^T, B=[-1 \ -1]^T$	$C=[1 \ -1]^T, D=[-1 \ 1]^T$
(iii)	$A=[2 \ 2]^T, B=[1 \ 1]^T, C=[-1 \ 1]^T$	$D=[-1 \ -1]^T$

Identify and classify which of these problems can be solved by using a SLP. If not give reason?

- (b) Let $X = \{1, 2, 3\}$, $Y = \{1, 2\}$, $Z = \{1, 2\}$ are three crisp set. Form fuzzy relations 'R' on $X \times Y$ and 'S' on $Y \times Z$ such that membership grades of these relations are as follows:

$$\mu_R(x, y) = e^{-(x-y)^2}, \quad \mu_S(y, z) = e^{-|y-z|}$$

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Find the relation $T = R \circ S$ using max min and max product composition.

[4+4=8][CO1, 3]

- Q.3 (a) Explain the following with an example related to fuzzy set theory:
 (i) Core of a set, (ii) Crossover point, (iii) Law of excluded middle.
 (b) Explain min-max method of fuzzy implication with a suitable example.
 (c) The membership function of a fuzzy set 'A' is assumed to follow a Gaussian distribution with mean $m = 100$ and standard deviation $\sigma = 10$. Gaussian membership function distribution is expressed as follows:

$$\mu_A(x) = \frac{1}{e^{\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2}}$$

Find α -cut, $A_{0.5}$

[3+3+2=8][CO3]

- Q.4 (a) In Mamdani approach of fuzzy implication, let us assume that two rules are getting fired for a set of inputs. The combined fuzzified output considering these two fired rules is shown in Fig. 1. Find the defuzzified value using centre of sum, first of maxima and mean of maxima methods.

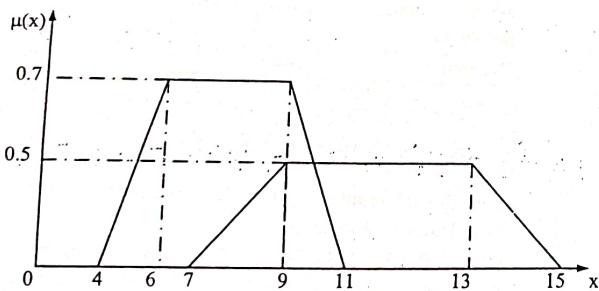


Fig. 1.

- (b) A binary-coded genetic algorithm (GA) is used to optimize a function $f(x)$. The optimized value of 'f' represented by a binary string

is obtained as: 1000110100. The range in which f can vary is of (1, 20). The real value of f is found to be equal to

[6+2=8][CO3, 4]

- Q.5 (a) Suppose a GA uses chromosomes of the form $n = abcdef$ with a fixed length of six genes. Each gene in n can have value between 0 and 9. Let the fitness of individual 'n' in the population be evaluated by the fitness function to be maximized as:

$$F(n) = (a+b) - (c+d) + (e+f)$$

Let the initial population consist of four individuals chromosomes as given in table below. Fill in the rest of the tables and comment on the result obtained.

String No.	String	$F_i(n)$	$\frac{F_i}{\sum F_i}$	No. Surviving	Mating Pool
1	123456				
2	989898				
3	245245				
4	636363				

Mating Pool	Mate	Crossover point	New Population	New $F_i(n)$

- (b) Explain the following related to Genetic algorithm

- (i) Fitness function
 (ii) Selection

[6+2=8][CO4]

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Total No. of Pages: 3

Roll No.

FIRST/THIRD SEMESTER

M. Tech.SPDD

END TERM EXAMINATION

Nov-2023

COURSE CODE: SPD 6301

COURSE TITLE: Data Analytics

Time: 3:00 Hours

Max. Marks: 50

Note: Answer FIVE questions.

Assume suitable missing data, if any.

- Q.1 a) Discuss the importance of Lasso and Ridge regression. [5] [CO-4]
- b) Suppose 10000 patients get tested for flu; out of them, 9000 are actually healthy and 1000 are actually sick. For the sick people, a test was positive for 620 and negative for 380. For the healthy people, the same test was positive for 180 and negative for 8820. Construct a confusion matrix for the data and compute the precision and recall for the data. [3] [CO-1]
- c) In class X, 20% of the students are boys and 80% of them are girls. The probability that boys passed in mathematics is 0.5 and the probability that girls passed in mathematics is 0.10. One student is selected at random. What is the probability that the selected student is passed in mathematics? [2] [CO-1]
- Q.2 a) In 1912 over 800 passengers perished after the oceanliner Titanic collided with an iceberg and sank. The following table compares the survival frequencies of cabin and steerage passengers. Using the .05 level of significance, test the null hypothesis that survival rates are independent of the passengers' accommodations (cabin or steerage). Assuming a significant χ^2 , estimate the strength of the relationship. [5] [CO-3]

ACCOMMODATIONS ON THE TITANIC			
SURVIVED	CABIN	STEERAGE	TOTAL
Yes	299	186	485
No	280	526	806
Total	579	712	1291

- b) The marks obtained by a student are dependent on her/his study time. Given the study time in minutes and marks out of 2000, as in the table below.

[5] [CO-4]

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Study Time (minutes)	350	1070	630	890	940	500
Marks Obtained	520	1600	1000	850	1350	490

- (i) Find the relationship between study time and marks using the concept of linear regression.
(ii) Predict the marks for a student if she/he studied for 790 minutes.

- Q.3 a) Discuss briefly about PCA and LDA. How is LDA different from PCA in performing classification? [5] [CO-2]
b) Assume that the database D is given by the table below. Follow single link technique to find clusters in D. Use Euclidean distance measure. [5] [CO-1]

	x	y
p1	0.40	0.53
p2	0.22	0.38
p3	0.35	0.32
p4	0.26	0.19
p5	0.08	0.41
p6	0.45	0.30

- Q.4 a) Derive an expression of minimum distance classifier for M classes. [5] [CO-5]
b) Discuss how the non-linearity can be handled by SVM. Why are SVMs fast? Also Why are SVMs often more accurate than logistic regression? [5] [CO-5]

- Q.5 a) With the dataset given below, learn a decision tree which predicts if people pass machine learning (Yes or No), based on their previous GPA (High, Medium, or Low) and whether or not they studied. [5] [CO-6]

GPA	Studied	Passed
L	F	F
L	T	F
M	F	F
M	T	T
H	F	T
H	T	T

- b) Discuss briefly about back propagation algorithm. [2] [CO-2]
c) Explain the concept of bias and variance in machine Learning? [3] [CO-2]
- Q.6 a) Discuss different types of data analytics and mention the importance of Prescriptive Analytics. [4] [CO-2]
b) Discuss briefly about ensemble learning. [3] [CO-5]
c) Explain the concept of gradient boosting algorithm [3] [CO-2]

Appendix: Chi-Square distribution Table

Chi-Square Right-Tail Probability ($z \chi^2$)										
df	0.995	0.99	0.975	0.95	0.9	0.8	0.7	0.6	0.5	0.4
1	0.0001	0.0002	0.0005	0.0010	0.0020	0.0040	0.0070	0.0100	0.0150	0.0200
2	0.0100	0.0200	0.0500	0.1000	0.2000	0.3000	0.4000	0.4750	0.5400	0.5900
3	0.0720	0.1150	0.2160	0.3520	0.5840	0.8500	1.1000	1.3000	1.4900	1.6700
4	0.2070	0.2970	0.4840	0.7110	1.0640	1.4600	1.8500	2.1500	2.3700	2.5700
5	0.4120	0.5540	0.8310	1.1450	1.6100	2.2000	2.7000	3.0000	3.3500	3.6400
6	0.6760	0.8720	1.2370	1.6350	2.2040	2.6880	3.1500	3.4500	3.8000	4.1000
7	0.9890	1.2390	1.6900	2.1670	2.8330	3.3900	3.8500	4.1500	4.5000	4.7800
8	1.3440	1.6460	2.1800	2.7330	3.4900	4.1500	4.6500	4.9500	5.3000	5.5800
9	1.7350	2.0880	2.7000	3.3250	4.1680	4.8400	5.3400	5.6400	6.0000	6.2500
10	2.1560	2.5580	3.2470	3.9400	4.8650	5.5800	6.0800	6.3800	6.7500	6.9900
11	2.6030	3.0530	3.8160	4.5750	5.5780	6.2900	6.7900	7.0900	7.4700	7.7100
12	3.0740	3.5710	4.4040	5.2260	6.3040	7.0200	7.5200	7.8200	8.2000	8.4400
13	3.5650	4.1070	5.0090	5.8920	7.0420	7.7600	8.2600	8.5600	8.9400	9.1800
14	4.0750	4.6600	5.6290	6.5710	7.7900	8.5100	9.0100	9.3100	9.6900	9.9300
15	4.6010	5.2290	6.2620	7.2610	8.5470	9.2700	9.7700	10.0700	10.4500	10.6900
16	5.1420	5.8120	6.9080	7.9620	9.3120	10.0400	10.5400	10.8400	11.2200	11.4600
17	5.6970	6.4080	7.5640	8.6720	10.0850	10.8100	11.3100	11.6100	12.0000	12.2400
18	6.2650	7.0150	8.2310	9.3900	10.8650	11.5900	12.0900	12.3900	12.7800	13.0200
19	6.8440	7.6330	8.9070	10.1170	11.6510	12.3700	12.8700	13.1700	13.5600	13.8000
20	7.4340	8.2600	9.5910	10.8510	12.4430	13.1200	13.6200	13.9200	14.3100	14.5500
21	8.0340	8.8970	10.2830	11.5910	13.2400	13.9100	14.4100	14.7100	15.1000	15.3400
22	8.6430	9.5420	10.9820	12.3380	14.0410	14.7300	15.2300	15.5300	15.9200	16.1600
23	9.2600	10.1960	11.6890	13.0910	14.8480	15.5300	16.0300	16.3300	16.7200	16.9600
24	9.8860	10.8560	12.4010	13.8480	15.6590	16.3400	16.7400	17.0400	17.4300	17.6700
25	10.5200	11.5240	13.1200	14.6110	16.4730	17.1600	17.5600	17.8600	18.2500	18.4900
26	11.1600	12.1980	13.8440	15.3790	17.2920	17.9800	18.3800	18.6800	19.0700	19.3100
27	11.8080	12.8790	14.5730	16.1510	18.1140	18.8000	19.2000	19.5000	19.8900	20.1300
28	12.4610	13.5650	15.3080	16.9280	18.9390	19.6100	20.0100	20.3100	20.7000	20.9400
29	13.1210	14.2560	16.0470	17.7080	19.7480	20.4200	20.8200	21.1200	21.5100	21.7500
30	13.7870	14.9530	16.7910	18.4930	20.5990	21.2300	21.6300	21.9300	22.3200	22.5600
40	20.7070	22.1640	24.4330	26.5090	29.0510	31.8050	33.7580	35.7420	37.7540	39.7960
50	27.9910	29.7070	32.3570	34.7640	37.6890	40.1560	42.7960	45.4410	48.1140	50.8050
60	35.5340	37.4850	40.4820	43.1880	46.4590	49.3320	52.0020	54.6730	57.3390	60.0000
70	43.2750	45.4420	48.7580	51.7390	55.3290	58.5270	61.1540	63.7850	66.4110	69.0320
80	51.1720	53.5400	57.1530	60.3910	64.2780	67.5780	70.1790	72.7800	75.3710	77.9520
90	59.1960	61.7540	65.6470	69.1260	73.2910	76.5950	79.1860	81.7770	84.3580	86.9290
100	67.3280	70.0650	74.2220	77.9290	82.3580	85.6810	88.2720	90.8630	93.4340	96.0000

Chi-Square Distribution Table

Total No. of Pages-01

Roll No.....

I/III SEMESTER
M.Tech.
(SPDD)

END TERM EXAMINATION

Nov/Dec-2023

SPD-6407 Digital Design and Verification

Time: 3:00 Hours

Max. Marks: 40

Note: Attempt any five questions

- Q1. (a) What is Substrate Bias Effect. Explain it in detail with a diagram and mathematical expression. Explain the ways to reduce the same. (4) [CO1]
(b) What is the Switching Power Dissipation. Explain it in detail with derivation. (4) [CO3]
- Q2. (a) Explain Noise Margin Calculation in CMOS Inverter along with the mathematics involved. (5) [CO3]
(b) What is MOSFET scaling? Explain the types of the sample with examples? (3) [CO1]
- Q3. (a) Explain MOSFET capacitances with diagram and mathematical expressions. (4) [CO2]
(b) Explain the implementation of CMOS Latch. (4) [CO4]
- Q4. (a) Explain the behavior of MOSFET under different bias condition with expressions along with the band diagram? (5) [CO2]
(b) What are the Design Rules for Layout Design. Explain the significance of the same. (3) [CO5]
- Q5. (a) Explain CMOS Transmission along with an application. (4) [CO4]
(b) Write a note on MOS circuit Design Process. (4) [CO5]
- Q6. (a) Implement NOR gate with CMOS Logic circuit. Explain it in detail with truth table and diagram. (5) [CO3]
(b) Explain Gradual Channel Approximation. (3) [CO1]

Total No. of Pages: 02

Roll No.....

I SEMESTER
M.Tech. [3E]

END TERM EXAMINATION

Nov/Dec-2023

SWE501 Software Requirement Engineering

Time: 03:00 Hours

Max. Marks: 40

Note: All questions carry equal marks.
Attempt any five questions.
Assume suitable missing data, if any.

- Q1. Differentiate the following: [8]
a) Functional and non-functional requirements.
b) Waterfall and agile software development methodologies.
- Q2. Consider yourself the project manager for a major software company. You have been asked to lead a team that is developing "next generation" word-processing software. Create a risk table for the project. [8]
- Q3. A project size of 200 KLOC is to be developed. Software development team has average experience on similar type of projects. The project schedule is not very tight. Calculate the effort, development time, average staff size and productivity of the project. [8]
- Q4. Discuss the significance of formal specifications in Cleanroom Software Engineering. How do formal specifications enhance the development and verification process? [8]
- Q5. An object-oriented system is estimated to require 320 objects, when complete. It is further estimated that 190 objects can be acquired from an existing repository. What is the reuse leverage? Assume that new objects cost \$1000 each and that the cost to adapt an object is \$600 and to integrate each object [8]

is \$400. What is the estimated cost of the system. What is the value for Rb?

[8]

Q6. Write a short note (any two):

- a) Reverse Engineering.
- b) Economics of Reengineering
- c) BPR model

Total no. of Pages: 2

Roll no.....

164

FIRST SEMESTER

M.Tech

END TERM EXAMINATION

November 2023

COURSE CODE: SWE 503

COURSE TITLE: OOSE

Time: 03:00 Hours

Max. Marks: 40

Note : All questions carry equal marks.
Assume suitable missing data, if any.
Attempt any five questions.

- Q.1 (a) Describe various types of messages in sequence diagram with their notations. [3][CO5]
(b) Write short notes on lifeline and focus of control in sequence diagram. [2][CO5]
(c) Explain the fountain model with the help of a diagram. List the advantages and disadvantages of this model. [3][CO2]
- Q.2 Consider a course scheduling system (CSS) for scheduling courses in Delhi Technological University. The purpose of CSS is to:
- (i) enable entering data of courses, faculty members, the available facilities.
 - (ii) calculate and propose schedule for courses.
 - (iii) enable to manually update the proposed schedule, but keep track of the consistent schedule.
- Entering programs and courses: An administrator should be able to enter new program and its running period. A data entry operator should be able to enter details of courses with their examiners. The examiner should be able to upload lecture, tutorials, projects, etc.
 - Entering resources: An administrator should be able to enter information about lecture rooms and laboratories in which classes will be taken place.

- 165 • Scheduling: It provides schedule proposal, the days and time, and places where they can be scheduled. The scheduler allows some manual predefinition of the schedule. It shows if there are any conflicts.

Draw the following using standard notations. If necessary, you can make suitable assumptions regarding the details of various features of CSS, but you must clearly write down the assumptions you make.

- (i) Identify use cases and actors.
- (ii) Draw use case diagram for CSS
- (iii) Write use case description of "Schedule Course" use case.

[8][CO5]

Q.3 Draw class diagram for the CSS given above.

[8][CO5]

Q.4 Draw sequence diagram of "Schedule course" (basic flow and at least 2 alternative flows) use case of CSS.

[8][CO5]

Q.5 Consider the process of scheduling course in CSS. Construct the scenario diagram, scenario matrix, test case matrix and test case matrix with actual values.

[8][CO5]

Q.6 (a) What are the various requirement elicitation techniques. Which requirements elicitation is most popular? Explain.

[4][CO3]

(b) Explain macro and micro process of Booch Methodology.

[4][CO2]

Q.7 (a) What are the various phases in object-oriented software development life cycle approach.

[3][CO2]

(b) Differentiate between

i. Verification and validation

ii. Fault, bug and failure

[2][CO1]

(c) What is software requirements specification (SRS)? List five desirable characteristics of a good SRS document. List the important issues which an SRS must address.

[3][CO4]

Total No. of Pages: 02

Roll No.

FIRST SEMESTER
M.Tech. (SE/DSC)

NOV-2023

END SEMESTER EXAMINATION

SWE/DSC 5405 ADVANCED OPERATING SYSTEM

Time: 3:00 Hours

Max. Marks: 40

Note: Attempt all questions.

Assume suitable missing data, if any.

1. [a] What are the contiguous memory allocation schemes and how do they suffer from external and internal fragmentation? [4] [CO4]
[b] A system uses 3-page frames for storing process pages in main memory and uses the First in First out (FIFO) page replacement policy. Initially, all the page frames are empty. For the following page reference string: 4, 7, 6, 1, 7, 6, 1, 2, 7, 2, what is the hit ratio? [4] [CO4]
2. [a] In a 64-bit machine, if RAM is 2GB RAM and page size is 8 KB, and the page table is inverted, what is the number of entries on the page [2] [CO4]
[b] What is virtual memory and how does it use paging? Where is the problem of thrashing and how can it be overcome? [6] [CO4]
3. [a] How does a hard disk store data with respect to track, sector cylinder, and platter? How is Data stored for uniform access of data? [4] [CO5]
[b] Consider a typical disk that rotates at 15000 RPM and has a transfer rate of 50×10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time. What is the average time (in milliseconds) to read or write a 512-byte sector of the disk? [CO5][4]
4. [a] How does unix protect file access from different users? [CO6] [4]
[b] Consider a disk system with 100 cylinders. The requests to access the cylinders occur in the following sequence- [CO5][4]

4, 34, 10, 7, 19, 73, 2, 15, 6, 20

Assuming that the head is currently at cylinder 50, what is the time taken to satisfy all requests if it takes 1 ms to move from one cylinder to adjacent one and the shortest seek time first policy is used?

5 [a] The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as $S_0=1$, $S_1=0$, $S_2=0$.

```
Process P0 :  
while (true) {  
    wait (S0);  
    print (0);  
    release (S1);  
    release (S2); }
```

```
Process P1 :  
wait (S1);  
Release (S0);
```

```
Process P2 :  
wait (S2);  
release (S0);
```

How many times will P0 print '0'?

[CO3][4]

ii. What is a File Control Block and how is it used to access a file? Explain how system tables are used to reach the FCB of a file by a process? [CO5][4]

Total No. of Pages:01

Roll No.

FOURTH SEMESTER

M.Tech.

END TERM EXAMINATION

NOV/DEC-2023

SWE6205/DSC6205. STATISTICAL TOOLS

Time: 3:00 Hours

Max. Marks: 60

Note: Answer ALL questions. All questions carry equal marks.
Assume suitable missing data, if any.

1. What is the difference between the sample and the population? What are the various techniques to select a sample? [10][CO1]
2. Define mean, median, mode, skewness, kurtosis, and correlation. What is the difference between population mean and sample mean? Mention their formulas, too. [10][CO2]
3. Find the data samples' mean, median, Q1, Q3, and IQR. Do an outlier analysis and use a whisker plot to represent the same. [10][CO3]
 - a) 43 151 197 199 223 253 256 270 300 445 467 522 574 741 782 856 897 910 1698
 - b) 43 151 197 199 223 253 256 270 300 445 467 522 574 741 856 897 910 1698
4. What is statistical testing? Explain the two types of Hypothesis testing. [10][CO1]
5. Explain the following methods:
 - (a).Parametric Methods [5][CO1]
 - (b).Non-parametric Methods. [5][CO1]
6. Explain the following tests:
 - (a).Wilcoxon Signed Rank Test [5][CO3]
 - (b).Sign Test [5][CO3]

Total no. of Pages: 01

3rd SEMESTER

Roll no.....

M.Tech.(SWE/ DSC)

END TERM EXAMINATION

(Nov-2023)

SWE- DSC-6309 SWARM AND EVOLUTIONARY COMPUTING

Time: 03:00 Hours

Max. Marks: 50

Note: All questions carry equal marks. Answer any five questions.
Assume suitable missing data if any.

- Q.1 Explain the meaning of Levy's flight. How it is important in the Cuckoo search algorithm. Explain Cuckoo search algorithm with the help of a flowchart. [10M] [CO5]
- Q.2 Differentiate between multi-model and multi objective problem. Explain how ACO deals with multi model problem. [10M] [CO2]
- Q.3 Explain in detail how travelling salesman problem deals with Genetic Algorithm. [10M] [CO3]
- Q.4 How Bacterial Foraging Optimization algorithm is used as a denoising filter. Explain with the help of some real-life examples. Write some advantages and disadvantages of BFO algorithm. [10M] [CO4]
- Q.5 What is hybrid optimization technique. Write the challenges in hybrid optimization. With the help of a flowchart write the hybrid of GA (+) PSO. [10M] [CO2]
- Q.6 Using Genetic Algorithm Maximize $f(x) = X^2$ over $\{0,1,2,\dots,31\}$ with initial x values of (13,24,8,19). Show one crossover and mutation operation with the help of a flow chart of Genetic Algorithm. [10M] [CO1]
- Q.7 Discuss briefly any two: [10M] [CO1]
- Swarm computing
 - Fire fly algorithm
 - Use of cross-over and mutation
 - Global Optimization

Total No. of Pages 01

THIRD SEMESTER

END SEMESTER EXAMINATION

SWE-6405 THINGS OF INTERNET/DSC-6405 INTERNET OF THINGS

Roll No.

M.Tech. (SWE/DSC)

NOV-2023

Time: 3:00 Hours

Max. Marks: 40

Note: Answer ANY FIVE questions. All questions carry equal marks. Assume suitable missing data, if any.

1. [a] What is IoT characteristics, issues and how it is different from cellular characteristics? [4][CO2]
[b] Draw and discuss following IoT communication model. [4][CO4]
I) Push-pull II) Publish-subscribe
2. [a] Draw and explain component diagram of Arduino Nano. [4][CO2]
[b] What is classification of sensors? Write five gas sensors name and their measures. [4][CO3]
3. [a] What is the utility of setup and loop function of Arduino IDE, write the syntax also discuss four predefined functions which can be called inside them and discuss their importance. [4][CO5]
[b] What is NFC? What are the operating modes of NFC and Write their applications. [4][CO4]
4. [a] Write different IoT communication protocols and compare the features of Bluetooth Vs BLE and RFID [4][CO3]
[b] Draw and discuss various components of raspberry pi 4. [4][CO5]
5. Draw and explain the IoT architectural view and discuss protocols at each layer in detail. [8][CO5]
6. What do you mean by sensors and actuators? Differentiate and discuss various types of sensors and actuators with their applications. [8][CO5]
7. Explain Hadoop architecture with their components and differentiate Hadoop with cloud computing. [8][CO2]

Total No. of Pages: 1

Roll No.....

First Semester
PhD

MID TERM EXAMINATION

Nov/Dec-2023

SM 901 Research Methodology and IPR

Time: 3:00 Hours

Max Marks: 50

Note: There is a total of seven questions. Read all questions carefully.

Question 1 is compulsory. Attempt any 4 Questions in remaining 6 Questions.

Assume suitable data, if any. Answer as precisely as possible.

Q.1 Write short notes on the followings

- (a) Primary and Secondary Data
- (b) Qualitative and Quantitative research methodology
- (c) Type 1 and Type 2 error
- (d) Characteristics of a research problem
- (e) Descriptive and Causal Research Design
- (f) Covariance and Corelation

[M-3X6=18] [CO-1, 2, 3]

Q.2 What is the need and significance of Observation method of data collection? Differentiate between (a) structured and unstructured observation, and (b) primary and secondary observation.

[M-8] [CO-1, 2]

Q.3 Explain the following with respect to data analysis: problem with outliers, sample and population, regression analysis, ANOVA.

[M-8] [CO-3]

Q.4 Explain the following with respect to communicating research findings: computer software to be used, referencing styles, plagiarism, general report format.

[M-8] [CO-4]

Q.5 Discuss about various ethical issues in Research with examples.

[M-8] [CO-1, 2, 3, 4, 5]

Q.6 What is Intellectual Property Right (IPR)? Explain various types of IPR.

[M-8] [CO-5]

Q.7 What is significance of Normal Distribution? Explain the steps of hypotheses testing.

[M-8] [CO-3]

Total no. of Pages: 1

Roll no.....

FIRST SEMESTER **Ph.D**

END TERM EXAMINATION

DEC-2023

COURSE CODE SM903 COURSE TITLE RESEARCH AND PUBLICATION ETHICS

Time: 03:00 Hours

Max. Marks: 50

**Note : All questions carry equal marks.
Write detailed answers. Use diagrams if necessary.**

- Q.1 Distinguish between Basic and Applied Research. [10][CO1]
- Q.2 With the help of Moral Reasoning Theory explain moral standard for ethics of research. [10][CO1]
- Q.3 Explain the relationship between research integrity, quality, and the research process. [M][CO2]
- Q.4 Explain academic and publication standards in research? [M][CO3]
- Q.5 Write short notes on:
1. Praxis
 2. Morality and Ethics
 3. Plagiarism
 4. Research Governance
- [M][CO:1-4]

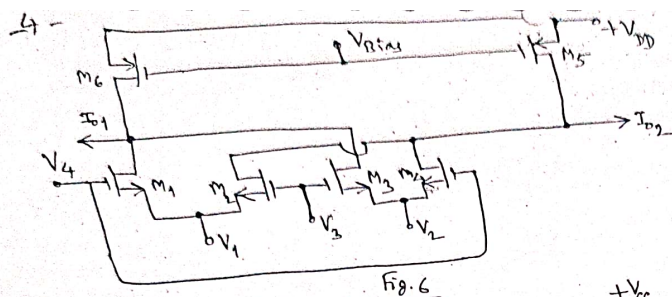


Fig. 6

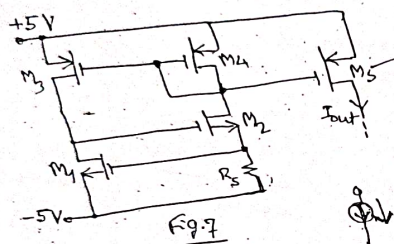


Fig. 7

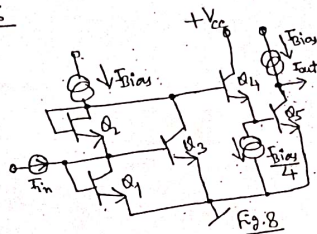


Fig. 8

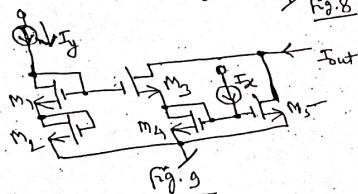


Fig. 9

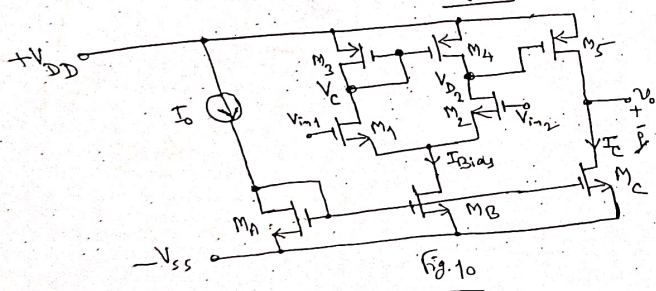


Fig. 10

Total No. of Pages 3

M.Tech

END SEMESTER EXAMINATION
VLS-501 ANALOG IC DESIGN

Time: 3:00 Hours

Roll No.

ISEMESTER(VLS)

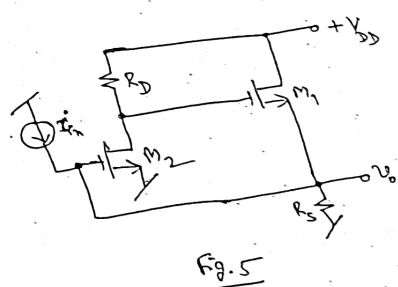
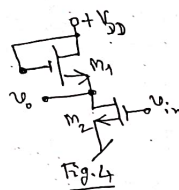
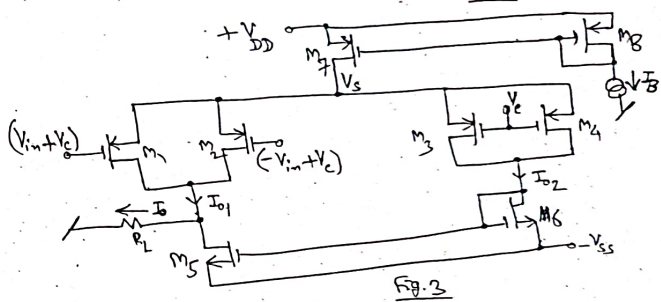
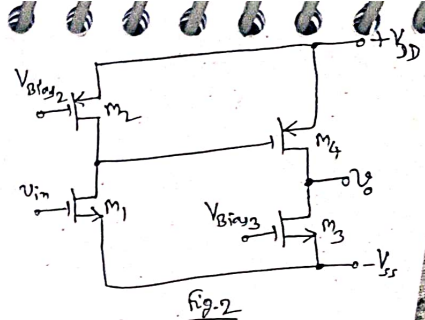
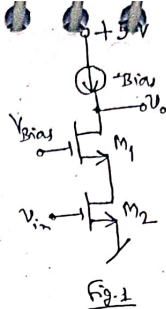
(Nov.-2023)

Maximum Marks: 40

Note: Answer any FIVE questions.
Assume suitable missing data, if any.

- 1[a] Sketch a neat high frequency MOSFET model and hence derive an expression for the unity gain frequency (f_T). [2+2 CO1]
- [b] For the cascode amplifier as shown in Fig.1, draw its small signal low frequency equivalent circuit and determine the voltage gain v_o/v_{in} . [2+2 CO1]
- 2[a] Sketch a neat circuit of NMOS output stage and hence deduce an expression for its output voltage. [2+2 CO2]
- [b] For the CMOS amplifier of Fig.2, draw its small signal low frequency equivalent circuit and hence determine its voltage gain v_o/v_{in} . [2+2 CO2]
- 3[a] Show that I_0 is proportional to square of v_{in} in the circuit of Fig.3, where MOSFETs M_1 - M_4 are operating in saturation and have the same aspect ratios. [2+2 CO2]
- [b] Sketch the small signal low frequency equivalent circuit of Fig.4 and determine the value of its output resistance if $V_{DD} = 10V$ and MOSFETs are biased at $V_0 = 5V$. The NMOS parameters are: $\mu_n C_{ox} = 20\mu A/V^2$, $V_{th} = 1V$, $(\frac{W}{L})_2 = 60$, and $(\frac{W}{L})_1 = 1$. The MOSFET output resistances, channel-length modulation and body effect may be neglected. [2+2 CO2]
- 4[a] For the NMOS circuit shown in Fig.5, draw its small signal low frequency equivalent circuit and hence derive an expression for v_o/v_{in} . [2+2 CO2]
- [b] For the CMOS Gilbert type cell (Fig. 6), derive an expression for $(I_{01}-I_{02})$ in terms of input voltages V_1 , V_2 , V_3 and V_4 . MOSFETs M_1 - M_4 are matched and operating in saturation region. [2+2 CO2]
- 5 For a V_{in} -referenced self-biased CMOS circuit of Fig.7, calculate I_{out} if MOSFETs have the following parameters: $\mu_n C_{ox} = 20\mu A/V^2$, $V_{th} = 1V$, $\frac{W}{L} = 10$, and $R_S = 10K\Omega$. The channel-length modulation and body effect may be neglected. [8 CO3]
- 6 [a] Determine the function performed by the BJT translinear circuit of Fig.8. [4 CO3]
- [b] In the MOSFET translinear circuit of Fig.9, the (W/L) ratios of M_1 and M_2 are four times that of the other MOSFETs. Determine an expression for I_{out} . [4 CO4]
- 7 For a simple CMOS op-amp shown in Fig.10, the (W/L) ratios are given in Table A. The op-amp is biased by $V_{DD} = +5V$ and $V_{SS} = -5V$. Calculate the values of I_{Bias} , I_C , V_C , and V_{D2} for $I_0 = 20\mu A$, $V_{thn} = |V_{thp}| = 1V$, $\mu_n C_{ox} = 20\mu A/V^2$ and $\mu_p C_{ox} = 10\mu A/V^2$. [2x4 CO4]

μm	M_A	M_B	M_C	M_1	M_2	M_3	M_4	M_5
W	10	20	10	20	20	5		90
L	10	100	10	5	5	11	11	20



(b) Analyze the D Flip-flop implementation shown in Fig. 6 and answer the following [4][CO5]

- Is this a static or dynamic flip-flop?
- Is this positive edge triggered or negative edge triggered?
- Calculate t_{setup} , t_{CtoQ} and t_{hold} for this flop in terms of the transmission gate and inverter delays.

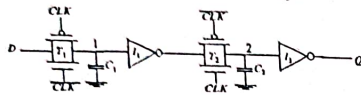


Fig. 6

Q. 6 (a) How do you ensure non-destructive readout in 1T1R1C1 DRAM cell. Explain with suitable cell schematic and control signals. [4][CO6]

- Compare the various VLSI design styles on the basis of cell size, cell type, Cell placement, interconnect and design time. [4][CO6]

1st SEMESTER

END TERM EXAMINATION

COURSE CODE VLS503

COURSE TITLE Digital CMOS IC Design

Max. Marks: 40

Time: 3:00 Hours

Note: Q. 1 is COMPULSORY, Attempt any FOUR questions from remaining. All questions carry equal marks. Assume suitable missing data, if any.

Q.1(a) How does the increase in (width, length, mobility and threshold voltage) of NMOS transistor impact the VTC of a CMOS inverter? [2][CO2]

(b) Extract the combinational circuit implemented in the stick diagram given in Fig. 1. [2][CO1,CO3]

(c) Differentiate between charge sharing and charge leakage in dynamic circuits. [2][CO4]

(d) How would you avoid channel formation between two devices on same substrate/well? [2][CO1]

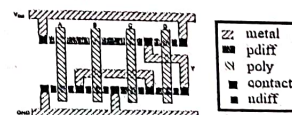


Fig. 1

Q.2 (a) For a resistive load inverter, the power dissipation is given as 1mW. Compute the value of load resistance and aspect ratio of NMOS transistor if the value of V_{OL} is 0.1V ($V_{DD} = 1.8V$, $\mu_n C_{ox} = 100\mu A/V^2$). What change would you expect in the value of load resistance if V_{DD} is increased to 2.1V? [4][CO2]

- (b) The following parameters are given for an CMOS process:
 $t_{ox} = 500 \text{ \AA}$, substrate doping $N_A = 10^{16}/\text{cm}^3$, polysilicon gate doping $N_D = 10^{20}/\text{cm}^3$, oxide-interface fixed-charge density $N_{ox} = 2 \times 10^{10}/\text{cm}^2$ (i) Calculate V_{FB} and V_T for an unimplanted transistor. (ii) What type and what concentration of impurities must be implanted to achieve $V_T = +2 \text{ V}$ and $V_T = -2 \text{ V}$? ($\epsilon_{si} = 11.7 \epsilon_0$, $\epsilon_{ox} = 3.9 \epsilon_0$, $\epsilon_0 = 8.85 \times 10^{-14} \text{ F/cm}$). [4][CO1]

Q.3(a) Find out the logic function implemented by the circuit of Fig. 2. Indicate the purpose of PMOS transistor. [4] [CO3]

- (b) What is logic function implemented by circuit of Fig. 3? Is this a ratioed circuit? Explain. Assume all inputs swing as (0 to V_{DD}) and no body effect. [4][CO3]

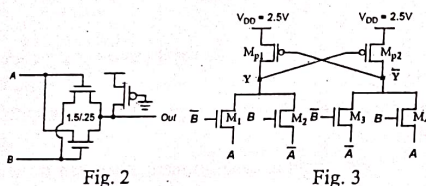


Fig. 2

Fig. 3

Q.4 (a) Design a combinational circuit $F = \overline{(AB + F)(CD + E)}$ using static CMOS and calculate equivalent W/L of pull and pull down networks by assuming all NMOS transistors as $(W/L)_N = 2$ and for all PMOS transistors $(W/L)_P = 4$. [4][CO3]

- (b) Consider the conventional N-P CMOS circuit of Fig. 4 in which all pre-charge and evaluate devices are clocked using a common clock ϕ and its complement. For this entire problem, assume that the pull down/pull up network is simply a single NMOS/PMOS device, so that each Domino stage consists of a dynamic inverter followed by a static inverter. Assume that the pre-charge time, evaluate time, and propagation delay of the static inverter are all $T/2$. Assume that the transitions are ideal (zero rise/fall times) [4][CO4]

- (i) Do any problems occur when the input makes a 0->1 transition? What about a 1->0 transition? If so, describe what happens and insert one inverter somewhere in the circuit to fix the problem.
 (ii) For your corrected circuit, complete the timing diagram for signals Out1, Out2, Out3 and Out4, when the IN signal goes high before the rising edge of the clock ϕ . Assume that the clock period is 10 T time units.

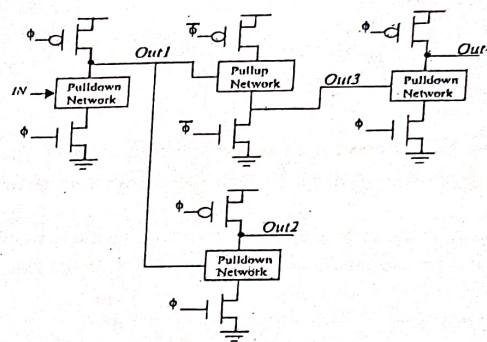


Fig. 4

Q5 (a) An implementation of a sequential element is shown in Fig. 5. Answer the following (i) Construct a positive edge triggered D flip-flop using this sequential element. (ii) For the DFF constructed above, calculate t_{setup} , t_{CtoQ} and t_{hold} in terms of the transmission gate and inverter delays. Assume that CLK is generated from CLK with an ideal inverter (0 delay). [4][CO5]

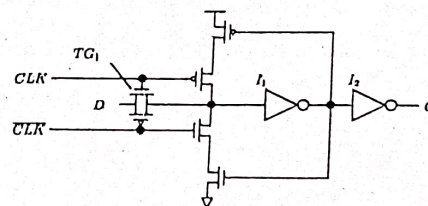


Fig. 5

Total No. of Pages: 03

Roll No.

FIRST SEMESTER

M.Tech. (VLSI & Embedded Systems)

END TERM EXAMINATION

Nov/Dec-2023

VLS-5307 ORGANIC FLEXIBLE ELECTRONICS

Time: 3.00 Hours

Max. Marks: 50

Note: Answer any FIVE questions by selecting all parts from a particular question. All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 (a) Design the circuit for given expression using all p-OTFT along with truth table. Justify the working of circuit for input combination; ABCDEFG=1101101.

$$Y = (A+B)' + (C+D+E)' + (F+G)'$$

Also make the connection diagram for given expression using CMOS. State the benefits and limitations of using p-OTFT only based circuit. (5) [CO4]

(b) Develop the equations using differential model to extract OTFT parameters; mobility enhancement factor (γ), mobility (μ_0), source resistance (R_s) and threshold voltage (V_T) in saturation region. Write the steps to find all above parameters using developed equations. (5) [CO3]

Q. 2 (a) Differentiate the circuits of NAND and NOR gate using all-p OTFTs. Justify that in all-p NAND gate, different magnitude for V_{OUT} is achieved for inputs (AB) combinations; 00, 01, 10 and why? (3) [CO4]

(b) Describe the structure of multilayer OLED and role of each layer to enhance the luminance and current density. (2) [CO2]

(c) Illustrate that bootstrapping technique can improve the performance of an inverter including all necessary derivations. Calculate the max and min values of V_x and Boot capacitor; C_B , if $V_{DD} = 10V$, $V_{OL} = 0.5V$ and $C_S = 1nF$. Consider V_T for all transistors equals to 1V. (5) [CO3]

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Q. 3 (a) Describe, following for organic LED. [CO5]

- How conduction occurs in OLED using necessary diagrams? (1)
- How the carrier concentration can be enhanced in OLED. (2)
- How disease can be detected using OLED. (1)
- Why insertion of electron blocking layer is not liable to increase the performance of OLED. (1)

(b) Sketch Hybrid- π models for low, high and mid frequency response for given CS amplifier. Also Calculate Bandwidth and Gain (in dB) using circuit parameters mentioned in Table 1; (5) [CO3, CO4]

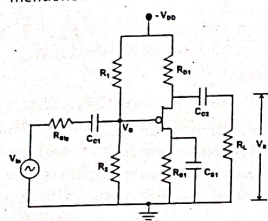


Table 1

Parameter	Value	Parameter	Value
R_1	1 M Ω	C_{ox}	1.5 nF/cm ²
R_2	5 M Ω	W	5000 μ m
R_C	1.3 M Ω	L	25 μ m
R_{ON}	2 M Ω	L_D	1 μ m
R_{OL}	0.5 M Ω	g_m	9 nA/V
R_L	4 M Ω	CC_1	1 pF
R_{S1}	1.5 k Ω	CC_2	0.1 pF
R_{DS}	100 Ω	CS_1	1 μ F

Q. 4 (a) (i) Describe the write operation for CMOS SRAM cell. Derive the expression for pull-up ratio for successful write operation. (2.5) [CO5]

(ii) Identify the trade-off between read and write operation in SRAM cell. Explain static noise margin of an SRAM cell. (2.5) [CO5]

(b) (i) Demonstrate that device threshold voltage reduction is the most viable solution for reducing the average power of CMOS inverter circuit as compared to other parameters. (2) [CO1]

(ii) Differentiate HOMO and LUMO. (1) [CO1]

(iii) How bonds are different in organic and inorganic materials? (1) [CO1]

(iv) What are limitations of organic semiconductor-based devices (1) [CO1]

Q. 5 (a) (i) Which is the most significant p-type OSC and why? (1.5) [CO1]

(ii) Explain the channel formation and conduction mechanism of organic TFT. (2) [CO1]

(iii) Illustrate one possible combination of materials for flexible p-type OTFT, non-flexible p-type OTFT and hybrid (organic and inorganic) p-type TFT. (1.5) [CO1]

(b) Calculate V_T for an OTFT of size $L = 15$ nm, $W = 1000$ nm with copper gate and dielectric; PVA (Polyvinyl alcohol) thickness of 10 nm is operating at $V_{GS} = -1$ V. The P3HT ($\phi = 5.2$) Semiconductor of 50 nm is used with doping concentration of 10^{18} /cm³. The transistor exhibits trap density of 2×10^{12} /cm². (5) [CO2]

Q. 6 (a) Solve the noise margins; NM_L and NM_H for a ZVLL configuration based all-p inverter circuit with Driver transistor ($V_T = -3$ V, $\mu = 10$ cm²/V.s, $C_{ox} = 5$ μ F/m², $W = 100$ nm, $L = 50$ nm) and Load transistor ($V_T = -0.5$ V, $\mu = 20$ cm²/V.s, $C_{ox} = 2.5$ μ F/m², $W = 0.5$ μ m, $L = 250$ nm). Consider $V_{DD} = 10$ V and V_{out} (at V_{IH}) = 0.5 V. (5) [CO3, CO4]

(b) Explain the structure and benefits of cylindrical OTFT. Derive the expressions for drain current and Device total resistance. (5) [CO2]

END

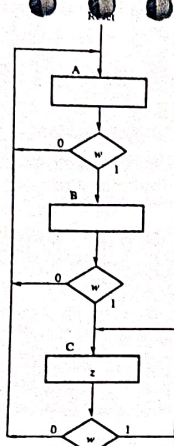


Fig.3

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Total no. of Pages:

Roll No.

END TERM EXAMINATION

Dec-2023

VL55401 DIGITAL DESIGN WITH HDL (VERILOG)

Time: 03:00 Hours

Max. Marks: 40

Note : All questions carry equal marks.
Assume suitable missing data, if any.
Answer any five questions.

Q.1 Develop a primitive flow table for a logic system that has two inputs, X and Y, and a single output Z, which is to behave in the following manner. Initially, both inputs and output are equal to 0. Whenever $X = 1$ and $Y = 0$, the Z becomes 1 and whenever $X = 0$ and $Y = 1$, the Z becomes 0. When inputs are zero, i.e. $X = Y = 0$ or inputs are one, i.e. $X = Y = 1$, the output Z does not change; it remains in the previous state. Complete the critical race free circuit design without any clock and explain all the steps. [8][CO#4]

Q.2 (i) Implement the following Boolean functions on Programmable Array Logic with one OR gate per three AND gates. [4][CO#1]

- (a) $w(A,B,C,D) = \sum(2,12,13)$
- (b) $x(A,B,C,D) = \sum(7,8,9,10,11,12,13,14,15)$
- (c) $y(A,B,C,D) = \sum(0,2,3,4,5,6,7,8,10,11,15)$
- (d) $z(A,B,C,D) = \sum(1,2,8,12,13)$

(ii) Implement the following boolean functions on Programmable Logic Array. [4][CO#1]

- (a) $x(A, B, C) = \Pi M(0,1,2,4)$
- (b) $y(A,B,C) = \Pi M(3,5,6,7)$

Q.3 (i) Determine the test vectors to detect the faults in the circuits shown in Fig.1. [6][CO#3]

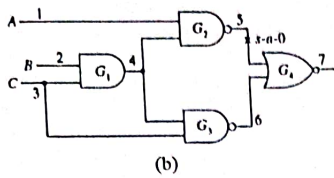
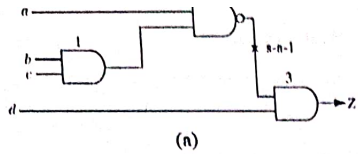


Fig.1

(ii) What will be the outputs of the following codes: [2][CO#1]

(a) always @(i1 or i2)	(b) always @(i1 or i2)
begin	begin
i1=1;	i1=1;
i2=2;	i2=2;
#10;	#10;
i1=i2;	i1<=i2;
i2=i1;	i2<=i1;
end	end

Q.4 (i) Design an asynchronous sequential circuit that has two internal states and one output. The excitation and output function describing the circuit are as follows: [6][CO#4]

$$Y1 = x1x2 + x1y2 + x2y1$$

$$Y2 = x2 + x1y1y2 + x1y1$$

$$Z = x2 + y1.$$

- Draw the logic diagram of the circuit.
- Derive the transition table and output map.

(ii) Design a hazard-free circuit to implement the following function.
 $F(A, B, C, D) = \sum m(0, 2, 6, 7, 8, 10, 12)$. [2][CO#4]

Q.5 (i) Draw an ASM chart for the state diagram shown in Fig.2 and determine the expressions for next state variable and output. [5][CO#5]

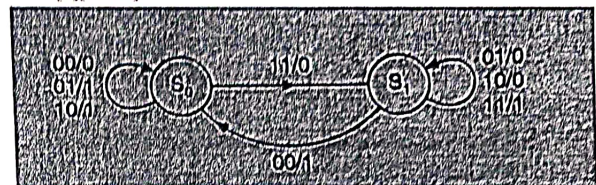


Fig.2

(ii) What are the types of delay control for procedural assignments? Define and give an example of all of them. [3][CO#1]

Q.6 (i) A sequential circuit has one input (X) and two outputs (Z1 and Z2). An output Z1=1 occurs every time the input sequence 100 is completed, provided that the sequence 010 has never occurred. An output Z2=1 occurs every time the input sequence 010 is completed. Note that once Z2=1 output has occurred, Z1=1 can never occur but not vice versa. Find a Mealy state graph and table. Also determine the output sequences for input sequence: X=100110010101001010100. [6][CO#2]

(ii) Draw the state diagram for ASM chart shown in Fig.3. [2][CO#5]

Show that the SOI thickness (t_s) has direct impact on subthreshold swing. How does leakage current depend on SS?

6[a] Derive an expression for equivalent oxide thickness (EOT) and explain its physical significance. What is the EOT of 6 nm of hafnium dioxide HfO_2 , which has a relative dielectric constant of 24? Comment on the answer. [5][CO4]

6[b] Mention different modes of operation of SOI MOSFET. Draw the electric field profile and potential profile across the structure and calculate the peak electric field (E_{sf}) at front gate Si-SiO_2 interface in terms of depletion charge and surface potential for the following cases. [5][CO4]

- Front channel inverted and back channel accumulated
- Front channel inverted and back channel grounded

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Total No. of Pages 4

Roll No.

**I & III SEMESTER
M.Tech (VLSI)**

End Semester Examination

December-2023

VLS-6207, Selected Topics in VLSI

Time: 3 Hours

Max. Marks: 50

Note: Answer any five questions
All questions carry equal marks
Use the answer sheet space judiciously
Assume suitable missing data, if any.

- Derive an expression for the front gate threshold voltage of a Silicon-On-Insulator (SOI) double gate MOSFET when the back gate is in an inverted condition. [5][CO4]
- An n^+ polysilicon device is fabricated on p-type substrate. It has $N_A = 5 \times 10^{16} \text{ atoms/cm}^3$, $N_D = 3.5 \times 10^{20} \text{ atoms/cm}^3$, $n_i = 1.5 \times 10^{10} / \text{cm}^3$, $t_{ox} = 7 \text{ nm}$. The oxide layer has $4 \times 10^{10} \text{ positive ions/cm}^2$. Calculate [5][CO1]
 - Maximum depletion layer width in substrate
 - Maximum and minimum capacitance per unit area on CV characteristics
 - Flatband Voltage
 - Zero bias threshold voltage
 - Threshold voltage when $V_{SB} = 2 \text{ V}$.

2[a] Consider an ideal MOS capacitor fabricate in p-substrate. [5][CO1]
Explain the Body effect in 3 terminal MOS capacitor. Draw the space charge diagram as a function of position in the semiconductor. Does the source contact is always kept positive w.r.t bulk substrate? Justify your answer.

2[b] Derive the mathematical relation between charge (Q) and voltage (V) of an ideal MOS capacitor in depletion and inversion region considering the p-type substrate, also plot Q-V characteristics in depletion and inversion region based on the derived expressions. [5][CO1]

3[a] How can channel engineering be useful in minimizing short channel effects? Explain the process steps to fabricate super steep retrograde channel (SSRC). Can a light dopant like Boron and Phosphorous be chosen for SSRC profile? Justify your answer. [5][CO3]

3[b] Why MOSFETs are fabricated on <100> oriented wafers? How a metal gate technology is different from the polysilicon gate technology? Explain why a MOSFET fabricated with metal gate technology has a poor transient performance as compare to the MOSFET fabricated with self-aligned process? [5][CO2]

4[a] Define the term spacer used in MOSFET. Explain the application of spacer technology in the fabrication of MOSFET with the help of a suitable example. Does spacer technology improve the performance of short channel MOSFET? Justify your answer. [5][CO3]

4[b] Determine the nature of the tunneling current illustrated in Fig.1 [5][CO4]
A and B. Additionally, elaborate on the concept of direct tunneling current and elucidate its distinctions from Fowler-Nordheim tunneling current. Analyze the predominant current at low electric fields and provide the rationale behind its prevalence.

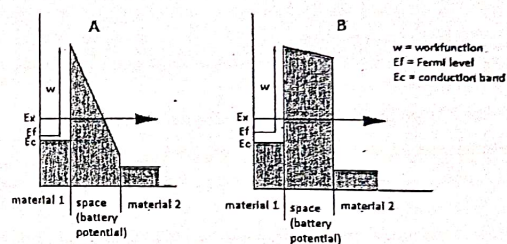


Fig. 1

5[a] List the various techniques employed in the production of Silicon on Insulator (SOI) wafers. Elaborate the SIMOX process for creating SOI wafers with a 50 nm silicon-on-insulator thickness (t_{SOI}) and a 200 nm buried oxide thickness (t_{BOX}). Compute the necessary oxygen dose to achieve the specified buried oxide thickness. [5][CO4]

5[b] Compare the performance of SOI and bulk MOSFET in subthreshold regime from transfer characteristics. Write down the expression of subthreshold swing (SS) for both MOSFETs. [5][CO4]

Total No. of Pages 1

Roll No.

FIRST SEMESTER

M.Tech. (VLSI)

END SEMESTER EXAMINATION

Nov./Dec. 2023

VLS 6305 MACHINE LEARNING

Time: 3 Hours

Max. Marks :40

Note: Answer any Five questions. Assume suitable missing data, if any.

1. (a) Let There be a 2:2:1 Multi-Layer Perceptron. Assume the activation functions of all layers and the initial weights as per the basic principles of Neural Networks and Draw the figure and write in detail the Back Propagation Algorithm to train the network. (4)
- (b) Write in detail about the Dimension Reduction using PCA and propose Neural System to implement the same. (4)
2. (a) What are Support Vector Machines (Explain Mathematically) and VC Dimension for distinguishing between two Hypothesis. (4)
- (b) How can SVM be modified for, if number of classes are more than 5? (4)
3. (a) Write and explain the Maximum Likelihood technique to distinguish between the two classes. (4)
- (b) Write a method to generate 4-bit orthogonal Codes. What do you understand by ABA^T when B is the Data Matrix and A is the orthogonal Matrix. (4)
4. (a) Write the fundamental concept of Hop-Field ANNs. Explain through derivation, how the network can classify 4-bit Binary input. (4)
- (b) Draw the Electrical Model of Neuron and Prove the Lyapunov concept for the Unsupervised ANNs. (4)
5. (a) Write about the Gaussian Mixture Model. (4)
- (b) Explain Maximum A-Posteriori Algorithm and it's implementation in ANN. (4)
6. Write short notes on following: (4,4)
 - (a) Dirichlet MultiNomial Model.
 - (b) Generative Machine Learning.

3rd SEMESTER

M.Tech. (VLSI)

END TERM EXAMINATION

Nov-2023

COURSE CODE: VLS-6401
COURSE TITLE: Mixed Signal Design

Time: 3:00 Hours

Max. Marks: 40

Note: Attempt any five questions.
 All questions carry equal marks.
 Assume suitable missing data, if any.

- Q.1 (a) Explain the concept of switched capacitor, its basic building blocks and discuss its applications. [4] [CO1]
- (b) Explain charge injection phenomenon in switched capacitor circuits at higher frequencies. Also provide formula that gives an approximate upper bound on the (clocking) frequency of operation of SC circuit for a specified voltage change due to charge injection. Ignore charge injection due to overlap capacitance. [4] [CO1]
- Q.2 Consider a PLL (type-1) as in Fig. 1, which incorporates a VCO with $K_o = 100 \text{ MHz/V}$, a phase detector with $K_d = 1 \text{ V/rad}$, and a first order low pass filter with $\omega_{LPF} = 2\pi \times 10^6 \text{ radians/s}$ below. A divider of 100 has been placed in the feedback path to implement a frequency synthesizer.
- (i) Obtain the value of the natural damping frequency, ω_n and the damping factor, ζ , for the transfer function $\phi_{out}(s)/\phi_{in}(s)$, for this PLL.
- (ii) If a step input of $\Delta\phi_{in}$ is applied at $t = 0$, what is the steady-state phase error at the output of the phase detector, ϕ_e ? The steady-state error is evaluated by multiplying the desired phase by s and letting $s \rightarrow 0$. [8] [CO1]

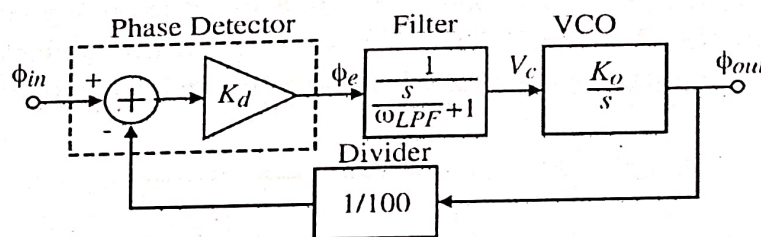


Fig. 1

- Q.3 (a) Discuss the implementation of charge pump and causes of jitter and skew in these circuits. How these problems can be suppressed? Use suitable diagrams and examples. [4] [CO2]
- (b) Discuss in details the non-ideal effects in switched capacitor and non-ideal effects in PLLs/PFD. [4] [CO1,2]

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Q.4 (a) Explain quantization noise in data converters and analyse quantization error using stochastic approach. Also elaborate effects of quantization noise on SNR and only list SNR improvement techniques in brief. [4] [CO-2]

(b) Discuss Nyquist rate converters and oversampling converters. Explain 3-bit thermometer based D/A converter. [4] [CO-3]

Q.5 (a) Determine Intermediate D/A values and the final output for 3-bit conversion where $V_{ref} = 8\text{ V}$, $V_{in} = 2.831\text{ V}$. [4] [CO-3]

(b) Consider the multiply-by-two gain circuit shown in Fig. 2 below. Assume the op-amp has an input offset designated as V_{off} . Find the values of V_{C1} , V_{C2} and V_{out} at the end of each of the phases. [4] [CO-3]

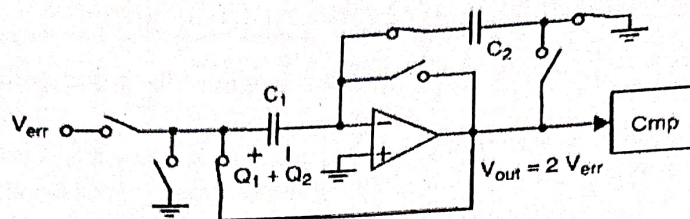


Fig. 2

Q.6 (a) Explain why we must use a priority encoder to encode the comparator outputs into a four-bit binary code, and not a regular encoder. What problem(s) would we have if we were to use a non-priority encoder in this ADC circuit? [4] [CO-4]

(b) Using current mirrors, show how one can interpolate two current outputs I_1 and I_2 by three. What reduction in input capacitance of the converter would be expected over a traditional flash architecture? [4] [CO-4]

Q.7 (a) Discuss four issues in designing of Flash A/D converter. Also explain ideal A/D converter with example of 2-bit A/D converter and its input-output transfer curve. [4] [CO-4]

(b) Many very high speed A/D converters do not use a sample and hold since it would limit their speed, but instead allow the input signal to be applied to the array of comparators, which are all clocked simultaneously. Explain why a clocked flash or interpolating A/D converter might operate faster than a sample and hold circuit. [4] [CO-4]