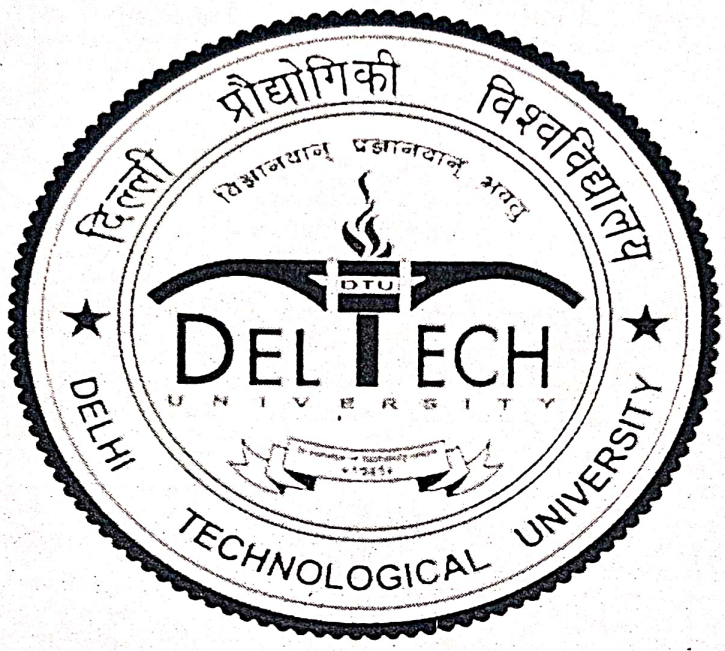
QUESTION PAPERS FOR END TERM THEORY EXAMINATIONS

November/ December-2022



M.Tech., MTPT, M.Sc., MBA, EMBA, M.Des.,

1st, 3rd & 5th SEMESTER

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M.TECH/MTPT/Ph.D.

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FIRST SEMESTER **M. Tech**

END TERM EXAMINATION **Nov-*2022***

CSE503 ADVANCED ALGORITHMS AND DATA STRUCTURES

Time: 3:00 Hours ***Max. Marks: 40***

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

Q.1 Attempt both questions.

i. Show that the worst-case running time complexity for building a max-heap of size n is *O(n)*. [3] [CO1]

ii. Solve the following recurrence relations using the method mentioned respectively. Assume T(1) =1.

a. $T(n) = 2T(n/4) + n^2$ using master method.

b. $T(n) = T(n/2) + n^3$ using substitution method.

c. $T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + \theta(n)$ using recursion-tree method. [1+2+2] [CO2]

Q.2 Attempt any two questions.

i. Analyse the time complexity of randomized quick sort in worst-case with solution of the recurrence relation for the same. [4] [CO2]

ii. In a selection process for university cricket team, total N number of players are appearing. The selectors have assigned a ranking to each player. Design an algorithm using Divide and Conquer

approach to find the minimum and maximum rating assigned by the selectors. [4] [CO3]

iii. Elaborate the following: [2+2] [CO1]

a. Self-adjusting trees

b. Dictionaries

Q.3 Attempt any two questions.

i. Write the Bellman-Ford algorithm to solve single source shortest path problem, which can handle a graph that contains negative weight edges. Further, apply the same to solve single source shortest path problem for the graph shown in Fig. 1.

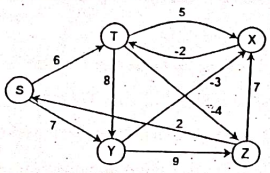


Fig. 1 [4] [CO5]

ii. Write the Flyod-Warshall algorithm to solve all pair shortest path problem. Further, apply the same to find the all pair shortest path for graph shown in Fig. 1. [4] [CO5]

iii. Differentiate between Depth First Search and Breadth First Search. [4] [CO1]

Q.4 Attempt any two questions.

i. Consider we have a knapsack of 8 kg and number of items available is 4. The weights and profits for each item is shown in Table 1. Solve the problem of item selection using dynamic programming in such a way that no item can be divided into parts.

Table. 1

Item	I1	I2	I3	I4
Weight	3	4	6	5
Profit	2	3	1	4

[4] [CO2]

ii. From the given two strings, write an algorithm to find out shortest uncommon subsequence. [4] [CO4]

iii. From the given array of integers [2, 3, 5, 6, 8, 10], we want to find out the subsets whose sum is 10. Solve the problem using backtracking approach to find such subsets. [4] [CO6]

Q.5 Discuss any two of the following in details with diagram: [2x4] [CO7]

i. Genetic Algorithm with mutation and crossover

ii. Particle Swarm Optimization with exploration and exploitation

iii. Vertex cover problem

3

Total no. of Pages: 02 *Roll no.....*

End Term Examination **Nov-2022**

First Semester **M.Tech. CSE**

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) Discuss with example how updates are made in B^+ trees. [4] [CO2]

b) When is it preferable to use a dense index than a sparse index? Explain your answer. [4] [CO2]

Q2. a) Explain the commit protocols used in distributed database systems. [4] [CO4]

b) What is the cost based optimization? [4] [CO3]

Q3. a) Compute the canonical cover of the following set of functional dependencies for relation schema. [4] [CO1]

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

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

b) What is recoverable schedule? Why is the recoverability desirable? Explain with suitable example. [4] [CO3]

Q4. Differentiate between (any four):

a) Static and Dynamic Hashing [4] [CO3]
b) Interquery and Intraquery parallelism [4] [CO4]
c) Clustering and secondary index [4] [CO2]
d) Homogeneous and Heterogeneous databases [4] [CO4]
e) Parallel and distributed databases [4] [CO4]

END

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

Roll No.....
M.TECH. [CSE]
(November- 2022)

CSE-5307 Subject: Parallel Computer Architecture

Time: 3:00 Hours ***Max. Marks: 100***

Note: Attempt any five questions. All questions carry equal marks.

1.(a) Explain Flynn's classification of computer system architecture with neat and clean diagram and suitable examples. 10

(b) 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. 10

2.(a) Explain the various network properties and differentiate between static and dynamic inter connection networks. And also discuss 16X16 baseline network. 10

(b) What is cache coherence problem? Discuss various protocol to solve the cache coherence problem. 10

3. (a) Compare the PRAM model with physical model of parallel computers in which PRAM variant can be best model SIMD machines and how? 10

(b) Describe Tomasulo's and scoreboarding techniques for dynamic scheduling in details. 10

4.(a) For given pipeline reservation table: 10

	t	t	t	t	t	t	t
S	X					X	
S 2			X				X
S 3		X		X			
S 4			X		X		

(i). Determine the latencies in the forbidden set and the initial collision vector.
(ii). Draw the state transition diagram for scheduling the pipeline.
(iii) Draw the MAL.
(iv) Draw the speedup and efficiency of the pipeline.

(b) Draw and define the architecture and instruction format of a VLIW processor. 10

5.(a) Differentiate between implicit and explicit parallelism and also discuss Hardware and Software parallelism with suitable examples. 10

(b) Discuss grain packing and scheduling with suitable examples and also discuss node duplication mechanism in a static multiprocessor system. 10

6.(a) Describe the branch effect and branch prediction in detail. And also define the performance degradation factor due to branch prediction. 10

(b) Amdahl's law and Gustafson's law are special case of memory bound speedup model. Justify this statement. 10

7. Write short notes on the following: 5X4
(i). Internal data Forwarding.
(ii). C -Access memory organization.
(iii) Control Hazards.
(iv) Perfect shuffle and exchange

Total No. of Pages:4 Roll No.....

ENDSEMESTER EXAMINATION (November – 2022)

M.Tech.(CSE) I st SEMESTER

CSE5401 Artificial Intelligence AND Expert

Paper Code **Title of the subject** Systems

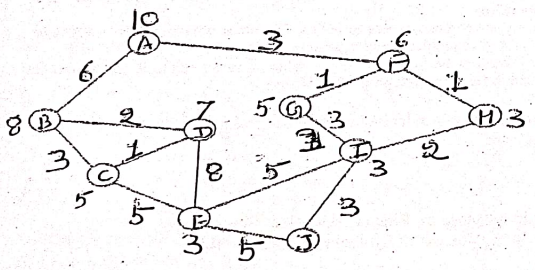
Time: 3Hours **Max. Marks:**40

Note: All diagrams and pseudocode should be neat and clean.
Answer any 5 questions.
Assume suitable missing data, if any.

Q1.(a) Explain different project characteristics and analyze the problem characteristics for robot moving a desk from one room to another.

(b) Consider the OR graph shown in figure 1, where number written on edges represent the distance between the nodes. The number written on nodes represent the heuristic values. Find the most cost-effective path to reach from start A to final state J using: (i) A* (ii)Best first search algorithm. Explain steps used. **[4,4]**

Figure(1)



Q2.(a) Consider the given graph(Refer Fig:2) that represents an AND-OR graph. The terminal nodes are labelled SOLVED and have zero cost. The arcs (all of them labeled) represent the cost of transforming the problem. Values associated with nodes are heuristic estimates of solving that node. Simulate the exploration of graph by *AO** algorithm till it terminates. Show how the graph looks at the end of each cycle. Assume FUTILITY value of 45. Clearly mark the final solution (by double-lined arcs) in the final graph.

(b) Define alpha beta cut-offs? Show how the algorithm Alpha Beta explores the given game tree(Fig:3,) searching from left to right
(i) Fill in the leaves that are inspected by Alpha Beta. Show the for the cutoffs and label them with their type.
(ii)Mark the move that Alpha Beta will choose for MAX at the root. **[4,4]**

Q3. (a) Explain the search strategy that uses forward reasoning as well as backward reasoning.

(b) Draw the flow graph to solve constraint satisfaction problem. Illustrate the steps for solving any crypt arithmetic problem. **[4,4]**

Q4. (a) Write down the unification procedure and illustrate its step to unify following literals where x,y,z are variables:
(i) love (x,y) and like (Radha, Shyam)
(ii) father(x,y,z) and father(Bhat, Alia, Pooja)

(b) Consider the following facts:
All man who are hard working or smart working attain success. All man who attain success and have saved money buy new house. Rohit is hard working and has good money.Rahul is neither hard working nor smart working

(i) Represent theses sentences as wff.
(ii) Using backward chaining prove that Rahul does not buy a new house.
(iii) Convert them to clause form indicating the law used.
(iv) Write down algorithm for resolution and illustrate its step to prove that Rohit buys a new house. **[2, 6]**

Fig:2

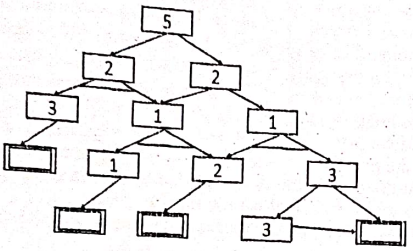
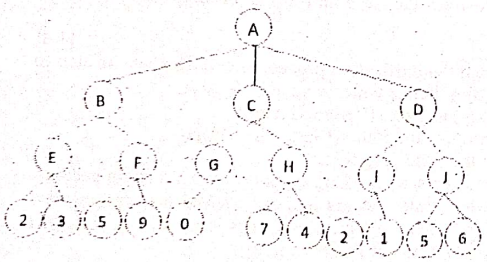


Fig:3



Q5. (a) With help of following example, illustrate how knowledge is represented using semantic net. Also write the corresponding property inference procedure

Every human, animal, bird is living thing who breathe and eat. All man and woman are humans who have two legs and hair. All birds have feathers, can fly and make nest. All animals have four legs, tail and can move. Monkey is an animal and can climb. Cat is an animal has fur. Parrot is a bird and is green in color. Robert is a man having no hair. Pusy is a cat having black color.

(b) Write the corresponding prolog representation and rules for inferences. Illustrate it to prove that parrot has nest and can not climb.

(c) What are the draw backs of semantic network representation and how they are overcome in semantic Frames representation. What are the various links and components in semantic frames. Convert above representation in to sematic frames assuming suitable attributes. Supporting your answer with prolog representation and inference rules.

[2,3,3]

Q6. (a) Draw a Process flow diagram to build Expert system. Also describe the general architecture of expert system with the help of medical diagnostic system that can diagnose stomach related pain as diarrhea, dysentery or appendicitis.

(b) Explain the Process of Learning by using any neural network model.

[4,4]

Q7. (a) Develop production system for diagnosis of male functioning of TV using probabilities described below. The situation for TV not working can be classified in to following classes

- Faulty knobs with over all probability of 70%
- Problem with antenna with probability of 80%
- Broken cable with probability 60%
- If the TV is old it is 40% sure that fault lies with knobs
- If children play with knobs it is 80%sure that fault is with knobs.
- If for some unusual situation, some one played with knobs, it is 80% sure that knobs are faulty.
- Problem of antenna can be due to fault at TV center with probability of 50% or connecting switch problem with probability of 60%.
- Broken cable can be 90% due to old cable or recent storm. It can be due to movement of furniture with probability of 80%.

(b) Explain the steps to calculate uncertainty factor with the help of suitable example.

[5,3]

Q8. (a) Explain the steps of PSO or ACO algorithm.

(b) Explain the process of Syntactic analysis in NLP.

[4, 4]

Total no. of Pages: 8

Roll no.....

III SEMESTER

M.Tech.

END TERM EXAMINATION

Nov/Dec-2022

CSE6301 - Natural Language Processing

Time: 03:00 Hours

Max. Marks: 50

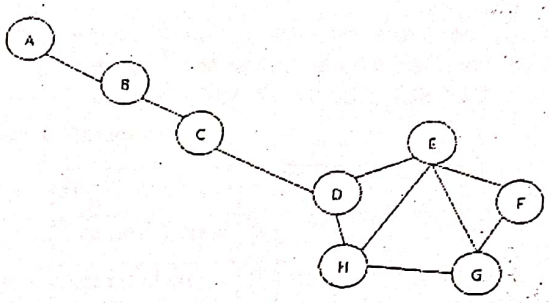
Note : All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 [a] Difference between lexicon and dictionary.
[b] Construction Criteria for Semantic Lexicon Generation.
[c] Discuss WordNet. [10] [CO1]

Q.2 Explain Dice coefficient, WuP similarity, Jaccard similarity, TF-IDF and Pointwise mutual Inclusion similarity measures. [10] [CO2]

Q.3 [a] What is the difference between semantic relatedness and semantic similarity? [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 Prisoner's Dilemma Game theory with illustration. [5] [CO4]

[b] Discuss the methodology for word spelling error detection and correction. [5] [CO4]

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

OR

Applications of Word Sense Disambiguation (WSD)? Explain any graph -based methodology for WSD with illustration. [10] [CO4]

Total no. of Pages:2 Roll no.....

III SEMESTER

M.Tech

END TERM EXAMINATION Nov/Dec-2022

COURSE CODE CSE6401 COURSE TITLE Pattern Recognition

Time: 03:00 Hours Max. Marks: 40

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

Q.1 Differentiate between the following: [4x2=8][CO2]

a) Dimensionality Reduction and Data Reduction

b) Covariance and Correlation

c) Recurrent Neural Network and Convolutional Neural Network

d) Overfitting and Underfitting

Q.2 a) What is the significance of Precision and Recall measures? Explain in detail using an example. [4][CO1]

b) Explain any 5 Activation functions used in a Neural Network based model. [4][CO3]

Q.3 The output of a classifier is described in the below table. Generate the confusion matrix and evaluate the classifier based on Specificity, Sensitivity, False Positive Rate and False Negative Rate. [8][CO4]

Item#	1	2	3	4	5	6	7	8	9	10
Predicted class	A	A	A	B	A	B	B	B	A	B
Actual class	B	A	B	B	B	B	A	A	A	A

Q.4 a) What problems can occur when clustering is applied to the real-world databases? Compare and contrast various clustering methods. [4][CO3]

b) With the help of an example, explain the differences between outliers and noise. [2][CO2]

c) What are the limitations of K-Nearest Neighbour technique and how may they be addressed. [2][CO2]

Q.5 a) Using the data in the given table, find the accuracy of a classifier categorizing a person into Buyer/Non-Buyer classes. [2][CO4]

		Predicted class	
		Buyer	Non-Buyer
Actual class	Buyer	345	89
	Non-Buyer	27	867

b) Calculate the city-block distance between the two data points $X_1(1,3)$ and $X_2(2,3)$. [2][CO4]

c) Suppose there are 2 white and 3 black coins in a box B1 and 3 white and 4 black coins in a box B2. One box is selected at random and a coin is drawn from it. If the coin drawn is found black, what is the probability that the box chosen was B1? [4][CO4]

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Total No. of Pages 2 Roll No.....

THIRD SEMESTER M. Tech.

END SEMESTER EXAMINATION November- 2022

CSE-6205 ADVANCES IN INTERNET AND WEB TECHNOLOGY

Time: 3 Hours *Max. Marks: 50*

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

Q.1 (a) Define the anchor tag with an example. [2] [CO-2]

(b) List the types of Style Sheets. [2] [CO-2]

(c)What does a scripting language need in Web Technology? [3] [CO-3]

(d) Discuss the significance of JavaScript in Web development? Explain the ways to create objects in JavaScript. [3] [CO-3]

Q.2(a) How does Model View Controller architecture work? Explain with a suitable diagram. [4] [CO-5]

(b) Enlist the differences between static and dynamic websites. [3] [CO-4]

(c) Which parts of PHP are case-sensitive and which are not? Define the main characteristics of PHP variables. [3] [CO-3]

Q.3(a) Difference between Information Retrieval and Data Retrieval with a suitable example. [3] [CO-5]

(b) What are the key issues in Web Mining? [3] [CO-5]

(c) Why is Multithreading required in web applications? State at least three areas of the web application where multithreading is used. [4] [CO-6]

Q.4 (a) How does client-side scripting differ from server-side scripting? [3] [CO-4]

(b)What is the use of Cascading Style Sheets Opacity? Explain through examples [3] [CO-3]

(c) Write a code Using HTML, CSS creates an input with a visual, the non-editable prefix. [4] [CO-3]

P.T.O.

Q.5 (a) Explain subjectivity and polarity in Sentiment Analysis. [2] [CO-6]

(b) How is consistency in HTTP proxies maintained? Explain with a suitable example. [4] [CO-3]

(c) Suppose you are on vacation for a long period, and your email inbox is receiving many emails. These emails could be urgent or important for your business or job. How your email services are managed then, and how is a reply sent to the important email senders? Give at least Four ways of handling the situation. [4] [CO-2]

Q.6 Write a short note on (Any five)

(i) Sentiment analysis [2][CO-6]
(ii) Content-based filtering [2][CO-6]
(iii) Dark Web [2][CO-1]
(vi) Client-side rendering [2][CO-3]
(v) Heuristic Cache [2][CO-2]
(vi) Web crawling [2][CO-4]

Total no. of Pages: 1 +2 14 Roll no.....

III SEMESTER

M.Tech. Hydraulics and Water Resources Engineering

END TERM EXAMINATION *Nov/Dec-2022*

HWE6203 Introduction to AI Techniques

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 (a) How expert systems help in the working of artificial intelligence. [5][CO1]

(b) Explain the following mechanisms with neat sketches: Forward reasoning and backward reasoning. [5][CO1]

Q.2 Describe the behaviour of variables with an example and how they will impact the analysis. [10][CO2]

Q.3 What do you understand by neural networks. Describe the various supervised and unsupervised learning methods with neat sketches. [10][CO3]

Q.4 (a) What are Genetic Algorithms. Explain their working with the help of flow chart. [5][CO4]

(b) State the various applications of Genetic Algorithms in Water Resources Engineering. [5][CO4]

Q.5 Explain the fundamentals and preliminary concepts of evolution and genetic algorithms. [10][CO5]

Q.6 Explain the following terms: [10][CO5]

(a) Genetic operators

(b) Mutation

(c) Crossover

(d) Recombination rate

Q.7 What do you understand by the term Optimization. Which optimization technique provides better results and how it affects uncertainty of the results? [10][CO5]

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M.Tech Nov-Dec 2022

END TERM EXAMINATION

HWE6403 (Environmental Impact Assessment)

Time 3:00 Hours Max Marks: 40

- **Attempt 05 Questions. QNO 1& 2 are compulsory**
- **Make necessary assumptions wherever required and clearly state them. Any data, if not given, may be assumed appropriately and stated clearly.**

Q1. A city discharges 1.4 m3/s of wastewater into a stream whose minimum rate of flow is 8.0 m^3/s. The velocity of the stream is about 3.0 km/h . The temperature of the wastewater is 20° C, and that of the stream is 20° C. The 20° C BOD of the wastewater is 200mg/L, and that of the stream is 1.0 mg/L. The waste water contains no dissolved oxygen, but the stream is 80 percent saturated upstream of the discharge. At 20° C, 'k_1' is estimated to be 0.30 per day and 'K_2' is 0.7 per day. Determine the critical-oxygen deficit and its location. Also estimate the 20° C BOD of a sample taken at the critical point. Also plot the dissolved-oxygen-sag curve.

(10 Marks) [CO (3)]

Q2 (A) Explain the monitoring requirements of EIA for

(i) Air and water polluting industry like Urea manufacturing plant

(ii) Water polluting industry producing organic waste like dairy industry

[CO (4)]

(B) Also explain the sampling and monitoring protocols, which are required to be followed for [CO (5)]

(i) NH_3 measurement in air emissions from fertilizer plant

(ii) Bod measurement from dairy waste water

(C) Explain the possible impact of these pollutants on the ambient air quality and river water quality respectively.

(3 x 3 = 9 Marks) [CO(2)]

Q3. Explain the importance of economic feasibility of project prior to EIA. How the economic feasibility of a water resource project is carried out? Explain with example data and analyze the same for economic feasibility.

(7 Marks) [CO (2)]

Q4. Explain the concept of Regional EIA. What is its significance and who is required to carry such study. Illustrate with example case/data and the benefits of such study. Also explain the concept of WLA with reference to regional EIA

(7 Marks) [CO (1),CO (2)]

Q5. Explain the inter relationship of EIA with sustainable development and indicate how the issues of human settlement, biodiversity and agriculture are addressed.

(7 Marks) [CO (1)]

Q6. (a) Explain and differentiate 'grab' sample and 'composite' samples.

(b) Salient features of Rules and regulations related to EIA

(3+4 =7 Marks) [CO (1)]

Q7. List the methods of Impact identification in EIA. Explain any of the Matrix methods or Network methods alongwith its advantages and limitations

(7 Marks) [CO (1)]

Roll Number: .....

Total Pages: 3

FIRST SEMESTER
M. Tech.

END TERM EXAMINATION — *Nov-2022*
COURSE CODE: VLS 501 — Analog IC Design

Time: 3 Hours — *Max. Marks: 40*

Note: · Attempt any 4 out of 5 questions.
· Clearly specify any assumptions you make.
· Unless specified, all MOSFETs are in saturation.

1. Discuss the motivation behind, and the working of bandgap reference circuits. [10][CO-5]

2. (a) Assuming $\lambda > 0$, find the input and output poles for the amplifier stage shown in Fig. 1(a). [5][CO-2]

   (b) Find the transfer function (voltage gain as a function of frequency) for the amplifier shown in Fig. 1(b). Assume $\lambda = 0$ for M1. [5][CO-2]

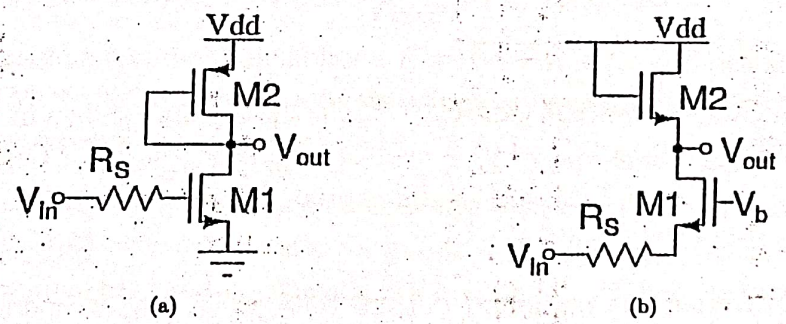


Figure 1

3. (a) Identify the sense and return mechanisms used in the closed loop amplifier given in Fig. 2(a). Justify your answers. Also, find the sign of feedback (positive or negative) using inspection method. [6][CO-2]

(b) If the open-loop gain A in a negative feedback system changes by 20%, find the minimum loop gain $A\beta$ required to ensure the closed-loop gain changes by less than 1%. [4][CO-1]

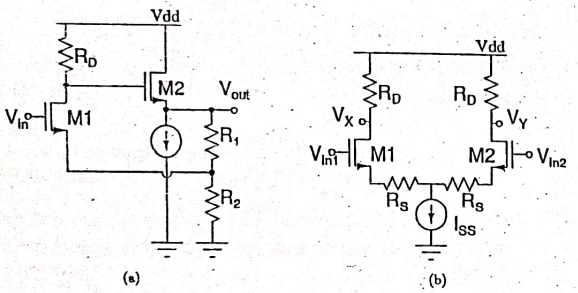


Figure 2

4. (a) Find the voltage gain V_{out}/V_{in} for the diff-amp shown in Fig. 2(b) where $V_{out} = V_X - V_Y$ and $V_{in} = V_{in1} - V_{in2}$. Output and input both are in differential mode. Assume M1 and M2 to be identical. [5][CO-1]

(b) Derive the minimum output voltage for proper operation (V_{O-min}), and output resistance of a 3-transistor Wilson current mirror circuit. [5][CO-4]

5. (a) Describe the purpose of the capacitor C_F in the single ended Op-Amp circuit shown in Fig. 3. [5][CO-3]

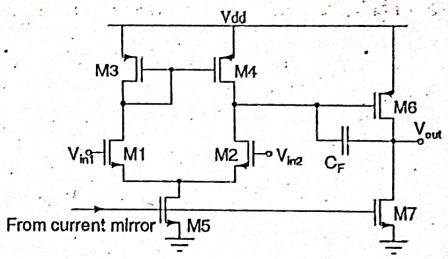


Figure 3

(b) For a Source-Follower amplifier stage, analyze the behavior of the output impedance with frequency, considering only C_{GS} capacitance (neglect all other capacitances). [5][CO-2]

Total No of Pages

Roll No.

1st SEMESTER

M.Tech

END TERM EXAMINATION *Nov-2022*

COURSE CODE VLS503 **COURSE TITLE Digital CMOS IC Design**

Time: 3:00 Hours *Max. Marks: 40*

Note : Q. 1 is COMPULSORY, Attempt any FIVE questions from remaining.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1(a) Why does NMOS transistor passes a strong '0' and weak '1'? [2][CO1]

(b) How many ways a NAND gate can be converted to an inverter? Comment on the delay of the implementations. [2][CO3]

(c) Why do dynamic circuits exhibit lesser noise margin than static circuits? [2][CO4]

(d) What would be the impact of increasing threshold voltage of NMOS transistor on CMOS VTC in terms of noise margins (V_{IL}, V_{IH})? [2][CO2]

(e) Design a 2 input AND gate with PMOS pass transistor. [2][CO3]

Q.2(a) Design a combinational circuit $F = \overline{(A+B)(CD+E)}$ using static CMOS and size the transistors using equivalent inverter method. Assume $(W/L)_{n,inv.} = 2$; $(W/L)_{p,inv.} = 4$. [3][CO3]

(b)Assuming that the primary inputs and their complements in circuits of Fig. 1 have rail-to-rail swing (0 to VDD), (i) Compute the output obtained at Y and Z. (ii) what is the voltage swing on outputs Y and Z? [3][CO3]

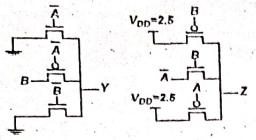


Fig. 1

Q.3 (a) Consider the circuit of Fig. 2, Give the logic of x and y in terms of A, B and C. Sketch the waveforms at x and y for given inputs. Do x and y evaluate to the values you expect from their logic functions? Explain. [3] [CO4]

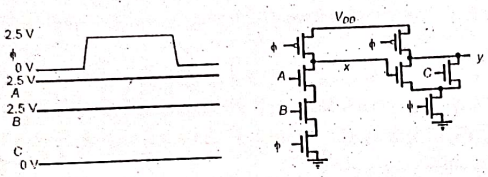


Fig. 2

(b) Redesign the gates using NORA-CMOS to eliminate any race condition. Sketch the waveforms at x and y for your new circuits. [3][CO4]

Q.4 (a) What is the logic function performed by circuit of Fig. 3? Explain why this circuit has non-zero static dissipation. Using only just 1 transistor, design a fix so that there will not be any static power dissipation. [3] [CO3]

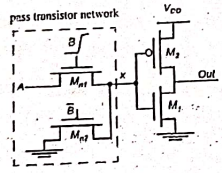


Fig. 3

(b) Design the following Boolean functions using multiple output domino logic [3][CO4]

$C_1 = G_1 + P_1C_0$, $C_2 = G_2 + P_2G_1 + P_2P_1C_0$,

where $P_i = \bar{A}_i O_i + A_i\bar{O}_i$, $G_i = A_i O_i$ (i = 1,2,3)

Q5 (a) Design a rising edge triggered register using transmission gates and inverters. Calculate propagation delay, setup and hold time. Discuss the behaviour of the circuit in presence of clock overlap and suggest strategy to ensure correct operation of the circuit. [3][CO5]

(b) Analyze the circuit of Fig. 4 and compute propagation delay, setup and hold time. Can you embed the logic into the circuit? Illustrate your answer with suitable example. [3][CO5]

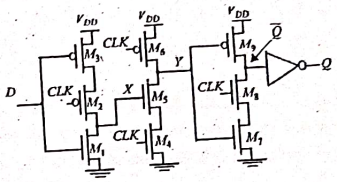


Fig. 4

Q.6 (a) The transistors in 6T SRAM cell have to be properly sized to perform correct read and write operation. Explain. [3][CO6]

(b) Differentiate between different VLSI design styles. Which out of these is most suitable for a time critical design? [3][CO6]

Q.7(a) Consider a CMOS inverter fabricated in 0.25-µm process for which Cox = 6 fF/µm2, $\mu_n C_{ox}$ = 115 µA/V2, $\mu_p C_{ox}$ = 30 µA/V^2, Vtn = -Vtp = 0.4 V and VDD = 2.5 V. The $(W/L)_n$ = 0.375µm/0.25 µm and $(W/L)_p$ = 1.125 µm/0.25 µm. Determine switching threshold voltage of the inverter. [3][CO2]

(b) A particular n-channel MOSFET is measured to have a drain current of 0.4 mA at $V_{GS} = V_{DS} = 1$ V and of 0.1 mA at $V_{GS} = V_{DS} = 0.8$ V. What are the values of kn and V_T for this device? [3][CO1]

Total No. of Pages ..... Roll No. .....

FIRST SEMESTER
M.Tech.

END SEM EXAMINATION (Nov-2022)
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) Realize the connection diagram for the given expression using p-OTFT only. Also Justify the working of circuit for any one combination of inputs and subsequent output. (5) [CO4]

$$Y' = (A+B+C)'+(C+D)'+E'$$

(b) Discuss trade-off (advantage/disadvantage) for dual gate OTFT. Derive the drain current equation for dual gate OTFT. (5) [CO2]

Q. 2 (a) Make the connection diagrams for following using p-OTFT only. (5) [CO4]

i) J-K Flip-Flop using NAND gate

ii) 5-stage ring oscillator

iii) Y = A+B

(b) Mention the significance and need of flexible electronics in our life. (5) [CO1]

Q. 3 (a) Discuss different layers and their working that can be used for enhancing carrier concentration in OLED. What are disadvantages of basic OLED architecture. Which Color of OLED has the least lifetime and why? (5) [CO5]

(b) Discuss different possible combinations for inverter using organic transistor. Which combination best suits in terms of (i) low-cost fabrication and (ii) ease of fabrication. (5) [CO1]

Q. 4 (a.1) Differentiate organic inverter using DLL and ZVLL techniques. (2.5) [CO4]

(a.2) What is the limitation of using only one type of transistor for inverter and why? (2.5) [CO3]

(b) Justify that bootstrapping technique can improve the performance of all-n TFT inverter and find the required ratio of C_{boot}/C_s for high output. Make the connection diagram for all-p and all-n inverter using bootstrapping. (5) [CO3]

Q. 5 (a) Calculate Bandwidth and Gain (in dB) of OTFT based common source amplifier, given below. Also make Hybrid-Π models for low, high and mid frequency response. Consider circuit parameters as per Table 1; (5) [CO3]

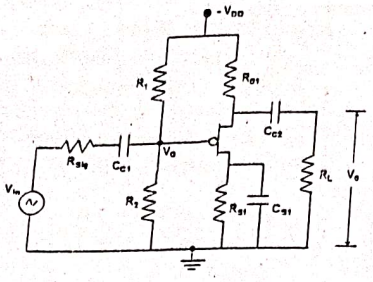


Table 1

R_1	0.5 MΩ	R_{S1}	1k Ω	R_L	5 MΩ
R_2	6 MΩ	R_{sig}	100 Ω	Cox	1.5 nF/cm²
R_C	1.5 MΩ	CC_1	1 nF	W	500 µm
R_{Ch}	500kΩ	CC_2	0.1 nF	L	2 µm
R_D	1 MΩ	C_{S1}	1 µF	g_m	3.2 nA/V
L_o (overlapping contact length)					100 nm

(b) Discuss different types, operating principle and one potential application of an organic solar cell. (5) [CO5]

Q. 6 (a) Fill the following table for all-p inverter circuit. Also Derive the expressions for VIL and VIH for all-n inverter circuit (5) [CO4]

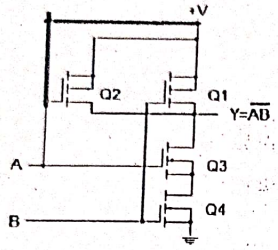
V_{in}	V_{out}	Operating Region	
		Driver	Load
0			
1			

(b) Discuss all 4 basic structures of single gate OTFT along with their advantages and disadvantages. (5) [CO2]

END

(c) Draw the ideal state diagram and state table to determine the 2's complement of a binary number. Also, convert this state table to Moore's state table. [2][CO#2]

Q.6 (a) What is the difference between defect and fault? Model the defect present in the circuit shown below at gate level. [2][CO#3]



(b) Obtain a primitive flow table for a circuit with two inputs, x1 and x2, and two outputs, z1 and z2, that satisfy the following four conditions: [4][CO#4]

(b.1) When x1x2 = 00, the output is z1z2 = 00.
(b.2) When x1 = 1 and x2changes from 0 to 1, the output is z1z2 = 01.
(b.3) When x2 = 1 and x1 changes from 0 to 1, the output is z1z2 = 10.
(b.4) Otherwise, the output does not change.

(c) Obtain the ASM chart for the following state transitions: If x=0, control goes from state T1 to state T2. If x=1, generate the conditional operation and go from T1 to T2. [2][CO#5]

END

SEMESTER - I M.Tech
END TERM EXAMINATION Nov-2022
VLS 5401 Digital Design with HDL (Verilog)
Time: 3 Hours *Max. Marks :40*

Note: Attempt any five questions.
All questions carry equal marks.
Assume suitable missing data, if any.
[CO#] stands for Course Outcome

Q.1 Explain the difference between critical and non- critical race with the help of an example. An asynchronous sequential circuit is having two inputs (a and b) and two state variable x and y, where the next state variables are given by:
X= a'b +by'+x
Y=ab+by+y'a'b'+a'b'x'
(a) Find all the races in this circuit and indicate those that are critical and those that are not.
(b) Find another assignment that contains no critical races.
(c) Are there any possibility of hazards in this circuit. Suggest a solution to avoid those hazards. [8][CO#4]

Q.2 (a) Implement the following Boolean function on PLA, PAL (4-input OR gate) and ROM (8 × 3 block): F (A, B, C) = π (0,3,6,7). [4.5][CO#3]

(b) A clocked Moore sequential circuit should have an output of Z=1 if the total no. of zeros received is an even number greater than zero, provided that two consecutive 1's have never been received. Draw the state diagram and obtain the output for the following sequence of input: X= 00001010110000. [3.5][CO#2]

Q.3 (a) Draw the ASM chart for the state table 1 shown below. [2][CO#5]

present state	next state $x=0$	next state $x=1$	output z
A	D	B	1
B	A	C	1
C	B	D	0
D	C	D	1

Table 1

(b) Draw the ASM chart to determine the number of 0s present in the binary representation of a number. Explain the role of each state and input. [4][CO#5]

(c) Name and explain the function of the type of boxes in ASM chart. [2][CO#5]

Q.4 (a) Determine all the test vectors to detect stuck-at-1 fault on line F in Figure 1 below. [4][CO#3]

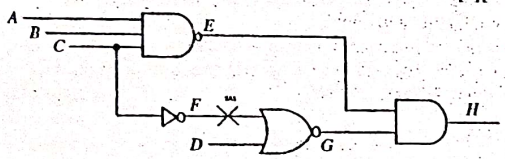


Figure 1

(b) Draw the equivalent circuit diagram corresponding to an OR bridging fault between lines E and F in Figure 1 (assuming no stuck at fault on line F). Determine the test vectors to detect this fault. [4][CO#3]

Q.5 (a) Write down the four missing operations in the design process using FPGA in the flowchart shown below in Fig.2.

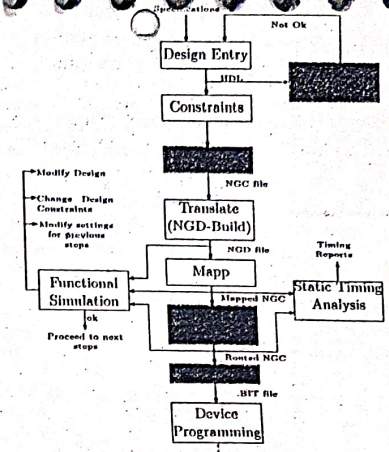


Figure 2 [2][CO#1]

(b) [4][CO#1]

(b.1) Draw the circuit diagram for the following Verilog code:

```
module fulladd4(sum, c_out, a, b, c_in);
output [3:0] sum;
output c_out;
input[3:0] a, b;
input c_in;
wire c1, c2, c3;
fulladd fa0(sum[0], c1, a[0], b[0], c_in);
fulladd fa1(sum[1], c2, a[1], b[1], c1);
fulladd fa2(sum[2], c3, a[2], b[2], c2);
fulladd fa3(sum[3], c_out, a[3], b[3], c3);
endmodule
```

(b.2) Explain the behaviour of the code shown below line by line.

```
always @(posedge clock)
begin
reg1 <= #1 in1;
reg2 <= @(negedge clock) in2 ^ in3;
reg3 <= #1 reg1;
```

25

Total no. of Pages: 2

Roll no.....

I & III SEMESTER

M.Tech.

END TERM EXAMINATION Nov/Dec-2022

VLS6207 SELECTED TOPICS in VLSI

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) To design the oxide thickness of a MOS system to yield a specified threshold voltage. Consider an n^+ polysilicon gate and a p-type silicon substrate doped to $N_A = 3\times10^{16}$ cm^{-3}. Assume $Q'_{SS} = 10^{11}$ cm^{-2}. Determine the oxide thickness such that $V_{TN} = +0.65$ V. Given $\Phi_{ms} = -1.13$ V, $\Phi_{fp} = 0.376$. [6M] [CO1]

(b) Discuss fixed oxide and interface charge effects. Draw high-frequency CV characteristics of a MOS capacitor showing the effects of interface effects. [4M] [CO1]

Q.2 (a) An ideal n-channel MOSFET has an inversion carrier mobility $\mu_n = 525$ cm^2/V-s, a threshold voltage $V_T = 0.75$ V, and an oxide thickness $t_{ox} = 400$ Å. When biased in the saturation region, the required rated current is the $I_{D(sat)} = 6$ mA when $V_{GS} = 5$V. Determine the required W/L ratio. A p-channel MOSFET has the same requirements when $V_{GS} = 5$ V and has the same parameters as part (a) except $\mu_p = 300$ cm^2/V-s and $V_T = -0.75$ V. Determine the W/L ratio. [5M] [CO2]

(b) Explain the narrow-width effect. How this effect modifies the threshold voltage of the device? [5M] [CO3]

Q.3 (a) A metal, with a work function $\Phi_m = 4.2$ eV, is deposited on an n-type silicon semiconductor with $\chi_s = 4.0$ eV and $E_g = 1.12$ eV. Assume no interface states exist at the junction. Let T = 300 K, $N_C = 2.8\times10^{19}$ cm^{-3}.

(i) Sketch the energy band diagram for zero bias for the case when no space charge region exists at the junction.

(ii) Determine N_d so that condition in part (i) is satisfied.

(iii) What is the potential barrier height seen by electrons in the metal moving into the semiconductor? [6M] [CO4]

(b) Explain the working of ideal non-rectifying contacts with the help of energy band diagrams. [4M] [CO4]

Q.4 (a) Draw and explain the basic principle of operation of Tunnel FET. Why is tunnel FET regarded as a better alternative for low-power applications? [5M] [CO5]

(b) What is ambipolar conduction in Schottky Barrier MOSFET? Discuss the techniques to minimize this effect. Write the advantages of the device. [5M] [CO5]

Q.5 (a) Draw and Explain the fabrication steps of FinFET. Discuss the benefits of FinFET over conventional MOSFET. How does FinFET reduce leakage? [5M] [CO5]

(b) Explain the working of Ion Sensitive FET. Write down the limitations of the device as a biosensor. [5M] [CO5]

Q.6 (a) A pn junction diode and a Schottky diode have equal cross-sectional areas and have forward-biased currents of 0.5 mA. The reverse-saturation current of the Schottky diode is 5×10^{-7} A. The difference in forward bias voltage between the two diodes is 0.30 V Determine the reverse-saturation current of the pn junction. [5M] [CO4]

(b) Discuss the challenges and the solutions of scaling conventional MOSFET. [5M] [CO3]

III SEMESTER

Roll No.

M.Tech

END-TERM EXAMINATION *NOV-2022*

VLS6305:MACHINE LEARNING

Time: 3 Hours *Max. Marks: 50*

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

Q.1 Describe the following: [2x5 = 10 M]

i. Pruning in Decision Tree classification. **[VLS6305.2]**

ii. Temporal difference model in reinforcement learning. **[VLS6305.1]**

iii. Clustering. **[VLS6305.1]**

iv. Dimensionality reduction using Principal Components Analysis. **[VLS6305.2]**

v. Basic Reinforcement Learning model. **[VLS6305.1]**

Q.2 Attempt the following:

i. List the steps to be followed for K-NN algorithm and determine the status of a sample (181, 64) based on the following dataset of health status, using the K-NN, K=3, instance-based classifier. **[5M] [VLS63 05.3]**

S. No.	Weight (Kg)	Height (cm)	Status
1	190	70	Healthy
2	185	65	Healthy
3	183	52	Unhealthy
4	181	50	Unhealthy
5	180	55	Unhealthy
6	178	59	Healthy
7	175	56	Healthy
8	170	51	Healthy
9	160	66	Unhealthy

ii. For the following data, classify a sample X=(Outlook=Overcast, Temperature=Cool, Humidity=High, Wind=Strong) **[5M] [VLS63 05.3]**

PlayTennis: training examples

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

Q.3 Attempt any two from the following:

i. Compare the value iteration and policy iteration approaches related to model-based learning in reinforcement learning. **[5 M] [VLS63 05.5]**

ii. Analyze the geometric interpretation of the linear discriminant for binary classification and show that a data point x in the feature space can be represented as $x = x_p + r\frac{w}{\|w\|}$, where x_p is the normal projection of x onto the decision boundary/plane ,and r is the distance from the data point to the decision boundary. Also, determine the expression to calculate r and the distance of the decision boundary with respect to the origin. **[5M] [VLS63 05.4]**

iii. Formulate the scheme for multiple class ($K>2$) classification through the logistic discrimination approach and derive the expression for update equations for the weights/coefficients of discriminant functions as per the gradient descent algorithm. **[5M] [VLS63 05.4]**

Q.4 Attempt the following:

i. Implement Boolean functions AND and OR with single layer perceptron and assess whether XNOR function can also be realized using single layer perceptron. Justify your assessment based on VC dimension analysis for the given problem. **[5M] [VLS63 05.5]**

ii. Explain Single state case: K-Armed Bandit scheme of Reinforcement Learning. **[5 M] [VLS63 05.2]**

Q.5 Attempt any two of the following:

i. Define the partially observable Markov decision process (POMDP) with an example and formulate a reinforcement learning application that POMDP can model. **[5 M] [VLS63 05.4]**

ii. Describe the various elements of reinforcement learning in detail. **[5 M] [VLS63 05.2]**

S. No.	Marital Status	Refund	Taxable Income	Cheat
1	Single	Yes	1,25,000	No
2	Married	No	100,000	No
3	Single	No	70,000	No
4	Married	Yes	1,10,000	No
5	Divorced	No	90,000	Yes
6	Married	No	65,000	No
7	Divorced	Yes	200,000	No
8	Single	No	82,000	No
9	Married	No	75,000	No
10	Single	No	95,000	Yes

iii. Generate two different Decision Trees that fit the above-mentioned data for classifying an individual as a cheat or not-cheater and determine the classification for the following test data. **[5 M] [VLS63 05.3]**

S. No.	Marital Status	Refund	Taxable Income	Cheat
11	Single	Yes	1,02,000	?
12	Married	No	85,000	?
13	Single	No	94,000	?
14	Divorced	No	80,000	?

Q.5 (a) A 10-bit ADC has a reference voltage V_{ref} tuned to 10.24 V at 25° C. Find the maximum allowable temperature coefficient in terms of (μV)/°C for the reference voltage if the reference voltage is allowed to cause a maximum error of ± ½ LSB over the operating temperature range from 0° to 50° C. [4] [CO-3,4]

(b) Design and explain 4-bit folding A/D converter with a folding rate of four and an interpolate by two. Also mention merits over interpolating A/D converter. [4] [CO-4]

Q.6 (a) Define followings with respect to data converters in brief:

i) Offset and gain error

ii) Monotonicity

iii) D/A settling time

iv) Dynamic range [4] [CO-4]

(b) Draw binary weighted 10-bit resistor D/A converter and assume that R_F is chosen such that the output goes from 0 to $V_{ref} - V_{LSB}$. What is the resistor ratio between the largest and smallest resistors? What is the ratio between the currents through the switches for b_1 to b_{10}? Consider Binary weighted 4-bit resistor D/A converter as a reference circuit as given in Fig. 4. [4] [CO-4]

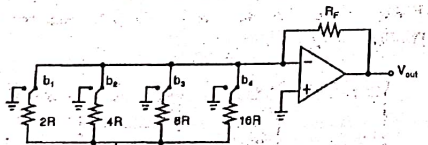


Fig. 4

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1st & 3rd SEMESTER **M.Tech**

END TERM EXAMINATION ***Nov-2022***

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 charge injection phenomenon in switched capacitor circuits a higher frequencies. Also provide formula that gives an approximate upp bound on the (clocking) frequency of operation of SC circuit for specified voltage change due to charge injection. Ignore charge injectio due to overlap capacitance. [4] [CO-1

(b) Consider a PLL (type-1) as shown in Fig. 1, which incorporates a VC with K_o = 100 MHz/V, a phase detector with K_d = 1 V/rad, and a fir order low pass filter with $\omega_{LPF} = 2\pi \times 10^6$ radians/s. A divider of 100 ha been placed in the feedback path to implement a frequency synthesizer.

(i) Obtain the value of the natural damping frequency, ω_n and th damping factor, ζ, for the transfer function $\phi_{out}(s)/\phi_{in}(s)$, for th PLL.

(ii) If a step input of $\Delta\phi_{in}$ is applied at t = 0, what is the steady-sta phase error at the output of the phase detector, ϕ_e? The steady-sta error is evaluated by multiplying the desired phase by s and lettir $s \rightarrow 0$. [4] [CO-

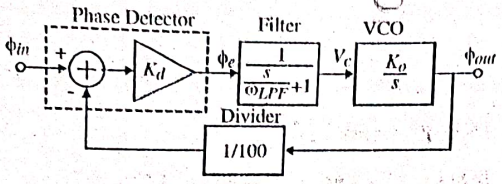


Fig. 1

Q.2 (a) Describe the cause of limited acquisition range and problem of lock acquisition in PLL. Explain whether a master-slave D flipflop can operate as a phase detector or a frequency detector. Assume the flipflop provides differential outputs. **[4] [CO-2]**

(b) A filter for a phase locked loop is specified by function given below and must be implemented on a CMOS chip using resistors no larger than 10 kΩ and capacitors no larger than 10 pF. Using the circuit shown in Fig. 2, determine values of R_1 and R_2 that will satisfy the component value constraints. **[4] [CO-2]**

$$|F(s)| = \frac{10\omega_1}{s+\omega_1} = \frac{1{,}000{,}000}{s+100{,}000}$$

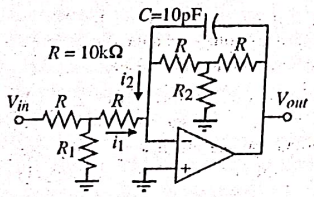


Fig. 2

Q.3 (a) Draw and explain the implementation of charge pump. Discuss the cause of jitter and skew in these circuits and how both of these can be suppressed. Use suitable diagrams. **[4] [CO-2]**

(b) 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-3]**

Q.4 (a) Assume the following values for the ADC, clock frequency = 1 MHz, V_T = 0.1 mV, DAC has full scale (F.S.) output = 10.23 V and a 10-bit input. Determine the following values:

i) the digital equivalent obtained for V_A = 3.728 V.

ii) the conversion time.

iii) the resolution of this converter. **[4] [CO-3]**

(b) Predict how the operation of this "flash" ADC circuit shown in Fig. 3 will be affected as a result of the following faults. Consider each fault independently (i.e. one fault at a time, no multiple faults). **[4] [CO-3,4]**

i) Resistor R_{16} fails open

ii) Resistor R_1 fails open

iii) Comparator U_{13} output fails low

iv) Solder bridge (short) across resistor R_{14}

For each of these conditions, explain why the resulting effects will occur.

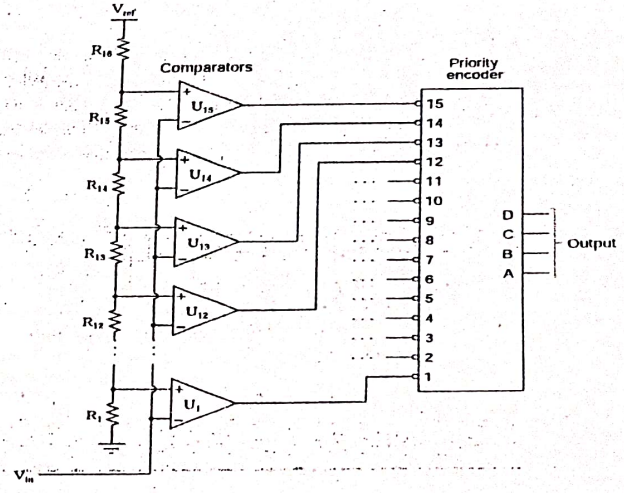


Fig. 3

Total No. of Pages:4

Roll No.....

M.Tech.(AI) IstSEMESTER

End SEMESTER EXAMINATION (November – 2022)

AI 501 Advance Data Structure &Algorithm

Paper Code **Title of the subject**

Time: 3 Hours **Max. Marks:** 40

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

Q1. Solve the recurrence relation:

(i) $T(n)=2T(n/2)+n \log n$

(ii) $T(n)= \begin{cases} T(n-1)+T(n-2)-T(n-3), & n>=3 \\ n, & n<=2 \end{cases}$

[2.5x2]

Q2. (i) Propose an algorithm that requires minimum number of comparison to determine if an integer appears more than n/2 times in a sorted array of n elements. State time complexity.

(ii) Consider an array storing minimum heap having $n.2^n$ elements. Work down the time complexity of extracting minimum element maintaining property of heap.

[2.5x2]

Q3. (i)Generate a binary tree that represent optimal merge pattern for files of length:- 10, 5, 30,20,30,35.

(ii) consider 5 jobs requiring one unit of time with their respective profit vector as p = < 15, 10, 20, 2, 5>and deadline vector D = <2, 1, 2, 4, 3>.Find the optimal job scheduling for these job for single CPU.

[2.5x2]

Q4. Write an algorithm that read n1xn2 sparse matrix containing n nonzero element and store non zero elements as nx3 matrix, find the transpose and print the final transpose as n2xn1 matrix.

[5]

Q5. Define and illustrate the properties of red black tree given in Figure (1). Show the steps for insertion of element 20 maintaining property of red black tree.

[5]

Q6. Describe how computing matrix multiplication can be improved by Strassen methods using divide and conquer approach?

[5]

Q7. Consider an undirected graph G = (V,E) with nonnegative edge weights we >=0. Suppose that you have computed a minimum spanning tree of G, and that you have also computed shortest paths to all nodes from a particular node S ∈ V .Now suppose each edge weight is increased by 1 i.e. the new weights are w'e = we + 1.

(i) Does the minimum spanning tree change? Give an example where it changes or prove it cannot change.

(ii) Do the shortest paths change? Give an example where they change or prove they cannot change.

[5]

Q8. Suppose Bellman Ford Algorithm is run on the Graph shown in Figure 2.

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.

[5]

Q9. Given two strings $x = x_1x_2 \cdots x_n$ and $y = y_1y_2 \cdots y_m$, we wish to find the length of their longest common substring, that is, the largest k for which there are indices i and j with

$x_ix_{i+1} \cdots x_{i+k-1} = y_jy_{j+1} \cdots y_{j+k-1}$

Show how to do this in time O(mn).

[5]

Q10. Given positive numbers w_i, $1 \le i \le n$, and m, find all subsets of the w_i whose sum is m. For eg) $(w_1, w_2, w_3, w_4) = (1,2,3,4)$ and m=7. Illustrate the algorithm using backtracking approach.

[5]

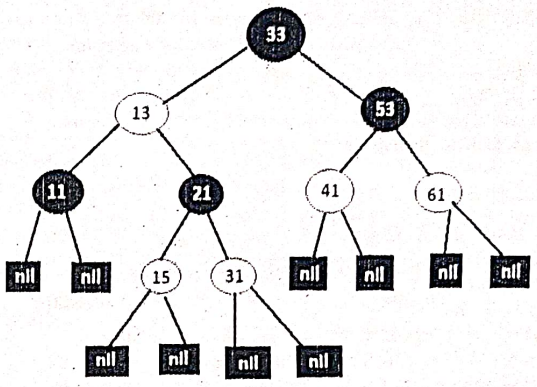
Q11. What is NP- Complete problem? Prove that TSP is a NP-Complete problem?

[5]

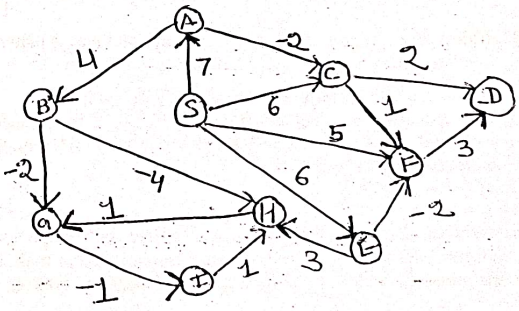
Q12. Write down the importance of approximation algorithm? Solve the vertex cover problem using approximation algorithm and prove that it is a polynomial-time 2-approximation algorithm.

[5]

Figure(1)



Figure(2)



Total No. of Pages 7

Roll No. .....

FIRST SEMESTER

M.Tech. AI

END SEMESTER EXAMINATION ***December-2022***

AI503 PRINCIPLES OF AI

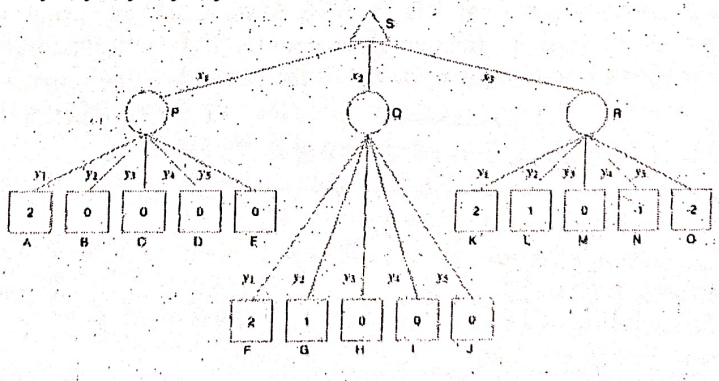
Time: 3:00 Hours *Max. Marks: 40*

Note:
- Attempt any two subparts of Q1.
- Attempt Q2 compulsory.
- Choice in Q3 is given.
- Choice in Q4 is given.
- Attempt Q5 compulsory.
- Assume suitable missing data, if any.

1. Alyssa P. Hacker and Ben Bitdiddle are bidding in an auction at Stanley University for a bike. Alyssa will either bid x1, x2, or x3 for the bike. She knows that Ben will bid y1, y2, y3, y4, or y5, but she does not know which. All bids are nonnegative.

Attempt any two from a,b,c.

[a] Alyssa wants to maximize her payoff given by the expectimax tree below. The leaf nodes show Alyssa's payoff. The nodes are labeled by letters, and the edges are labeled by the bid values xi and yi . The maximization node S represents Alyssa, and the branches below it represent each of her bids: x1, x2, x3. The chance nodes P, Q, R represent Ben, and the branches below them represent each of his bids: y1, y2, y3, y4, y5.



Suppose that Alyssa believes that Ben would bid any bid with equal probability. What are the values of the chance (circle) and maximization (triangle) nodes? MARKS:3

i) Node P
ii) Node Q
iii) Node R
iv)Node S

Based on the information from the above tree, how much should Alyssa bid for the bike? Tick the correct answer. MARKS:2

i) x1
ii) x2
iii) x3

[b] Alyssa does expectimax search by visiting child nodes from left to right. Ordinarily, expectimax trees cannot be pruned without some additional information about the tree. Suppose, however, that Alyssa knows that the leaf nodes are ordered such that payoffs are non-increasing from left to right (the leaf nodes of the above diagram is an example of this ordering). Recall that if node X is a child of a maximizer node, a child of node X may be pruned if we know that the value of node X will never be > some threshold (in other words, it is ≤ that threshold). Given this information, if it is possible to prune any branches from the tree, write those node names. Otherwise, write "None of the above." MARKS:5

[c] Unrelated to parts (a) and (b), consider the minimax tree below. whose leaves represent payoffs for the maximizer. The crossed out edges show the edges that are pruned when doing naive alpha-beta pruning visiting children nodes from left to right. Assume that we prune on equalities (as in, we prune the rest of the children if the current child is ≤ α (if the parent is a minimizer) or ≥ β (if the parent is a maximizer)). MARKS:5

- Assume that all ties are broken alphabetically. For example, if there is a tie between states "A", "B", and "C", expand "A" first, then "B", then "C".

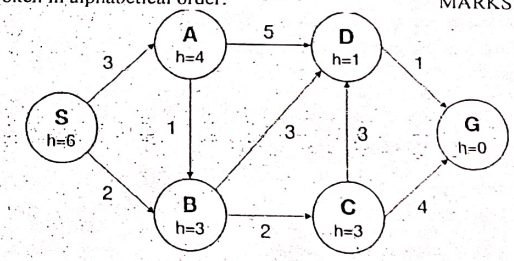
i) From the six correct passwords below, select the one that will be returned by depth-first search: MARKS:3

a. AAACCC
b. ABBCC
c. BABAB
d. BCABACB
e. CBAC
f. CBACB

ii) From the six correct passwords below, select the one that will be returned by breadth-first search: MARKS:3

a. AAACCC
b. ABBCC
c. BABAB
d. BCABACB
e. CBAC
f. CBACB

[b] Consider the following graph. For the following subquestions, ties are broken in alphabetical order: MARKS:4



(i) What path would DFS return?
(ii) What path would BFS return?
(iii) What path would UCS return?
(iv) What path would Greedy search return?

3 A candy manufacturer interviews a customer on his willingness to eat a candy of a particular color or flavor. The following table shows the collected responses:

Color	Flavor	Edibility
Red	Grape	Yes
Red	Cherry	Yes
Green	Grape	Yes
Green	Cherry	No
Blue	Grape	No
Blue	Cherry	No

[a] What is H(edibility)? MARKS:2

[b] What is H(edibility | color)? MARKS:2

[c] Which feature (color or flavor) has the larger mutual information with edibility? MARKS:2

[d] Draw the decision tree for predicting edibility that maximizes the information gain? Using your decision tree, what would you predict for the edibility of a blue, blueberry flavored candy? MARKS:4

OR

Four people, A, B, C, and D, are all looking to rent space in an apartment building. There are three floors in the building, 1, 2, and 3 (where 1 is the lowest floor and 3 is the highest). Each person must be assigned to some floor, but it's ok if more than one person is living on a floor. We have the following constraints on assignments:

- A and B must not live together on the same floor.
- If A and C live on the same floor, they must both be living on floor 2.
- If A and C live on different floors, one of them must be living on floor 3.
- D must not live on the same floor as anyone else.
- D must live on a higher floor than C.

We will formulate this as a CSP, where each person has a variable and the variable values are floors.

[a] Draw the edges for the constraint graph representing this problem. Use binary constraints only. MARKS:2

[b] Suppose we have assigned C = 2. Apply forward checking to the CSP, filling in the boxes next to the values for each variable that are eliminated. MARKS:3

	1	2	3
A	☐	☐	☐
B	☐	☐	☐
C		☐	
D	☐	☐	☐

[c] Starting from the original CSP with full domains (i.e. without assigning any variables or doing the forward checking in the previous part), enforce arc consistency for the entire CSP graph, filling in the boxes next to the values that are eliminated for each variable. MARKS:3

	1	2	3
A	☐	☐	☐
B	☐	☐	☐
C	☐	☐	☐
D	☐	☐	☐

[d] Suppose that we were running local search with the min-conflicts algorithm for this CSP, and currently have the following variable assignments. MARKS:2

A	3
B	1
C	2
D	3

Which variable would be reassigned, and which value would it be reassigned to? Assume that any ties are broken alphabetically for variables and in numerical order for values.

The variable ○ A ○ B ○ C ○ D will be assigned the new value ○ 1 ○ 2 ○ 3.

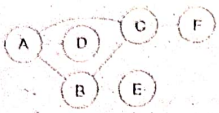
4 You have three coins in your pocket:

- Coin 1 is a fair coin that comes up heads with probability 1/2.
- Coin 2 is a biased coin that comes up heads with probability 1/4.
- Coin 3 is a biased coin that comes up heads with probability 3/4.

Suppose you pick one of the coins uniformly at random and flip it three times. If you observe the sequence HHT (where H stands for heads and T stands for tails), what is the probability that you chose Coin 3? MARKS:4

OR

The graph below is a constraint graph for a CSP that has only binary constraints. Initially, no variables have been assigned. For each of the following scenarios, mark all variables for which the specified filtering might result in their domain being changed. MARKS:4



(i) A value is assigned to A. Which domains might be changed as a result of running forward checking for A?

○ A ○ B ○ C ○ D ○ E ○ F

(ii) A value is assigned to A, and then forward checking is run for A. Then a value is assigned to B. Which domains might be changed as a result of running forward checking for B?

○ A ○ B ○ C ○ D ○ E ○ F

(iii) A value is assigned to A. Which domains might be changed as a result of enforcing arc consistency after this assignment?

○ A ○ B ○ C ○ D ○ E ○ F

(iv) A value is assigned to A, and then arc consistency is enforced. Then a value is assigned to B. Which domains might be changed as a result of enforcing arc consistency after the assignment to B?

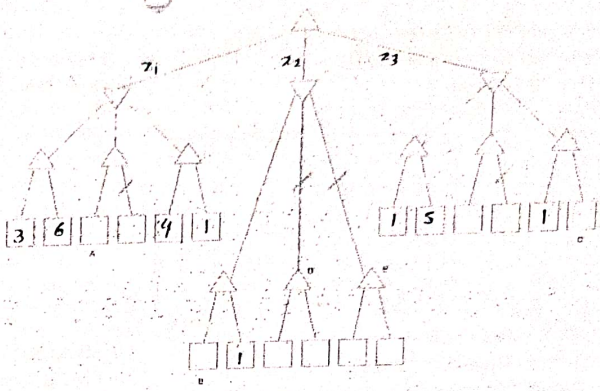
○ A ○ B ○ C ○ D ○ E ○ F

5[a] You are trying to recover a password to an encrypted file, by using search. You know that the password is up to 10 letters long and contains only the letters A, B, C.

You formulate a search problem:

- The initial state is the empty string.
- The successor function is to append one letter (A, B, or C) to the string.
- The goal test is to verify a candidate password using the decryption software. There are 6 correct passwords:

AAACCC, ABBCC, BABAB, BCABACB, CBAC, and CBACB.



2 We wish to come up with hypotheses that entail the following sentences:

S1: X1 ∧ X2 ⟹ Y

S2: ¬X1 ∨ X2 ⟹ Y

In this problem, we want to come up with a hypothesis H such that H |= S1 ∧ H |= S2.

[a] Assume we have the hypothesis H: Y ⟺ X1 ∨ X2.

Does H entail S1? Yes / No

Does H entail S2? Yes / No

MARKS:3

[b] Pretend that we have obtained a magical solver, SAT(s) which takes in a sentence s and returns true if s is satisfiable and false otherwise. We wish to use this solver to determine whether a hypothesis H0 entails the two sentences S1 and S2. Mark all of the following expressions that correctly return true if and only if H0 |= S1 ∧ H0 |= S2. If none of the expressions are correct, select "None of the above".

A. SAT(H0 ∧ ¬(S1 ∧ S2))

B. SAT(¬H0 ∨ (S1 ∧ S2))

C. ¬SAT(H0 ∧ ¬(S1 ∧ S2))

D. ¬SAT(¬H0 ∨ (S1 ∧ S2))

E. None of the above

MARKS:3

Total No. of Page

Roll No.....

FIRST SEMESTER
M.TECH [AI]
END TERM EXAMINATION
(Nov/Dec-2022)

AI 5305 INFORMATION AND NETWORK SECURITY

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 me 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 $\ell/2$ 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 $B, A_1, \ldots, A_n$, 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 $i = 1, \ldots, n$ party A_i chooses a random a_i in {1,...,q} and sends to Party B the quantity $X_i \leftarrow g^{a_i}$.
- Party B generates a random b in $\{1, \ldots, q\}$ and $for\ i = 1, \ldots, n$ 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. There are three servers (server A, server B, server C), providing three different services. A user wants to access all the three servers one by one. The system uses Kerberos protocol for authentication and key distribution. Explain all the steps with suitable diagrams to access the servers.

B. Let G be a finite cyclic group of order n and let $pk = (g, h = g^a)$ and $sk = (g, a)$ be an ElGamal public/secret key pair in G. Suppose we want to distribute the secret key to two parties so that both parties are needed to decrypt. Moreover, during decryption the secret key is never re-constructed in a single location. A simple way to do so it to choose random numbers $a1, a2$ in Z_n such that $a1 + a2 = a$. One party is given $a1$ and the other party is given $a2$. Now, to decrypt an ElGamal ciphertext (u, c) we send u to both parties. What do the two parties return and how do we use these values to decrypt? 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. **[10][CO1,2,3,4]**

3. A. With the advent of various online payment apps such as GooglePay, Paytm etc. more and more users are doing online payment. You being a security expert, explain the complete architecture of SET (Secure Electronic Transaction) Payment protocol with diagram ? What are the different types of Firewalls. How can they be used in SET architecture?

B. Suppose Alice and Bob live in a country with 50 states. Alice is currently in state $a \in \{1, \ldots, 50\}$ and Bob is currently in state $b \in \{1 \ldots, 50\}$. 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 chose random r and s in Z_p and sends back to Alice $(B1, B2) = (A_1^r g^s, \left(\frac{A_2}{g^b}\right)^r A_0^s)$ 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 recieves the encryption of a random value. Which of the following is the right option and why? **[10][CO1,2,3,6]**

a. Alice tests if a=b by checking if $B_1^x B_2 = 1$.
b. Alice tests if a=b by checking if $B_1 / B_2^x = 1$.
c. Alice tests if a=b by checking if $B_2^x B_1 = 1$.
d. Alice tests if a=b by checking if $B_2 B_1^x = 1$.
e. Alice tests if a=b by checking if $B_2 / B_1^x = 1$.

4. Write short note on (any two) **[10] [CO 2,5]**
   a. Any one symmetric encryption from RC4,IDEA or AES
   b. ElGamal Digital Signature
   c. PKI (Public Key Infrastructure) with Certificate Authority
   d. Hash Function and HMAC vs CMAC

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

Roll no.....
Nov-2022
M.Tech. AI

Paper Code: AI5403 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. (i) Explain "redo and undo" phase of recovery after a system crash. [2] [CO5]
(ii) List significant differences between file-processing system and DBMS. [2] [CO2]
(iii) Give all mapping cardinalities in ER – Diagram. [1] [CO2]

Q2. (i) Explain Active Database and Real Time Database with example. [2] [CO6]
(ii) Explain two phase commit protocol. [3] [CO5]

Q3. (i) Explain RAID models. [2] [CO5]
(ii) Why we prefer 4NF over BCNF. [1] [CO2]
(iii) For a relation Students(id, name, marks)
Find name of the students who score more than average marks of the his/her class arrange the result in descending order by marks. [2] [CO4]

Q4. (i) Explain wait-die and wound-wait scheme of deadlock prevention in transactions. [2] [CO3]
(ii) Explain triggers & ECA rules. [1] [CO4]

(iii) Explain primary key, Super key and candidate key and for given schema R= (P,Q,R,S,T,U) with following functional dependencies:

R→U
T→P
TR→S
P→Q

Find the key for relation. [2] [CO2]

Q5. (i) Explain majority protocol for concurrency control in Distributed Databases. [4] [CO5]

(ii) Construct B-tree with given key values: [3] [CO3]

1, 12, 8, 2, 25, 5, 14, 28, 17, 7, 52, 16, 48, 68, 3, 26, 29, 53, 55, 45.
Order of the tree = 5

Q6. (i) Let there is ordered file of 10,000 records stored on a disk with blocks of size 512 bytes and records are of fixed length and unspanned of length 20 bytes. Then find the number of index records in a single level primary index. [3] [CO3]

(ii) Explain Availability and any three approaches to attain availability in Distributed Databases. [4] [CO5]

Q7. (i) Explain Compensating Transaction. [2] [CO3]

(ii) Explain check integrity constraint in Relational Database. [2] [CO1]

(iii) Explain unsafe query in Relational calculus. [2] [CO1]

END

table shows the actual values of LOC and values of LOC that are predicted once the model has been trained. Calculate all the performance measures for the data given (MRE, MARE, PRED (at 25%, 50%,75%).

Table V: Actual and Predicted Values of Model Predicted

Module#	Actual (A_i)	Predicted (P_i)
1	100	90
2	76	35
3	45	60
4	278	300
5	360	90
6	240	250
7	520	500
8	390	800
9	50	45
10	110	52

---BEST OF LUCK---

Total No. of Pages 4

Roll No. .....

THIRD SEMESTER

M.Tech. (AI)

END SEMESTER EXAMINATION *November-2022*

AI 6209 PREDICTIVE MODELLING

Time: 3:00 Hours *Max. Marks: 50*

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

1[a] Consider the data set given below that shows the runtime performance (in seconds) of two learning techniques (A1 and A2) on several data sets. Use F-test to determine whether the populations have the same variances. **[5] [CO1]**

Table I: Runtime Performance of Learning Techniques:

A1	11	16	10	4	8	13	17	18	5
A2	14	17	9	5	7	11	19	21	4

Table II: F-Test Table at 0.05 Significance Level

$v1$ / $v2$	1	2	3	4	5	6	7	8	9
1	161.44	199.50	215.70	224.58	230.16	233.98	236.76	238.88	240.54
2	18.51	19.00	19.16	19.24	19.29	19.33	19.35	19.37	19.38
3	-	9.55	9.27	9.11	-	-	-	8.84	-
4	-	6.94	6.59	6.38	-	-	-	6.04	-
5	-	5.78	5.40	5.19	-	-	-	4.81	-
6	-	5.14	4.75	4.53	-	-	-	4.14	-
7	-	4.73	4.34	4.12	-	-	-	3.73	-
8	-	4.46	4.06	3.83	-	-	-	3.44	-
9	-	4.26	3.86	3.63	-	-	-	3.23	-

[b] Consider the dataset shown below that shows the accuracy of three techniques (A1, A2, and A3), which are applied on four data sets (D1, D2, D3, and D4) each. Use ANOVA test to investigate whether the performance of all the techniques calculated in terms of accuracy. **[5] [CO1]**

Table III: Accuracy values of techniques

Data Sets	Techniques		
	A1	A2	A3
D1	60(x_{11})	50(x_{12})	40(x_{13})
D2	40(x_{21})	50(x_{22})	40(x_{23})
D3	70(x_{31})	40(x_{32})	50(x_{33})
D4	80(x_{41})	70(x_{42})	30(x_{43})

2[a] What are outliers and its types? What is their effect on data analysis? What are the various techniques to detect outliers? What are the considerations of a researcher when dealing with outliers? **[5] [CO1]**

[b] What is the significance and types of attribute reduction in data analysis? Make a comparison between the two categories of attribute selection methods. **[5] [CO3]**

OR

Elaborate on the process of model prediction explaining the use case of Software Quality Prediction System.

3[a] Explain the usage of a box plot. Calculate univariate outliers for the following two datasets suing box plots. **[5] [CO1]**

Dataset1	0	2	72	75	78	80	80	85	85	87	87	87	87	89	90
Dataset2	20	37	40	43	45	52	55	57	63	65	74	75	77	86	86

[b] What the purpose of Histogram analysis? Perform Histogram analysis of the following datasets of sample fault count data and check the normality. **[5] [CO1]**

Fault Count:

Data 1: {35, 45, 45, 55, 55, 55, 65, 65, 65, 65, 75, 75, 75, 75, 75, 85, 85, 85, 85, 95, 95, 95, 105, 105, 115}

Data 2: {0, 2, 72, 75, 78, 80, 80, 85, 85, 87, 87, 87, 87, 88, 89, 90, 90, 92, 92, 95, 95, 98, 98, 99, 102}

4[a] Consider a system consisting of 1,276 instances. The independent variables of this data set are the OO metrics belonging to the popularly used Chidamber and Kemerer (C&K) metric suite. The dependent variable has two values, namely, faulty or not faulty. If a module is containing a fault, then the value of the outcome variable corresponding to that module is 1 and the value is 0 if not faulty. Now, this data set is used to predict the model. Given the confusion matrix, compute values of performance measures sensitivity, specificity, accuracy, precision, F-measure. **[5] [CO2]**

Table IV: Confusion Matrix for Binary Categorical Variable

		Predicted	
		Faulty (1)	Not Fualty (0)
Actual	Faulty (1)	TP = 516	FN = 25
	Not Faulty (0)	FP = 10	TN = 725

[b] What measures of central tendency are used for metrics data analysis? Show are they calculated and on what types of data/scales? Find the measures of central tendency for the following data set:
{18,23,23,25,35,40,42} **[5] [CO2]**

5[a] Express how are the following measures calculated using their mathematical expressions.
Sensitivity, Specificity, F-measure, G-measure, Variance Inflation Factor. **[5] [CO2]**

[b] What purpose is served by a confusion matrix in performance measurement? What measures does a confusion matrix use? Given the following confusion matrix for a three-class outcome variable, what will be the confusion matrix for individual classes C1, C2, and C3?
[5] [CO3]

		Predicted		
Actual		C1	C2	C3
	C1	a	b	c
	C2	d	e	f
	C3	g	h	i

OR

Consider assessment of the performance of model predicted with lines of code (LOC) as outcome. The following table presents a data set consisting of ten instances that depict the LOC of a given software. The

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III SEMESTER

M.Tech

END TERM EXAMINATION Nov/Dec-2022

COURSE CODE AI 6307 COURSE TITLE Block Chain and Applications

Time: 03:00 Hours Max. Marks: 50

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

Q.1 [a] What are Merkle trees and Patricia tries? Explain the working of Merkle trees. How do these two combine to give Merkle-Patricia Trees? [5][CO4]

[b] Explain the concept of forks along with its types in Blockchain.

OR

What is a zero-knowledge proof? How does it provide authentication and identity protection? Explain ZK-SNARK and ZK-STARK. [5][CO4]

Q.2 [a]. Define any 5 of the following terms:

pBFT, Avalanche effect in hashing, distributed ledger, smart contracts, Proof of Burn, ASIC resistance, Gas limit. [5][CO1]

[b] Elaborate on the concept of difficulty in Bitcoin. Also explain its importance, calculation, and frequency of adjustment. [5][CO3]

Q.3 [a] Compare decentralized and distributed systems. [5][CO2]

[b] How is HDFS fault tolerant and scalable? How does replication take place in HDFS? What is meant by heartbeat?

OR

What is a bitcoin. Explain how bitcoin uses the PoW mechanism? [5][CO3]

Q.4 [a] Explain the structure of a Distributed Hash table.

OR

Explain the concept of consistent hashing illustrating the process of adding and removing a node. [5][CO2]

[b] Briefly explain any 2 of the following

(i) Permissioned Blockchains

(ii) Turing Completeness and Anonymity in Blockchain

(iii) Rewards in Blockchain [5][CO1]

Q.5 [a] What is a block in blockchain? Explain its working with an example. Explain the three types of blocks in blockchain. [5][CO1]

[b] Enlist the various steps in the blockchain mining process.

OR

Elaborate on any 2 use cases of blockchain technology. [5][CO1]

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Total No. of Pages: 3

THIRD SEMESTER

M. Tech. (AI)

END SEMESTER EXAMINATION ***November-2022***

AI6405 ADVANCE COMPUTER VISION

Time: 3:00 Hours *Max. Marks: 40*

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

1[a] What is the rotation matrix for an object rotation of 30^0 around the Z axis, followed by 60^0 around the X axis, and followed by a rotation of 90^0 around the Y axis. All rotations are counter clockwise. [4] [CO2]

[b] Consider the following camera model. Assume that first camera gimbal center is at the original of the world coordinates, Next, the camera is translated by amount (0, 2, 2), and it is rotated by angle 90^0 around Z axis, followed by rotation of 135^0 around X-axis. Both rotations are in the clockwise directions. After that the image plane is translated by amount (.02, .01, -.03) with respect to gimbal center. Finally, image formed using perspective transform. Assume that the focal length of the camera is 0.030. Find the image coordinates of the point which has world coordinates (1, 1, 0.2). [4] [CO1, CO2]

2. Attempt any two

[a] Demonstrate the difference between spatial and intensity resolution of gray images with suitable example. Consider an image with physical size of the scanned image is 9X8 inches. The image is scanned at 300 dpi to produce a gray digital image. The resulting digital image has X pixel width and Y pixel height. Find the value of X and Y. [4] [CO3]

[b] Explain the notion of derivative of an image. Suggest a definition of first order derivative and second order derivative. Justify the definitions by using basic properties of the derivatives. [4] [CO2]

[c] Consider the Gaussian function $G(x,y) = e^{-\frac{x^2+y^2}{2\sigma^2}}$. Derive the expression for Laplacian of Gaussian (LoG) and obtain the relation for zero-crossing. [4] [CO1, CO2]

3. Consider the following image:

I

0	0	1	4	9
1	0	5	7	11
1	4	9	12	16
3	8	11	14	16
8	10	15	16	20

-1	0	1

-1
0
1

$$H = \sum_{(x,y)\in W} \begin{bmatrix} I_x(x,y)^2 & I_x(x,y)I_y(x,y) \\ I_x(x,y)I_y(x,y) & I_y(x,y)^2 \end{bmatrix}$$

For the 3x3 highlighted window W. In the above formula $I_x = dI/dx$, and $I_y = dI/dy$.

[a] Compute the derivatives using the differentiation kernels shown above. No normalization (division by 2) is needed. [4] [CO3]

[b] Compute the Harris matrix H and cornerness score C= $det(H) - k\ trace(H)^2$ for $k = 0.04$. Decide whether we have a corner, an edge Or a flat area? Also, justify your answer. [4] [CO2]

OR

Consider an image $I(x, y)$. The change in intensity for shift (u, v) is given by $E(u,v) = \sum_{x,y} w(x,y)[I(x+u, y+v) - I(x,y)]^2$, where $w(x,y)$ is a window function. Show that $E(u,v) = [u\ v]M \begin{bmatrix} u \\ v \end{bmatrix}$,

$$\text{where } M = \sum_{x,y} w(x,y) \begin{bmatrix} I_x I_x & I_x I_y \\ I_x I_y & I_y I_y \end{bmatrix}.$$

4. Attempt any two

[a] A 3x3 image is given as:

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 2 \\ 3 & 4 & 6 \end{bmatrix}$$

The bilinear interpolation of the image is given as:

$$\begin{bmatrix} 1.0 & 1.5 & 2.0 & 2.5 & 3.0 \\ 1.5 & X & 3.0 & W & 2.5 \\ 2.0 & Y & 4.0 & 3.0 & 2.0 \\ 2.5 & Z & 4.0 & 4.0 & 4.0 \\ 3.0 & 3.5 & 4.0 & 5.0 & 6.0 \end{bmatrix}$$

Find the value of X, Y, Z, and W. [4] [CO3, CO4]

[b] Illustrate the concept of scale-space used in Scale-Invariant Feature Transform (SIFT). Also show that Laplacian of Gaussian (LoG) can be approximated to difference of Gaussian (DoG). [2+2] [CO1]

[c] Demonstrate the use of gradient orientation histogram in orientation assignment step of SIFT using relevant diagrams. Use a 8x8 window for simpler representation. [4] [CO2]

5. Attempt all questions.

[a] Fig. 1 shows the grid that contains a star-shape. Obtain the shape number using chain code and differential chain code. (Start the chain code from right direction and anti-clockwise) [2+2] [CO4]

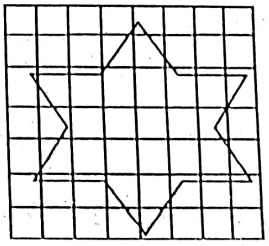


Fig. 1

[b] In an object detection algorithm, bounding boxes (BB) are denoted as (x, y, h, w) where x is x-axis coordinate, y is y-axis coordinate, h is the height of BB and w is the width of BB. Calculate the Intersection over union (IoU) for the following pair <Ground truth, Predicted> of bounding boxes: [2+2] [CO3]

(i) <(10, 15, 100, 150), (20, 20, 90, 130)>

(ii) <(40, 35, 120, 100), (30, 25, 100, 100)>

---Best of Luck---

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THIRD SEMESTER

M. Tech. (PSY)

November- 2022

END SEMESTER EXAMINATION

PSY-6207 ENERGY, ECOLOGY AND ENVIRONMENT

Time: 3:00 Hours

Max. Marks: 50

Note: ***Question 1 is compulsory.*** Answer ***any three questions from question 2-5.*** Assume the missing data suitably (if any).

1. Answer the following questions in brief. **(10x2=20)**

   (a) Name the major renewable energy resources for power generation along with their potential and installed capacity.

   (b) What will be share of renewable energy resources particularly from solar energy in Indian power sector by 2030. Also mention the limitations in achieving this.

   (c) What is sustainable ecosystem?

   (d) What are the major greenhouse gases? Mention the percentage of GHG production from energy.

   (e) What are the major sources of greenhouse gases? Also discuss how these gases are contributing in global warming and climate change.

   (f) Briefly explain how greenhouse gases can be controlled. Also mention the consequences of greenhouse gases.

   (g) With the help of suitable example, explain the role of renewable energy-based technologies in the reduction of greenhouse gases.

   (h) What is Clean Development Mechanism (CDM)? Briefly explain its requirements.

   (i) What is Kyoto Protocol? Discuss the significance of Kyoto Protocol in terms of developing country for the implementation of CDM.

   (j) Discuss the major differences between food chain and food web.

2. Name conventional and renewable sources of energy. Discuss their effects on environment. **[10]**

3. With the help of block diagram, discuss the architecture of CDM projects. Also discuss the benefits of CDM projects. **[10]**

4. What do you mean by ecology and ecosystem? Mention the levels of ecological studies. Illustrate land-based ecosystem and aquatic ecosystem. **[10]**

5. Write short notes on ***any two*** of the following. **(2x5=10)**

   (a) Ecological pyramids

   (b) "Solar energy is the energy for future in India." Elucidate.

   (c) How does global warming affect the world climate and food production?

   (d) Major sectors responsible for environmental pollutions and their possible solutions

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Total No. of Pages *Roll No. .....*

THIRD SEMESTER **M.TECH. (Power Systems)**

END SEM EXAMINATION **Nov.-Dec 2022**

PSY-6303 TRANSIENTS IN POWER SYSTEMS

Time:3:00Hours *Max. Marks : 50*

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

Q1. Justify the following: **2.5x4=10**

i. For the transient analysis in power systems, instead of impulse wave, rectangular wave is used.

ii. Rod gaps are used as secondary protection against surges.

iii. Long transmission lines are represented by distributed parameters.

iv. A short length of cable is connected between the dead end tower and the terminal apparatus in a station.

Q2.a. Explain, 'Direct' and 'Indirect' lightening strokes. 5

b. An overhead line with surge impedance 400 ohms bifurcates into two lines of surge impedance 400 ohms and 40 ohms respectively. If a surge of 20 kV is incident on the overhead line, determine the magnitudes of voltage and current which enter the bifurcated lines. 5

Q3. What are the volt-time curves? How they can be constructed for a particular insulation? **10**

Q4.a. Explain the principal and working of metal oxide arrestors. How they are superior to other types of lightning arrestors. 5

b. Let the I-V characteristic of MO arrestor is given by, $I = KV^{20}$. If the current through the arrestor changes from 10A to 10kA, what will be the change in voltage across it. Also comment upon the result. 5

Q5.a. What do you understand by Insulation Coordination? Explain the significance of insulation coordination in power systems. **10**

Q6.a. What are abnormal switching over voltages in power systems and why do these occur? 5

b. A surge of 900kV is travelling on a line of surge impedance 300 ohms. It encounters a lightning arrestor at a station which holds the voltage across itself at a constant value of 600kV. What is the current flowing through the arrestor and arrestor resistance under this condition? Also determine the refraction and reflection coefficients of voltage at the arrestor terminal. 5

Q7. Write Short Notes on any TWO: **5x2=10**

i. Protection against over voltages

ii. Arcing ground

iii. Expulsion type lightning arrestor

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_3rd ____SEMESTER **M.Tech. (Microwave & Optical Communication)**

END TERM EXAMINATION *Nov/Dec-2022*

COURSE CODE: MOC6201 COURSE TITLE: Wireless Sensor Networks

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 (a) Explain wireless mesh networks with examples. [5][CO1]

(b) Explain the different types of power sources used in wireless sensor networks. [5] [CO1]

Q.2 (a) Differentiate between layered architecture and clustered architecture for wireless sensor networks. Which architecture is better and why? [7][CO2]

(b) Draw block diagram for wireless sensor node hardware and explain the same in brief. [3] [CO3]

Q.3 (a) Compare adhoc wireless networks and wireless sensor networks. [6][CO2]

(b) Compare MCNs and iCAR networks. [4] [CO3]

Q.4 Differentiate between EYES node and BT node in detail. [10] [CO4]

Q.5 Explain SMART DUST and WINS in detail. [10][CO5]

M.Tech

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END TERM EXAMINATION — Nov. 2022

COURSE CODE - MOC6311 — COURSE TITLE – Spread Spectrum Communication

TIME:- 3:00 HOURS — Max. Marks: 50

Answer any five questions

10 CO-1

Q. 1 How spread-spectrum modulation can provide protection against externally generated jamming signals with finite power. Explain the working of transmitter and receiver to achieve this.

10 CO-2

Q.2 Explain the working of direct sequence spread spectrum with coherent BPSK. How the locally generated PN sequence used in receiver to dispread the received signal is synchronized to the PN sequence used to spread the transmitted signal in the transmitter?

10 CO-2

Q.3 By representing the transmitted signal and the interfering signal (Jammer) in the signal-space diagram, show that ouput signal to noise ratio $(SNR)_o$ can be expressed by

$(SNR)_o = 2T_b/T_c\ (SNR)_i$

Where T_b and T_c are the information bit duration and chip duration respectively. $(SNR)_i$ is the input signal to noise ratio.

10 CO-3

Q.4 Explain with suitable block diagram (Both transmitter & receiver) the slow frequency hoping spread spectrum with M-ary PSK.

Q.5 What in fast frequency hop spread spectrum? How it differs from slow frequency hop spread spectrum.

10 CO-4

A fast FH/MFSK System has the following parameters:

Number of bits per MFSK symbols =4

Number of MFSK symbols per hop=5

Calculate the processing gain of the system.

Q. 6

10 CO-5

a) A single tone jammer

$$j(t) = \sqrt{2J}\ \cos(2\pi f_c t + \theta)$$

is applied to DS/BPSK system. The N dimensional signal x(t) in described by

$$x(t) = \pm\sqrt{\frac{2E_b}{T_b}}\ c(t)\cos 2\pi f_c t$$

$$= \pm\sqrt{\frac{E_b}{N}}\sum_{K=0}^{N-1} c_K \phi_K(t) \qquad 0 \le t \le T_b$$

find the 2N coordinates of the jammer $j(t)$

b) explain the following

i). Processing gain (PG) ii) Antijam margin.

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3rd SEMESTER (M.Tech)

END TERM EXAMINATION ***Nov/Dec-2022***

COURSE CODE: MOC6403 COURSE TITLE: Fiber Optic Components

Time: 03:00 Hours *Max. Marks: 40*

Note : Attempt FIVE questions. Question 1 is COMPULSORY. Assume suitable missing data, if any.

Q.1 **Answer the following questions briefly:**

(a) If $n(\lambda) = 3\lambda+2$, where n is refractive index of the optical fiber, find the material dispersion in ps/km-nm for this fiber at a wavelength of 1500 nm. Support with proper justification. **[2][CO1]**

(b) In a weakly guided step index optical fiber, the mode profiles for two of the many LP_{lm} modes are given below. If the modes are designated as LP_{lm} modes, find out the values of l and m for the given intensity profiles.



Mode 1 Mode 2 **[2][CO1]**

(c) Explain the significance of system margin in an optical communication system. **[2][CO2]**

(d) Why are Graded-Index fibers used in optical communication? **[2][CO1]**

(e) Why are Raman Amplifiers called distributed amplifiers? **[2][CO4]**

(f) Elaborate the significance of the bandwidth-length product. **[2][CO1]**

Q.2 (a) Describe how a Fiber Bragg Grating is used as an Add/Drop element in an fiber optic communication system. **[4][CO1,3]**

(b) Design a optical add and drop element based on Fiber Bragg Gratings, if the wavelength to be dropped is 1580 nm, and the effective refractive index of the fiber grating is 1.6. Provide suitable diagrams and dimensions. **[3][CO3]**

Q.3 (a) Consider the design of a 1x8 demultiplexer based on cascaded Mach Zehnder Interferometers. Show a suitable arrangement of the MZIs to demultiplex 8 wavelengths, if the central wavelength is 1550 nm, the refractive index of the MZI arms is 2.4 nm, and the separation between adjacent wavelengths ($\Delta\lambda$) is 0.4 nm. Find the values of the arm length differences (Δd) for each MZI. **[4][CO2]**

(b) Elaborate briefly the applications of a Mach Zehnder Inteferometer as a fiber-optic component, with suitable diagrams. **[3][CO2]**

Q.4(a) What is a Faraday Rotator? How does it change the state of polarization of light? **[3][CO1,3]**

(b) With the help of suitable diagrams, explain how the Faraday rotator is used to design an optical circulator. **[4][CO3]**

Q.5(a) Illustrate the working of a Raman Amplifier. Provide suitable diagrams and equations. **[4][CO4]**

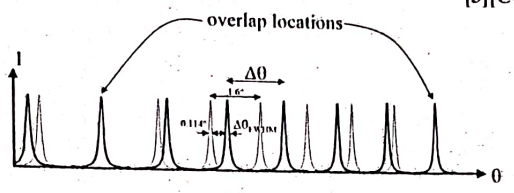
(b) Distinguish between Raman Amplifier and EDFA, and explain with proper justification which amplifier is better than the other? **[3][CO4]**

Q.6 The figure below shows the fringe intensity vs. angle obtained by a Fabry-Pérot spectrometer when illuminated by two laser sources. One of the laser sources is a red He-Ne laser (λ=632.8nm). The other source is an unknown green laser source. The mirror reflectivity is independent of wavelength. Answer the following questions:

(a) Identify which fringe pattern (the darker or lighter line) is produced by the He-Ne laser. **[1][CO2]**

(b) What is the wavelength of the green laser source? [3][CO2]

(c) Calculate the angular separation of the resonance peaks (Δθ) of the darker line. [3][CO2]



Q.7 (a) Illustrate the application of a diffraction grating as a wavelength multiplexer/demultiplexer in a fiber optic communication system. [4][CO3,1]

(b) Consider a diffraction grating with 500 lines/ mm to be used as a de-multiplexer for a WDM network. If the central wavelength is 1550 nm, calculate the resolution of the grating in ^{0}/nm (degree/nm) for the first order diffracted light. [3][CO3]

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THIRD SEMESTER

M.TECH (GEOINFORMATICS)

END TERM EXAMINATION NOV-2022

GEO 6205 : Application of Geoinformatics in Urban Plng and Infrastructure

Time: 3 Hours Max. Marks: 50

Note: All questions are compulsory. Answer in brief and in point form
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1(a) What is Urban remote sensing. [5]
(b) Discuss one application each of optical and microwave Urban remote sensing [5]

Q.2(a) Discuss how Landsat data be used for Urban growth forecasting [5]
(b) What are the limits and challenges of optical high resolution data [5]

Q.3 (a) Mention essential steps for remote sensing based planning of City drainage. [5]
(b) Mention essential steps for remote sensing based monitoring of City pollution. [5]

Q.4 (a) What are the challenges of using multisource remote sensing data in UP&I [5]
(b) Write ANN based implementation for classification. [5]

Q.5 (a) Write three advantages each of hyperspectral and SAR data in UP&I [5]
(b) Write down steps in 3D-Building reconstruction using lidar and aerial imagery. [5]

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3rd SEMESTER

M.Tech.

END TERM EXAMINATION *Nov/Dec-2022*

GEO6301 Application of Geoinformatics in Disaster Management

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) Write about the causes impact and mitigation of earthquakes? Being a specialist in geoinformatics, suggest the way how geoinformatics would aid in reducing and mitigating earthquake disaster?

b) How remote sensing satellites helpful in detecting a natural disaster like earthquake or tsunami? Explain with neat diagram.

[5+5][CO1- CO2]

Q.2 a) What is landslide? Explain how RS and GIS help in landslide mapping. [5][CO2]

b) List the factors considered for landslide hazard zonation mapping. How can we minimize the landslide hazard? [5][CO3]

Q.3 a) What is a Drought? Explain in detail how geoinformatics can help in the mitigation and management of droughts. [5][CO3]

b) What are the geographical problems of drought and what is the methodology used in drought assessment? [5][CO4]

Q.4 a) What is soil erosion? Discuss types of soil erosion? [5][CO4]

b) How geoinformatics helps in soil erosion and sediment estimation? What are the data used for soil erosion Modelling? [5][CO5]

Q.5 a) Explain the different types of floods? Write the conditioning factors that are effective for proper delineation of flood-susceptible areas?

b) Describe the flood hazard assessment and mapping. Also, explain the benefits and the barriers related to it? [5+5][CO5- CO6]

Q.6 Write note (any two): [2x5][CO1,CO2,CO6]

a) Vulnerability

b) Hazards

c) Risk

d) Disaster preparedness

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THIRD SEMESTER

M.TECH (GEOINFORMATICS)

END TERM EXAMINATION NOV -2022

GEO 6401: Application of Geoinformatics in Target Detection

Time: 3 Hours Max. Marks : 40

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

Q.1 (a) What is an information, an Intelligence and the intelligence Cycle ? [4]

(b) What are the four major milestones of Indian space history [4]

Q.2 (a) Compare classification with target detection. [4]

(b) Discuss major problems in target detection [4]

Q.3 (a) Discuss the concept of Independent component analysis [4]

(b) Explain full pixel, sub-pixel, and mixed pixels targets using a Diagram. [4]

Q.4 (a) Describe the scheme for ANN implementation for target detection ? [4]

(b) How does different types of resolutions affect target detection? [4]

Q.5 (a) Write a note on subpixel target detection and enhancement [4]

(b) Write basic taxonomy/process of spectral target detection. [4]

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III SEMESTER
M. TECH. GEOTECHNICAL ENGINEERING
END TERM EXAMINATION NOV/DEC-2022
GTE 6203 FOUNDATION ON WEAK ROCKS
TIME: 3 HR MAX MARKS:50

NOTE: ATTEMPT ANY FIVE QUESTIONS OF EQUAL WEIGHTAGE.ASSUME THE DATA SUITABLY, IF ANY

1.a. Discuss how the ultimate bearing capacity for a strip footing is determined as per Hoek-Brown failure criterion. (5) (CO-1)

b. A foundation is resting on sloping ground which consists of fractures/joints. Determine the ultimate bearing capacity of a strip footing on this ground which is 2m wide and founded at 2m below the sloping ground. The bulk density of the fractured rock is 21kN per cubic metre. The slope angle is 15^0 and angle of shearing resistance is 42^0. The non-dimensional bearing capacity factor $N_{\gamma q}$ is given as below-

	Angle of shearing resistance in degree	
Slope angle in degree	40	45
10	180	410
20	135	250

(5) (CO-1)

2.a. Explain the radial stress contours for various inclination of layers of rock with vertical. (5) (CO-1)

b. In order to estimate the settlement in rocks, how the modulus of rock is calculated. Discuss any two methods. (5) (CO-2)

3.a. The following data was obtained from a plate load test carried out on 30 cm square plate at 50 cm below the ground surface on a fractured rock. Determine the settlement of a foundation 2m x 2m carrying a load of 2000 kN and located at a depth of 2.5 m below ground surface.

Load (kN/m^2)	50	100	150	200	250	300	350	400
Settlement (mm)	1.5	3.5	7.0	10.0	15.0	22.0	31.0	40.0

(5) (CO-2)

b. Explain cyclic load test performed on weak rock as per IS: 12070-1987. (5) (CO-2)

4.a. Discuss the strength and deformation behaviour of weak rock due to anisotropy and heterogeneity. (5) (CO-2)

b. With a neat sketch, explain stilt footing. What are the types of stilt foundation. (5) (CO-3)

5.a. What are the types of loads transferred to the foundation for transmission tower. Discuss the stability analysis of foundation for transmission tower. (5) (CO-3)

b. What are the defects in rock foundations. Discuss how the foundation is treated by grouting technique. (5) (CO-4)

6.a. How the settlement of pile/pier is affected by socketed length and end bearing. (5) (CO-5)

b. Determine the safe load carrying capacity of a pile 3.0m long and 0.3 m in diameter founded in weak rock. The ultimate bearing capacity of rock is 800 kN/m^2. The unconfined compressive strength of intact rock is 80 MPa. Assume factor of safety as 3. (5) (CO-5)

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3rd SEMESTER

M.Tech.

END TERM EXAMINATION ***Nov/Dec-2022***

GTE6303 Ground Improvement Techniques

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 vibroflotation? Explain in detail the mechanism of ground improvement technique by vibroflotation? [5][CO1]

b) Explain the difference between conventional preloading and vacuum preloading with the help of neat diagrams? [5][CO2]

Q.2 a) What is the purpose of vertical drains? What are the advantages and disadvantages of using vertical drains with preloading? [5][CO2]

b) What are the types and functions of geosynthetics in civil engineering construction works? [5][CO3]

Q.3 a) Explain electro-chemical method of ground improvement with diagram? [5][CO3]

b) What do you understand by 'bioengineering technique' and how is it different from other methods of erosion control and slope stabilization. Explain. [5][CO4]

Q.4 a) Explain the role of soil reinforcement in stability, by citing the example of reinforcement material with neat diagram. [5][CO4]

b) What is collapsible soil? Describe the treatment, application and need of collapsible soil. [5][CO5]

Q.5 a) What is dynamic compaction process? What are the applications of dynamic compaction? [5][CO1]

e) What is electro-osmosis? Describe the mechanism and working of electro osmosis. [5][CO5]

Q.6 Write note: (any two): [2x5][CO2-CO5]

a) Ground freezing
b) Fiber reinforcement
c) Retaining wall
d) Soil nailing

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Total No. of Pages: 02 *Roll No.....*

THIRD SEMESTER
M.Tech.

END TERM EXAMINATION Nov/Dec-2022

GTE-6401 PLASTICITY AND FRACTURE MECHANICS IN ROCK STRUCTURES

Time: 3:00 Hours **Max. Marks: 40**

Note: Questions 1 is compulsory.
From the remaining questions attempt any three.
Assume suitable missing data, if any.

Q.1 Explain the following using self-explaining graphical descriptors [16M] (CO1-5)

(a) What is the critical state of stress at a point inside the gauge material of rock sample when lode angle is 15 and one of the stress invariants is known?

(b) Derive the flow rule for isotropic, kinematic, and mixed hardening in reference to intact and fractured rock mass with a diagram..

(c) What is the significance of stress invariants in the determining the strength of intact and fractured rocks? Express rock failure criteria in terms of J_2 and J_3 (second and third invariant of stress) in HB criterion.

(d) Express fracture criteria using joint-mapping parameter in relation to the strength ratio of the rock mass, number of joints, and joint orientation.

Q.2 Explain the development of Drucker's stability postulates. Express criteria of general theory of plasticity relating them to the Drucker's stability postulates. How does the Drucker's stability postulate differ from Hill's maximum plastic work? [8M] (CO1-2)

Q.3 The stress tensor at a point inside rock mass with reference to x, y, and z-axes is given by

$$\begin{bmatrix} 2 & 1 & 4 \\ 0 & 1 & 6 \\ 2 & 0 & 8 \end{bmatrix} \text{ Mpa.}$$

Show that Mises failure criteria remains unchanged by transforming the axes by 45° about z axes. [8M] (CO1-2)

Q.4 (a) Express pressure and damage sensitive parameter in relation to the dilatancy of intact and jointed/ fractured rock mass. [4M] (CO4-5)

(b) During the forward and reverse loading cycle, what are the various parameters that governs the hardening behavior and yielding of rock mass. [4M] (CO3)

Q.5 Calculate the tensile strength of the limestone if uniaxial compressive strength of the sample in MPa (uniaxial compressive strength = 6MPa) and first invariant of stress is 22 MPa. [8M] (CO4-5)

Rock type	χ_b	χ	χ_m
Limestone	0.0172	2.065	0.170

Q.6 (a) Derive a functional relationship among σ_{mr} vs. E_{mr} based upon pressure and damage sensitive plastic parameter, joint parameters and RQD. [4M] (CO4-5)

(b) Express stress intensity factor and associated energy for mode I, mode II, and mode III type of fracture in a rock sample. [4M] (CO1)

Total No. of Pages:03

Roll No.....

M.Tech./Ph.D. ISEMESTER M.Tech. (Struct.)

END SEMESTER EXAMINATION **Nov./Dec.2022**

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 To find the maximum stresses in a compound cylinder, the following four simultaneous linear equations needs to be solved.

$$\begin{bmatrix} 4.2857\times10^{7} & -9.2307\times10^{5} & 0 & 0 \\ 4.2857\times10^{7} & -5.4619\times10^{5} & -4.2857\times10^{7} & 5.4619\times10^{5} \\ -6.5 & -0.15384 & 6.5 & 0.15384 \\ 0 & 0 & 4.2857\times10^{7} & -3.6057\times10^{5} \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887\times10^{3} \\ 0 \\ 0.007 \\ 0 \end{bmatrix}$$

In the compound cylinder, the inner cylinder has an internal radius of a=5" and an outer radius of c=6.5", while the outer cylinder has an internal radius of c=6.5"and an outer radius of b=8". Given E=10×10^6 psi, ν=0.3 and that the hoop stress in the outer cylinder is given

$$\sigma_\theta = \frac{E}{1-\nu^2}\left[c_3(1+\nu)+c_4\left(\frac{1-\nu}{r^2}\right)\right]$$

Find the values of C_1, C_2, C_3 and C_4. Find the stress on the inside radius of the outer cylinder. [CO1][8]

Q.2(a) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's 1/3- rule, find the velocity of the rocket at $t = 80$seconds.

t (sec)	0	10	20	30	40	50	60	70	80
f (cm/ sec^2)	30.0	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

[CO2][4]

(b) The pressure p of wind corresponding to the velocity v is given by the following data. Estimate p, when v=0.25.

v	10	20	30	40
p	1.1	2.0	4.4	7.9

[CO2][4]

Q.3 (a) The table given below reveals the velocity v of a body during the time t. Find its acceleration at t=1.1

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

[CO3][4]

(b) Fit a straight line to the following data considering x as an independent variable:

x	0	2	4	6	8
y	10	12	14	16	18

[CO3][4]

Q.4 Using Euler's modified method, solve numerically the equation

$$\frac{dy}{dx} = x + |\sqrt{y}| \text{ with } y(0) = 1 \text{ for } 0 \le x \le 0.6 \text{ in step of } 0.2.$$

[CO4][8]

5 (a) Evaluate 1/31 correct to 3 places of decimal using the Newton-Rapson method. [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]

Q.6 Write short notes on [CO5][4X2=8]

(i) Fuzzy Membership Functions
(ii) Artificial Neural Network

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Total no. of Pages 02
1st SEMESTER
END TERM EXAMINATION

Roll no.....
M.Tech. (Structural Engg.)
Nov/ Dec 2022

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.

1. Given state of stress at a point with respect to x, y, z axes is:

$$\begin{bmatrix} 100 & -40 & 10 \\ -40 & 120 & -20 \\ 10 & -20 & 180 \end{bmatrix}$$

Determine principal stresses, maximum shear stress and their planes.

[10] [CO1]

2. The strain tensor at a point in a body is given by:

$$\begin{bmatrix} 12 & 3 & 4 \\ 3 & 8 & -4 \\ 4 & -4 & 18 \end{bmatrix} \times 10^{-3}$$

Determine the normal strain along a direction whose direction cosines with respect to the coordinate axes are given by $l = m = n = 1/\sqrt{3}$.

[10] [CO2]

3. Determine expressions for stresses using Airy's stress function for a cantilever beam of span, width and depth as 'L', 'h' and 'd' respectively, subject to a concentrated upward force 'P' at the free end.

[10] [CO3]

4. A thick cylinder of inside radius 8 cm and outside radius 16 cm is subjected to an internal pressure. Determine (a) the pressure for

incipient of yielding, (b) the stress distribution when the plastic front radius is 12 cm and (c) stress distribution in fully yielded cylinder. Assume yield strength for the cylinder material as 250 N/mm^2, von-Mises yield criterion and a state of plane strain. [10] [CO4]

5. A hollow steel tube is to be used for the measurement of torque. It is so designed that for a torque of 100 kg-cm the pointer deflects by 2 degrees. Its length is 60 cm. Find the inner and out diameter, if the maximum shear stress is limited to 420 kg/cm^2. Take, G = 840000 kg/cm^2. [10] [CO5]

6. A solid circular disc of uniform thickness is 20 cm in radius. It is rotated at a speed so that the disc yields upto a radius of 10 cm. If the yield strength of disc material is 250 N/mm^2, determine:
   (a) speed of rotation,
   (b) stresses in the disc and
   (c) speed when the disc has fully yielded.

   Density of the material and poisson's ratio is 7800 kg/m^3 and 0.3 respectively. [10] [CO4]

Total No. of Pages:02 67 *Roll No.* .....

FIRST SEMESTER
M.Tech.[STE]

END TERM EXAMINATION **(Nov/Dec-2022)**

STE-5401 DESIGN OF ADVANCE REINFORCED CONCRETE STRUCTURES

Time: 03 Hrs *Max. Marks:40*

Note: Attempt any Five
All questions carry equal marks
Assume suitable missing data if any
IS 456:2000 is allowed

Ques 1- Determine the suitable dimensions of a cantilever retaining wall, which is required to support a 4.0 m high bank of earth above the ground level on the toe side of the wall. Consider the backfill surface to be inclined at an angle of 15° with the horizontal. Assume good soil for foundation at depth of 1.25 m below the ground level with safe bearing capacity of 160 kN/m^2. Further assume the backfill to comprise granular soil with a unit weight of 16 kN/m^3 and angle of shearing resistance of 30°. Assume the coefficient of friction between soil and concrete to be 0.5. [8][CO 5]

Ques 2- Repeat the problem given in Ques-1, considering the backfill to be level, but subjected to a surcharge pressure of 40 kN/m^2 (due to the construction of a building). Design the retaining wall structure, assuming M25 concrete and Fe 500 steel. 8[CO 5]

Ques 3- A reinforced concrete beam has width equal to 300 mm and total depth equal to 700 mm, with a cover of 40 mm to the centre of the reinforcement. Design the beam if it is subjected to a total bending moment of 150 kN-m. Use M20 concrete and HYSD bars of grade Fe 415. 8[CO 2]

Ques 4- a reinforced concrete beam of M20 grade concrete, 300 mm wide and 500 mm deep is required to resist a super-imposed moment of 152 kN-m at an intermediate support of a continuous beam. Using mild steel bars, (a) calculate A_{st} at top, if 4 Nos. 16 mm dia. bars are required to be continued at bottom from one span to the other. Assume effective cover to compression steel as 45 mm and that to the tension steel as 50 mm. (b) Redesign the beam as doubly reinforced beam, if no A_{sc} is available from adjacent spans. 8[CO 2]

Ques 5- a simply supported beam, 300 mm wide and 600 mm effective depth carries a uniformly distributed load of 74 kN/m including its own weight over an effective span of 6 m. the reinforcement consists of 5 bars of 25 mm diameter. Out of these, two bars can be safely bent up at 1 m distance from the support. Design the shear reinforcement for the beam. Grade of concrete- M20 and Steel- Fe 415. Assume the width of support is 400 mm. 8[CO 3]

Ques 6- Determine the reinforcement required for a rectangular beam section with the following data: Width of section- 300 mm, Depth of section- 500 mm, Factored BM- 80 kN-m, Factored Torsional moment- 40 kN-m, Factored shear force- 70 kN. Use M15 grade of concrete and Fe415 grade steel. 8[CO 4]

Ques 7- Design a cylindrical water tank of capacity 300 m^3 (300 KL) with a height of 4.0 m, resting on ground, assuming an ideal sliding joint at the base of the wall, and assuming the tank to be open at top. Apply the limit states method of design, considering a limiting crack width of 0.1 mm. assume M30 concrete and Fe500 steel. Also, discuss the implications of using Fe415 grade in lieu of Fe500. 8[CO 5]

Total No. of pages: 01 Roll No.

III SEMESTER

M.Tech. |Civil Engg.||Structural Engg.|

END SEMESTER EXAMINATION NOV/DEC-2022

STE6201 SUSTAINABLE BUILDING TECHNOLOGIES

Time: 03 Hours Max. Marks: 50

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

Q1: Attempt any two parts:

a. Write a note on the environmentally sustainable development goals in the built environment.

b. Evaluate the mortar properties by combining concrete and demolished brick masonry as fine aggregate.

c. Embodied and operational energy of rural dwellings in India.

[2 x 05= 10]

Q2: Attempt any two parts:

a. Explain sustainable building objectives and strategies and comment on resource conservation.

b. Explain the Building information model and life cycle assessment.

c. Take suitable examples and explain the life cycle energy requirements with different construction technologies and materials. [2 x 05= 10]

Q3: Attempt any two parts:

a. Explain TERI – GRIHA rating methodology and the constraints of green rating systems.

b. Based on the BMTPC initiative, explain the broad parameters to evaluate suitable technology /systems fit for mass housing in India.

c. Explain the manufactured sand and compare its material properties with the natural river sand. [2 x 05= 10]

Q4: Attempt any two parts:

a. Comment on the durability and preservation of bamboo.

b. Explain the application of demolished brick masonry in stabilized mud mortar.

c. Explain the green design and construction strategies.

[2 x 05 = 10]

Q5. Explain the guidelines for effective and sustainable recycling of construction and demolition waste. [1 x 10 = 10]

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END TERM EXAMINATION NOV. 2022

III SEM M.Tech. (Structures) COURSE CODE: STE6301

COURSE TITLE: Instrumentation and Rehabilitation of Structures

TIME: 3 Hours Max. Marks: 50

Note: Attempt any Five questions. All questions carry equal marks.

1(a) Discuss stress strain relationship of HYSD reinforcement used in concrete. M5/CO1

(b) Discuss the role of undulations made on the surface of HYSD reinforcement. M5/CO1

2(a) What do you understand by stability characteristic of output of an instrument? Discuss with an example. M5/CO2

(b) What is meant by a transducer? Discuss with an example. M5/CO2

3(a) Discuss likely effects in an RC structure in a coastal area in view of durability. M5/CO3

(b) Should visual observation be applied as a necessary step in the rehabilitation of important structures also? Provide your comments. M5/CO3

4(a) Briefly discuss a method to enhance fire resistance of an RCC column in an industrial building. 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 Ferrocement, citing material composition, advantages and uses. M5/CO5

6 Write short notes on any two of the following topics.

(a) Effect of shape of aggregates on concrete strength

(b) V-B test on concrete

(c) Detailing considerations for beam shear stirrups M10/CO6

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III[rd] Semester

M.Tech.(Structural Engineering) Max. Marks: 40

END TERM EXAMINATION Nov. 2022

Course Code: STE 0407 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	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	CO 5
Q 2	(i) What are the Construction Problems responsible for the cracking in RCC roof/floor slabs? (ii) Explain in detail the steps involved in the restoration of Partially Collapsed RCC Roof.	06	CO 4
Q 3	What are various sources of weakness in RCC framed building?	03	CO 4
Q 4	Comment on the retrofitting technique of base isolating a building.	04	CO 3
Q 5	Comment on " RVS as a tool for preliminary assessment of an existing building"	04	CO 1
Q 6	Elaborate on the Retrofitting measures of Existing Masonry Walls w.r.t. weakness in Random Rubble Walls caused by Delamination of Wythes in thick Walls.	05	CO 5

1|2

Q 7	How Does a Seismic Belt Work and where is the optimal location of Seismic Belt Locations for Masonry Buildings?	05	CO 5
Q 8	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 6500 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.	08	CO 3/ CO 4

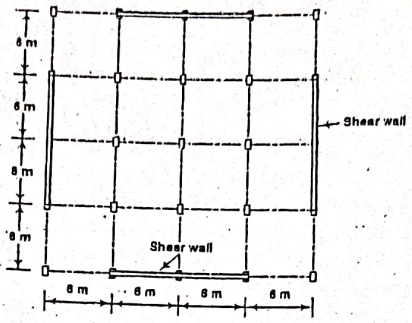


Fig 1

Total no. of Pages: 01 73 Roll no.....

III SEMESTER

M.Tech (IBT)

END TERM EXAMINATION Nov-2022

IBT 6201 BIOETHICS, BIOSAFETY AND IPR

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 What do you understand by biological safety cabinets? Explain briefly the different levels of biological safety cabinets. [10 Marks] [CO 1,5,6]

Q.2 Write short notes on the following (a) Industrial Design (b) Infringement (c) Copyright and related rights (d) Geographical indicators. [10 Marks] [CO 1,2,6]

Q.3 Discuss in detail the process of ethical issues clearance in GMOs and LMOs. [10 Marks] [CO 1,2,5,6]

Q.4 What are the legal and socio-economic concerns in biotechnology? Illustrate the process of patent filing in India. [10 Marks] [CO 1,2,5,6,8

Q.5 Explain the do and don'ts under GLP and GMP. [10 Marks] [CO 1,2,10

Total no. of Pages: 01 74 Roll no.....

III SEMESTER

M.Tech (IBT)

Nov-2022

END TERM EXAMINATION

IBT 6301 INDUSTRIAL WASTEWATER TREATMENT

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 Discuss in detail the role of different types of microbes in wastewat treatment with examples. [10 Marks] [CO 1,2,5,6

Q.2 Write short notes on any four (a) Ultrafiltration (b) Electrodialysis (Ion-Exchange (d) Reverse osmosis (e) Ammonia in Yamuna (Radioactive waste. [10 Marks] [CO 1,2,6]

Q.3 Comment on the deteriorating water quality of Yamuna in Delhi. Dis the recent case study in Delhi and strategies to maintain water quality. [10 Marks] [CO 1,2,5,6]

Q.4 Elucidate with an appropriate diagram the different techniques involv in the secondary treatment of wastewater. [10 Marks] [CO 1,2,5,6,

Q.5 Discuss the interdisciplinary strategies for the remediation of microplas pollution. [10 Marks] [CO 1,2,5,6,

Total no. of Pages:02 75 Roll no.....

I SEMESTER

M.Tech. (Bioinformatics)

END TERM EXAMINATION *Nov/Dec-2022*

BIO501 Introduction to Bioinformatics

Time: 03:00 Hours *Max. Marks: 40*

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

Q.1 Answer any two of the following. [2x4=8] [CO# BIO501.2]

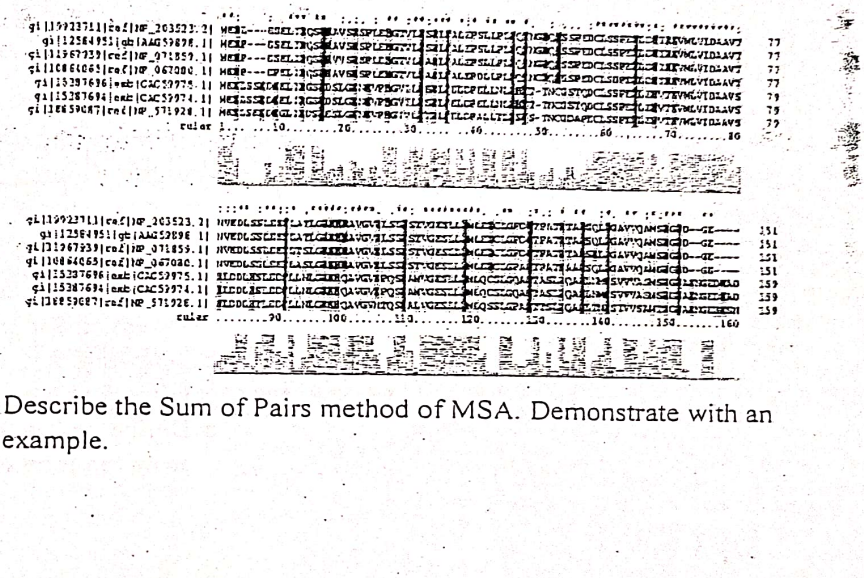
a) Discuss the various ways of functional annotation of proteins.

b) What is gene ontology? Discuss its significance in the present era of genome-scale ontology.

c) How to formulate a differential gene expression study? What is gene enrichment analysis?

Q.2 Answer any two of the following. [2x4=8] [CO# BIO501.5]

a) Given below is the multiple sequence alignment of a protein in seven species. What can you infer from this alignment?



b) Describe the Sum of Pairs method of MSA. Demonstrate with an example.

c) What is a consensus sequence? Construct consensus motif in DNA with an example.

Q.3 Answer any two of the following. [2x4=8] [CO# BIO501.4]

a) Design the steps to characterise an unknown 16S RNA sequence extracted from a bacterial genome, using bioinformatics tools.

b) What are the functional consequences of various type of SNPs on protein structure?

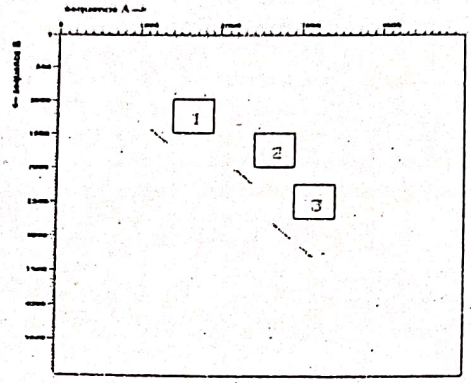
c) Write the methods to identify RFLPs and discuss their applications.

Q.4 Answer any two of the following. [2x4=8] [CO# BIO501.2]

a) What are the various bioinformatics methods that can be used to characterize a novel protein sequence's function and structure?

b) What are 3 basic computational methods for sequence alignment? Evaluate their merits and demerits. Why do we need/use heuristics for aligning sequences?

c) Below is a dot plot comparing two 5,000 bp DNA sequences. Interpret the pattern describing the events that may have happened during the divergence of sequences A and B.



Q.5 Answer any two of the following. [2x4=8] [CO# BIO501.1]

a) Name any five resources for Bioinformatics provided by NCBI. Discuss them briefly.

b) Why uniform file formats are required for storing information? Give examples of some commonly used file formats.

c) Define redundancy in a database. Why is redundancy an issue? How can it be solved?

Total no. of Pages: 01 77 Roll no.....

Ist SEMESTER

M.Tech.

END TERM EXAMINATION *Nov/Dec-2022*

BIO 503 ADVANCED PROTEOMICS

Time: 03:00 Hours *Max. Marks: 40*

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

Q.1 Why microarray is considered a high-throughput method? Mention different types of microarray techniques. Is DNA chip and microarray same? How do ChIP-On-Chip and Chip array differ? [8][CO5]

Q.2 Describe the Fluorescence Resonance Energy Transfer principle (FRET). What prerequisite must be met in order for FRET to take place? How does the distance between the donor and acceptor affect the efficiency of FRET? Describe the mechanism and the limitations? [8][CO4]

Q.3 Explain the fundamentals of the yeast 2 hybrid system. Use appropriate examples to illustrate the interplay between prey and bait. What are the benefits and drawbacks of this technology? [8][CO4]

Q.4 What distinguishes SDS-PAGE from 2D-Native PAGE? Mention whether Western blot technique is quantitative or qualitative in nature? Why the pH of stacking and resolving gel is different? Elaborate the rationale of adding a secondary antibody and probing for housekeeping protein in blot. [8][CO2]

Q.5 Explain the principle and types of ELISA? What is the difference between ELISA assays? What is the effects of coating ELISA plates with antigen for longer than recommended durations? [8][CO3]

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Total no. of Pages: 2

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Roll no.....

I SEMESTER

M.Tech

END TERM EXAMINATION *Nov-2022*

BIO 5301 Data Warehouse and Data Mining

Time: 3 Hours *Max. Marks: 50*

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

Q. 1 i. Explain Association rule mining and its applications. [3][CO3]

ii. How can one handle suspicious or missing data in a dataset while performing the analysis? [2][CO2]

Q. 2 Why multidimensional views of data and data-cubes are used? With a neat diagram, explain data-cube implementations. [5][CO1]

Q. 3 Perform a Chi-Square test of independence to see if gender is linked to political party preference. (Given: You poll 440 voters in a simple random sample to find out which political party they prefer)

	Republican	Democrat	Independent	Total
Male	100	70	30	200
Female	140	60	20	220
Total	240	130	50	440

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09

[5][CO3]

Q. 4 i. Distinguish between Classification and Clustering? [3][CO4]

ii. Explain different accuracy and error measures. [2][CO4]

Q. 5 What is Cluster analysis and what are the types of cluster analysis? [5][CO4]

Q. 6 Consider the following dataset to predict whether we can pet an animal or not for the given inputs (predictors) : (Cow, Medium, Black) [5][CO4]

	Animals	Size of Animal	Body Color	Can you Pet them?
0	Dog	Medium	Black	Yes
1	Dog	Big	White	No
2	Rat	Small	White	Yes
3	Cow	Big	White	Yes
4	Cow	Small	Brown	No
5	Cow	Big	Black	Yes
6	Rat	Big	Brown	No
7	Dog	Small	Brown	Yes
8	Dog	Medium	Brown	Yes
9	Cow	Medium	White	No
10	Dog	Small	Black	Yes
11	Rat	Medium	Black	No
12	Rat	Small	Brown	No
13	Cow	Big	White	Yes

Q. 7 Explain the following:

i. Decision Tree

ii. Support Vector Machine [5][CO4]

Q. 8 Explain Microarray Data mining and its challenges. [5][CO5]

Q. 9 Write a short note on:

i. Differential gene expression

ii. Coordinated gene expression? [5][CO5]

Q. 10 Discuss Genome annotation in detail. [5][CO5]

Total no. of Pages: 01

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Roll no.....

Ist SEMESTER

M.Tech.

END TERM EXAMINATION *Nov/Dec-2022*

BIO 5407 OMICS IN MEDICINE

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 What do you mean by transcription binding element and how it alters protein expression? What is the difference between cis and trans-regulatory elements? How *cis*-acting element can alter the coding sequence or gene expression? [10][CO3]

Q.2 Describe the important considerations for the planning and conduct of complex clinical trials. What are the benefits and risks of a clinical trial? Describe different phases of clinical trials. What are potential applications of genomic biomarkers in clinical trials? [10][CO5]

Q.3 Explain Omics Theory with the help of a flowchart. What would happen if the genetic flow is reversed? How is transcriptomics an important cognate in gene flow, especially when it is a unidirectional flow? [10][CO4]

Q.4 What is Long non-coding RNAs (lncRNAs). Explain gene regulation by lncRNAs and its biological functions and its role in disease pathology? [10][CO4]

Q.5 What drives antimicrobial resistance and why it is a global concern? Describe types of antimicrobial resistance. Support your answer with one example? [10][CO2]

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Total no. of pages: 3 *Roll no.....*

III SEMESTER

M.Tech.

END TERM EXAMINATION *Nov./Dec-2022*

BIO6207: Entrepreneurship

Time: 3:00 Hours *Max. Marks: 50*

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

Q.1 Started in 2020 primarily as a fashion accessory company, Heart up my sleeves provides hassle-free, reusable and detachable sleeves that serve as style solutions or quick fixes to any dull outfit-day. The primary focus of this Delhi based company is to provide the detachable sleeves which available in every size, cloth, and colour for a holistic & wholesome choice. but the company is planning to expand into various other countries and also plans to add other detachable fashion accessories, apart from sleeves. The company founder, Riya Khattar jokes that she wouldn't have named the company Heart up my sleeves if she had known its full potential and growth.

A. Could a feasibility analysis have helped Riya Khattar from the start?

B. The company is planning to expand its business in other countries as well. How would you identify a new potential market for this company to enter?

C. Do you see any potential problems with this business idea?

D. How would you advise the company on making go-or-no-go decisions for entering into new fashion accessories? [10][CO2, CO3]

Q.2(a) Explain the level of 'startup maturity model which requires founders to determine sustainability of their business model and validation from customers that proposed product/service will be relevant to and will be paid by various customers? [3] [CO1]

Q.2(b) Ms. Meera, an IIM alumnus, has started a gaming console business along with her friends. She has validated her product and

has few early customers. She is willing to raise funding at this stage. What is the type of funding required at this stage? Brief out the steps she is required to follow to raise the required funds. [7] [CO2]

Q.3 (a) An angel investor decided to invest in a robotic manufacturing company that was seeking to create a particular type of robot. The investment involved two parts. First, the investor extended a loan to the company @12% pa. Second, the investor purchased a portion of the company against INR 5 crore. Given the risks in the sector, investors are willing to have an exit plan in the event their investment does not live up to their expectations. What are the alternatives available to him? [5] [CO1]

Q.3 (b) Ms. Yasmin is planning to start a lifestyle clothing brand. She needs some funds (approx. 5L on urgent basis) for purchasing the raw material and manufacturing the sample products. After testing the prototype in the market, she will incorporate her business and will also need INR 5 Lakhs for purchasing of fixed assets and INR 6 Lakhs for financing the working capital and other legal compliances (such as incorporation, GST, Labor compliances, etc). What are the alternative(s) available to her to raise the initial funding. Will raising funds through crowdfunding platform be a good idea or not? What are the different types of crowdfunding methods? [5] [CO1]

Q.4 Ms. Heena is planning to start a lifestyle clothing brand but is unaware of legal compliances she is required to follow. In your viewpoint, what are the important compliances (laws, rules, and regulations) a person should be aware of before starting a business? [10] [CO4]

OR

Q.4(a) Mr. Rahul is working on an idea of providing athleisure wear to youngsters. For launching his business, he needs to raise funding of 50 Lakhs from external sources. While preparing pitch-deck and business plan to procure the required funds, he is confused with respect to the information which will be uncommon in both the documents. Advise him in regard to the type of information which is required to be presented in a pitch deck and not necessarily in

business plan. Also, list out the important components of a business plan. [5] [CO1]

Q.4(b) If you were thinking about starting a clothing store for teens and young women in your hometown, what competitive analysis techniques can be used to identify your unique selling proposition and competitive advantage? [5] [CO3]

Q.5(a) Explain the market size approach which uses multiplication method to find the SAM. Also, explain enlist the steps required to be followed for estimating market size. [5] [CO3]

Q.5(b)Mr. Tarun, along with his friends Rahul and Daksh, has recently started business of WEB DEVELOPMENT. They are planning to choose a right kind of legal structure to formalise their business. What are the different types of legal structures and what are the factors which will help them in deciding the legal structure which they should choose? [5] [CO4]

END

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Total No. of pages. 2

Roll No.....

THIRD SEMESTER M.TECH. (BIOINFORMATICS)

END SEMESTER EXAMINATION (NOVEMBER-2022)

BIO-6301 NANOTECHNOLOGY IN HEALTHCARE

Time: 3.00 Hours Max. Marks: 50

Note: Answer all Questions.
Assume suitable missing data, if any.

Q 1. All questions are Compulsory, answer briefly [(2×8) (CO-2, 3, 4, 5)]

a. Write down the two biomaterials used for preparation of ocular, heart and spinal prostheses each.
b. What are transducers explain with suitable examples.
c. Give details on principle and lookout methods for cantilever sensing.
d. Describe the working principle of glucose biosensor.
e. What are DNA sensors? Briefly discuss its working principle, how can it be used in detection of diseases
f. How tissue engineering is being implemented in diabetes treatment, explain.
g. Describe the working principle of surface plasmon resonance-based biosensor and its applications?
h. What are molecular beacons explain?

Q 2. Write short notes on Any four of the following, briefly describe their applications. [(4×4) CO- 4, 5, 6]

a. Bio-barcode assay.
b. MEMS hearing aid transducers.
c. Argus™ Retinal Prosthesis System.
d. Cardiac pacemaker and implantable cardioverter defibrillator (ICD)
e. Nanoflares.
f. Homing peptides
g. Nano-vaccines

P.T.O

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Q 3. Attempt Any one of the following questions. [(6) CO-4]

a. Define biomaterials and along with its classification briefly describe the significance of cell-surface interactions in the area of regenerative medicine, discuss about the application of biomaterials in implants and prosthesis.

OR

b. What is tissue engineering and how tissue engineering methods are currently being implemented in regenerative medicines, discuss about strategies applied development of artificial skin?

Q 4. Attempt Any one of the following questions. [(6) CO-4, 5]

a. Describe the process of bone remodeling and repair, briefly discuss about strategies applied in bone tissue engineering.
b. Briefly explain the in-vitro and in-vivo methods applied for biocompatibility testing.

OR

a. Classify the infectious disease agents, briefly discuss about their mode of transmission?
b. What are neuroprosthetic, briefly discuss about the methods applied for nerve regeneration.

Q 5. Attempt Any one of the following questions. [(6) CO-5, 6]

a. What is diffusion controlled and electric regulated release implants, explain with examples?
b. Define AMPs, briefly describe the structure, types and mode of action of these AMPs with examples.

OR

a. Describe the role of peptides in treatment of diabetes; with suitable example, discuss the mechanism of action of these peptides.
b. Briefly discuss the role of nanomaterials in clinical diagnostics and treatment of cancer.

-END-

[B] Attempt any TWO of the following [2+2] [CO5]

(i) Describe the principle of agarose gel electrophoresis. Also explain the significance of various chemicals / reagents used in the procedure

(ii) Give a flowsheet / diagrammatic representation of any one NGS technology used for DNA sequencing

(iii) Design a strategy based on color difference to select recombinants from non-recombinants in gene cloning experiment. Give specificities of the vector used, cloning site, selection pressure or criteria, and inference drawn results

*** END ***

Total No. of Pages: 4 *Roll No. .....*

THIRD SEMESTER

M.Tech.

END TERM EXAMINATION *Nov/Dec-2022*

BIO 6405 Cell and Molecular Biology

Time: 03:00 Hours *Max. Marks: 40*

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

Q.1 [A] Attempt any TWO of the following [2+2] [CO1]

(i) Compare and contrast any four of the following and write two points for each - *cis* Golgi and *trans* Golgi; Gram positive and Gram negative bacterial cell wall; COP I and COP II vesicles; Constitutive and Regulated secretion; Primary lysosome and Secondary lysosome

(ii) Identify the following and write two points about each of the following - rRNA synthesizing center in nucleus; Location of respiratory electron transport chain in mitochondria; Sorting center of Golgi; Center for photosynthetic light reaction in chloroplast

(iii) Draw a well-labelled diagram of the force generating structure of eukaryotic flagella. Clearly indicate the functions of various proteins involved in the bending motion of flagella

[B] Give an analysis of the chemical nature and structure of a lipid bilayer of membrane. Clearly indicate the chemical structure of the hydrophobic and hydrophilic parts of the bilayer with the help of diagrams. Enumerate membranes having high protein: lipid ratio in both prokaryotes and eukaryotes [4] [CO1]

Q.2 [A] Attempt any TWO of the following [2+2] [CO2]

(i) Enumerate any four functions of intracellular signaling proteins and small intracellular mediators involved in cell signaling and discuss each in about 60 words

(ii) Discuss about any three of the following in brief - Securin; G2 checkpoint; Sec 61; Ran-GTP; Signal recognition particle

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(iii) Describe the arrangement of topogenic sequences for targeting of type I and type IVA membrane proteins. Show the arrangement and orientation of protein within the membrane in each case

(iv) Draw self-explanatory signaling pathway to show how G-protein linked receptors relay signal for the secretion of saliva or generation of pain and inflammation

[B] Discuss the mechanism behind each phase of mitosis separately. Clearly indicate the roles of cytoskeletal elements, motor proteins, and CdK involved in each phase [4] [CO2]

Q.3 [A] Attempt any TWO of the following [2+2] [CO1, CO2]

(i) Compare and contrast any two of the following by mentioning two points about each
- (a) Endocrine signaling and Synaptic signaling
- (b) Cell surface receptor and Intracellular receptor
- (c) Desmosome and Hemidesmosome

(ii) Assign reason(s) to any two of the following with respect to cell cycle
- (a) Concentration of p53 rises at the time of DNA damage
- (b) Braking action of pRb depends on its state of phosphorylation
- (c) CdKs regulate their own level

(iii) Analyze the specificity of vesicle budding and fusion. Clearly indicate the roles of various proteins involved in vesicle formation, packing of cargo, budding and fusion

[B] Assign explanation(s) for any four of the following in about 60 words each [4][CO1, CO3]

(i) DNA Pol I acts on two Okazaki fragments simultaneously and is capable of nick translation

(ii) Prokaryotic DNA ligase requires NAD^+ as cofactor for its activity

(iii) DnaB helicase requires ATP for its function

(iv) Leading and lagging strands of DNA are synthesized simultaneously by DNA Pol III in a manner analogous to Trombone

(v) Diffusion of macromolecules of size >40 kDa is blocked between nucleus and cytoplasm

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Q.4 [A] Answer the following [2+2] [CO4]

(i) Specify the functions of any three proteins / RNAs that participate in the post-transcriptional processing of eukaryotic RNAs. Take one example each from post-transcriptional processing of mRNA, tRNA and rRNA. Explain in brief the processes in which each is involved

(ii) Assign reason(s) to any two of the following in ~60 words each
- (a) Acetylation of histones enhances transcription
- (b) CTD tail of RNA Pol II plays important roles in transcription and post-transcriptional processing
- (c) Mismatch repair in prokaryotes depends on the methylation status of DNA

[B] Answer the following [2+2] [CO4]

(i) Write in brief about the following
- (a) Conformational changes in *cis* ring of prokaryotic chaperonins leading to substrate protein folding
- (b) Transesterification reactions involved in spliceosomal splicing of GU-AG intron

(ii) Explain the following
- (a) Formylation of initiator methionine increases the efficiency of prokaryotic translation
- (b) SD sequence helps in initiation of translation from 5' end of prokaryotic mRNA

Q.5 [A] Answer the following [2+2] [CO5]

(i) Briefly answer the following in about 60 words each
- (a) Role of α-thio ATP and addition of single nucleotide at a time in pyrosequencing
- (b) Explain the difference between discontinuous PAGE and continuous PAGE with respect to gel employed and application

(ii) Explain any two of the following in ~60 words each
- (a) Reactions involved in Edman degradation method used for protein sequencing
- (b) Role of DNA fingerprinting in paternity testing
- (c) Principle and advantage of Real time PCR
- (d) Flowsheet representation of Sanger's method of DNA sequencing

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Roll No.....

THIRD SEMESTER

M. Tech.

END TERM EXAMINATION *Nov/Dec-2022*

PRD-6203 MATERIALS MANAGEMENT

Time: 3:00 Hours *Max. Marks: 50*

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

1 (a) What are the indicators of low materials productivity? [5] CO1

(b) Material manager is presently procuring four items with the following details: [5] CO5

Item	Annual Demand (Units)	Unit Price (Rs./unit)	No. of order per year
1	8000	10	3
2	5000	16	2
3	900	12	3
4	500	8	4

Use exchange curve to examine if his procedure is rational. Outline the strategies available for rationalization if require.

2 (a) "JIT system makes the organizations competitive". Discuss. [5] CO2

(b) What are the need and rationale of physical verification? [5] CO4

3 (a) What are the costs considered in favour of making and in favour of buying? [5] CO3

(b) What are the various vendor rating plans? Explain. [5] CO4

4 (a) What are the reasons for classification, codification and standardization of materials? [4] CO1

(b) Explain lot size model with Planned Backlogging and calculate optimum system cost, economic lot size, stock level and backlogging level. [6] CO2

5 (a) Show that under estimation is costlier than over estimation by deviation from optimal order quantity. [3] CO2

(b) A hardware store procures and sells hardware items. The following information is available: [7] CO5

Expected annual sales – 8000 units
Ordering cost – Rs. 1000 per order
Holding cost – 10% of average inventory value

The item can be purchased in the following schedule:

Lot size	Unit price (Rs.)
1 – 999	25.00
1000 – 1499	23.00
1500 – 1999	21.00
2000 and above	20.00

Determine order size.

6 Write short notes on any FOUR of the following: [10] CO2

(a) Parameters of carrying cost
(b) Importance of good store-keeping
(c) MISS model
(d) Types and kinds of inventories
(e) Color coding of ABC analysis

Total no. of pages: 1 Roll No. _____

THIRD SEMESTER 89 M. Tech (PE)

END SEMESTER EXAMINATION NOVEMBER- 2022

PRD-6401 ADVANCED MACHINING PROCESSES

Time: 3Hours Max. Marks: 50

Note: Attempt any five questions.
Assume missing data , if any

1 (a) Describe the working principle of Ultrasonic machining (USM) process with the help of schematic diagram. Also discuss the effect of amplitude and frequency of vibration, grain size and % of abrasive concentration on material removal rate (MRR). [CO2]

(b) Explain the function of slurry, horn, transducer and oscillator in USM. This process is used to drill a hole in aluminium and C.I. Which one will have higher depth of the drilled hole? [CO5]

2 (a) Describe the mechanism of material removal in AFM process. Justify the statement "AFM has high flexibility". Write the salient features of AFM system. [CO2]

(b) How material removal rate is enhanced in electro-chemo centrifugal force assisted AFM process as compared to conventional AFM process. Analyse the process and write its industrial applications. [CO4]

3 (a) Briefly discuss the working principle of magnetic abrasive finishing (MAF). Clearly show lines of magnetic force, magnetic equipotential lines, direction of pressure acting on work-piece and direction of rotary motion. [CO1]

(b) What is gap filling density in magnetic abrasive finishing (MAF). Also describe the mechanism in the use of bonded and unbonded magnetic abrasives on material removal rate and surface finish. [CO3]

4 (a) With the help of neat sketch, explain the working principle of electric discharge machining (EDM) process. Also discuss the mechanism of material removal in EDM. [CO2]

(b) Discuss with neat sketch the effect of resistance, current density, pulse energy and capacitance on material removal rate. [CO3]

5(a) Briefly discuss about mechanics of material removal in electrochemical machining (ECM) process. Also describe the effect of various process parameters on material removal rate. [CO3]

(b) Why there is no need to have short circuit protection device in electro-chemical grinding (ECG) system? Explain the mechanism of material removal during ECG and how it is different from ECM. [CO3]

6. Write short notes on any four of the following: [CO1]

(a) Laser beam machining

(b) Plasma arc machining

(c) Focused ion beam machining

(d) Chemical machining

(e) Biochemical machining

(f) Electric discharge diamond grinding

Total no. of Pages 02 91 Roll no.....

First Semester

M Tec.h Industrial Engineering and Management

IEM 501: Data Analytics

Maximum Marks :40 Time 3 Hours

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

1 A bank would like to classify the customers based on risk such as low-risk or high-risk customers. You have data file containing 14 dependent variables and one variable giving information about the risk associated with the customer. [16] [CO4,5]

By selecting the appropriate technique, develop a model to predict the risk of a customer. Provide all the steps with full explanation and code.

Explain confusion matrix and also discuss the methods to manipulate it to reduce the cost of wrong prediction.

2 Give three reasons for the increasing popularity of Data Analytics in Business and Industry. [8] [CO1,4]

CASE: Data Analytics in Sports

Analytics in sports was made popular by the book and movie, Moneyball, Statistician Bill James and Oakland A's general manager, Billy Bean, placed emphasis on crunching numbers and data instead of watching an athlete's style and looks. Their goal was to make a team better while using fewer resources. The key action plan was to pick important role players at a lower cost while avoiding the famous players who demand higher salaries but may provide a low return on a team's investment. Rather than relying on the scouts' experience and intuition, Bean selected players based almost exclusively on their on-base percentage (OBP). By finding players with a high OBP but with characteristics that lead scouts to dismiss them, Bean assembled a team of undervalued players with far more potential than the A's hamstrung finances would otherwise allow.

Using this strategy, they proved that even small market teams can be competitive – a case in point, the Oakland A's. In 2004, two years after adopting the same sabermetric model, the Boston Red Sox won their first world Series since 1918.

(Source: Moneyball, 2004)

a) Could similar techniques be applied to the games of soccer or cricket? If so, how?
b) What are the general lessons from this story?

3 A student is applying for a master course in 8 US Universities and believe that he has in each of the eight universities a constant and independent 0.35 probability of getting selected. [8] [CO2,3]
(i) What is the probability that he will get call from at least 3 universities?
(ii) What is the probability that he will get a call from exactly 4 universities?
Write Code also.

4 Discuss the different types of data based on level of measurement. [8] [CO1,3]
What is the difference between Linear Regression and Logistic Regression?
What is heatmap? How this is used in Linear Regression?

5 What do you understand by p-value in hypothesis testing? Explain the various steps of ANOVA. [8] [CO1,2]
According to a recent survey, Americans get a mean of 7 hours of sleep per night. A random sample of 50 students of a university revealed the mean number of hours slept last night was 6 hours and 48 minutes (6.8 hours). The standard deviation of the sample was 0.9 hours. Is it reasonable to conclude that the students at the university sleep lass than the typical American? Compute p-value.

6 Write brief notes on [8] [CO1]
(a) Principal Component Analysis
(b) ARMA Models

Total No. of Pages (03) *Roll No. .....*

FIRST SEMESTER **M.Tech.(IEM)**

END-TERM EXAMINATION ***NOV-2022***

IEM-503 PRODUCTION AND OPERATIONS MANAGEMENT

Time: 3:00 Hours ***Max. Marks: 50***

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

1. (a) What is the roles of Operations in strategy development? Discuss the competitive dimensions of operations Management.
(b) What do the expressions *order winner* and *order qualifiers* mean? What was the order winner for your last major purchase of a product or service? **[5+5=10](CO1)**
2. (a) Discuss the regional and global level factors influencing the decision related to facility location.
(b) Write the limitations of Centroid (or Centre of gravity) method and profit-volume ratio method of facility location decision. **[5+5=10](CO2)**
3. (a) A maker of personalized golf shirts has been tracking the relationship between sales and advertising dollars over the past four years. The results are as follows:

Sales Rs. in thousand	Advertisement Rs. in thousands
130	32
151	52
150	50
158	55

Use linear regression to find out what sales would be if the company invested Rs.53,000 in advertising for next year.
(b) A gardener wants to develop a forecast for next year's quarterly sales of cactus trees. He has collected quarterly sales for the past two years and expects total sales for next year to be 500 cactus trees. The data clearly exhibit seasonality. How much can

he expect to sell during each quarter of next year accounting for seasonality? **[5+5=10](CO3)**

	Cactus Trees Sold	
Season	Year 1	Year 2
Fall	100	110
Winter	82	95
Spring	180	173
Summer	110	110

4. (a) Discuss the meaning of MRP terms such as planned order release and scheduled order receipt. Why is the MRP process referred to as an "explosion"?

(b) The maintenance department for a small manufacturing firm has responsibility for maintaining an inventory of spare parts for the machinery it services. The parts inventory, unit cost, and annual usage are as follows: **[5+5=10](CO4)**

Part	Unit Cost	Annual Usage
1	Rs. 60	90
2	350	40
3	30	130
4	80	60
5	30	100
6	20	180
7	10	170
8	320	50
9	510	60
10	20	120

The department manager wants to classify the inventory parts according to the ABC system. Determine which stocks of parts should most closely be monitored.

5. (a) The Northern Lights Company is a retail catalogue operation specializing in outdoor clothing. The company has a pool of 28 telephone operators to take catalogue orders during the business hours of 9 A.M. to 5:00 P.M. (The company uses a smaller pool of operators for the remaining 16 off-peak hours.) The company has recently been experiencing a larger number of lost calls because operators are busy and suspects it is because the operators are spending around 30% of their time describing products to customers. The company believes that if operators knew more about the products instead of having to pull up a description screen on the computer each time a customer asked a question about a product, they could save a lot of operator time, so it is thinking about instituting a product awareness training program. However, first the company wants to perform a work sampling study to determine the proportion of time operators are answering product-related questions. The company wants the proportion of this activity to be accurate within 2%, with a 95% degree of confidence. (Z at 95% confidence level is 1.65).

(b) The Metro Food Services Company conducted a time study for 10 cycles of a job assembling ham and cheese sandwiches, which we will consider to be a sample. The average cycle time, for the job was 0.361 minute. The standard deviation of the sample was 0.03 minute. The company wants to determine the number of cycles for a time study such that it can be 95% confident that the average time computed from the time study is within 5% of the true average cycle time. (Z at 95% confidence level is 1.65). **[5+5=10](CO5)**

6. Write short notes on the following: **[4×2.5=10](CO6)**
   (a) Relationship between Operations Strategy and Corporate Strategy
   (b) Difference between Product layout and Process Layout.
   (c) Dependent and Independent Demand
   (d) Work Sampling

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Roll no.....

I SEMESTER
M.Tech.

END TERM EXAMINATION NOV-2022

IEM-5205 PRINCIPLES OF MANAGEMENT

Time: 3 Hours *Max. Marks: 50*

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

Q 1(a)	What is the scope of 'management'? Discuss in brief.	[05][CO1]
(b)	Distinguish between the relationship between Administration, Management and Organization. Is management a science, an art, or a profession?	[05][CO1]
Q 2(a)	Why is the line and staff organization preferred to the line type of organization in today's industry? Describe the implications of the relationship of staff department with the line department.	[05][CO2]
(b)	Outline the essential steps in the design of organization. State the problem that arise, if the span of control is too large or short.	[05][CO2]
Q 3(a)	Critically examine Maslow's need priority model. How far up the hierarchical ladder do most people progress?	[05][CO3]
(b)	What are the characteristics of motivation? Discuss the difference between job enlargement and job enrichment?	[05][CO3]
Q 4(a)	What do you mean by decision tree analysis? Discuss its use in the decision-making process.	[05][CO4]
(b)	Explain the process of decision making under uncertainty.	[05][CO4]
Q 5(a)	Explain the importance of completeness and correctness in effective communication.	[05][CO5]
(b)	Explain why management by wandering around considered as effective communication. What are the barriers to effective communications?	[05][CO5]
Q 6(a)	What do you understand by "leadership style"? Describe the different styles of leadership.	[05][CO4]
(b)	Explain the effects of globalization and liberation in improving organization growth.	[05][CO2]
Q 7(a)	Explain any four non-budgetary control techniques with suitable examples	[05][CO6]
(b)	Discuss some of the ethical attitude of the employees.	[05][CO6]

Total No. of Pages -2 Roll No. .....

I[ST] SEM M.TECH Industrial Engineering and Management

END SEMESTER EXAMINATION NOV 2022

IEM 5305 TOTAL QUALITY MANAGEMENT

Time: 3:00 Hours Max. Marks: 50

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

Q.1 What are the objectives and basis of quality in industries? Suggest a scheme for evaluation of quality control in a batch production organisation. (10) [CO:2]

Q.2 Consider the motorbike manufacturing industry. Develop a house of quality showing customer requirements and technical descriptors. (10) [CO:3]

Q.3 (a) What are the advantages and disadvantages of using variables rather than attributes in control charts?

(b) What are some considerations in the interpretation of control charts based on standard values? Is it possible for a process to be in control when its control chart is based on observations from the process but to be out of control when the control chart is based on a specified standard? Explain. (5, 5) [CO:3]

Q.4 20 samples each of size 10 were inspected. The number of defectives detected in each of them is given below:

Sample no	1	2	3	4	5	6	7	8	9	10
No. of defectives	0	1	0	3	9	2	0	7	0	1
Sample no	11	12	13	14	15	16	17	18	19	20
No. of defectives	1	0	0	3	1	0	0	2	1	0

Construct number defective chart and establish quality standard for the future. (10) [CO:4]

Q5. In a double sampling plan, N=5000, n_1=100, c_1=0, n_2=100 and c_2=1. (a) use Poisson's table (given below) to compute the probability of acceptance of a 1% defective lot. (b) Assume that a lot rejected by this sampling plan will be 100% inspected. What will be the AOQ if the submitted product is 1% defective? Considering both the inspection of rejected lots, what will be the average number of articles inspected per lot if the submitted product is 1% defective?

Assume the following (Poisson's 1000 x probability of c or less), (10) [CO: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

Q.6 Write short notes on any TWO (2 x 5 =10) [CO:5]

a. Elements of ISO-14001 according to Deming

b. Kaizen Key activities

c. TAGUCHI loss function

d. Type I & Type II error

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FIRST SEMESTER | M.Tech. (IEM)

END TERM EXAMINATION | November-2022

IEM-5407 Product Design & Development

Time: 3:00 Hours | Max. Marks: 40

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

Q.1 (a) Discuss any three design Methods/ techniques for a product. (3) (CO2)

Q.1 (b) Given the following data:

Sales	8000 units
Price/ Unit	Rs. 10/-
Variable expenses	Rs. 64000/-
Fixed Expenses	Rs. 24000/-
Contribution	Rs. 16000/-

Evaluate: (i) What sale are needed for break-even?
(ii) What will be selling price if the break even points should be brought down to 15000 units? (5) (CO5)

Q.2 (a) Draw a Bath tub curve and explain the phases involved. (3) (CO6)

Q.2 (b) Prove that $R(t) = e^{-\lambda t}$ (2) (CO6)

Q.2 (c) 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 16 hours, While C has an MTBF of 1200 minutes. Find the reliability of the system for 25 hours. (3) (CO6)

Q.3 (a) Discuss the role of computer in Product Design and its development. (4) (CO7)

Q.3 (b) What is meant by Ergonomics. Define Anthropometrics data. Plot and Discuss man-machine interface cycle. (4) (CO8)

Q.4 (a) What do you mean by Design communication. How does drawing and visual aids help the design engineer to share his ideas? (4) (CO4)

Q.4 (b) During writing a technical report, what point should be kept in mind for easy and impactful communication. (4) (CO4)

Q.5 (a) Write down the guidelines for Design of Manufacturing and Design for Assembly. (6) (CO3)

Q.5 (b) What is the role of need analysis in the design process. Give one need statement for Washing machine (2) (CO2)

Q.6 (a) A company makes curtain rods of size 2 meters in length. Three materials A; B & C are available. Each material calls for different process and machine for manufacturing and cost data is given as below (4) (CO5)

Materials	A	B	C
Raw material cost Rs. /meter	2.25	2.75	3.00
Equipment cost Rs. /year	5000	5000	3000
Labour cost Rs. /rod	0.55	0.62	0.25

Plot the total cost v/s yearly production volume. If sales volume of 10,000 rods/year is expected, which material should be used.

Q.6 (b) Discuss the major stages of product design. (4) (CO1)

Total No. of Page: 2 | 100 | Roll No.....

3rd Semester
M. Tech Thermal Engineering
End Semester Examination Nov.2022

THE 6205 Alternative Fuels

Time: 3:00 Hours *Max. Marks: 50*

Note: Answer any five questions.

All questions carry equal marks.

Q. 1(a) "Ever increasing demand of fuel due to increase in number of vehicles and toxic emissions caused by conventional hydrocarbon fuels prompted researchers to look for alternative fuels for IC engines"- Explain the statement. [5,5][CO2]

(b) What is a solar vehicle? With the help of a neat sketch explain how a solar car works.

Q. 2 a) What are main components of a electric vehicle. Discuss the advantages and disadvantages of electric vehicles over the vehicles powered by internal combustion engines. [5,5][CO1,CO2]

(b) What is a hybrid vehicle? Name the different types of Hybrid Vehicles and explain their working.

Q. 3(a) What are the basic requirements of IC engine fuels? Compare important physico-chemical and combustion properties of ethanol and gasoline for using them in SI engines. Also discuss the modifications required in an existing gasoline engine if E-85 is to be used. [5,5][CO2,CO3]

(b) Compare thermal efficiency and CO emissions of gasoline and E-85 when they are used in a gasoline engine at similar equivalence ratios.

Q. 4 a) What is transesterification? Explain how methyl ester is produced from vegetable oil using transesterification. [5,5][CO2,CO

(b) What are the major pollutants emitted by heavy duty diesel engines? Explain the impacts of average pollutant emissions of biodiesel for these heavy duty diesel engines.

Q. 5 a) What is green house effect? Name five major green house gases and explain their sources. [5,5][CO1,CO

(b) What are the maximum limits of CO, HC and NO_X for a car powered by gasoline engine as per BS-IV and BS-VI norms? What is meant by "phase separation" of alcohol-gasoline blends? Discuss phase seperation phenomenon of alcohol-gasoline blends and means to reduce this problem.

Q. 6 Write short notes on the following [5,5][CO2
(a) Use of bio-gas in SI engines
(b) Production of ethanol

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3rd SEMESTER

M.Tech. (Thermal Engineering)

END TERM EXAMINATION *Nov/Dec-2022*

THE6305 : Exergy Analysis of Thermal Systems

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 (a) A household refrigerator is maintained at a temperature of 2°C. Every time the door is opened, warm material is placed inside, introducing an average of 420 kJ, but making only a small change in the temperature of the refrigerator. The door is opened 20 times a day, and the refrigerator operates at 15% of the ideal COP. The cost of work is 32 paise per kWh. What is the monthly bill for this refrigerator? The atmosphere is at 30°C. [5][CO1]

(b) What is a reversible process? What is the difference between internal and external irreversibility? Explain with examples. [5][CO1]

Q.2 (a) What is Entropy Principle? Explain. [5][CO2]

(b) Using Entropy principle, show that mixing of two fluids results in an irreversible process. [5][CO3]

Q.3 One kg of ice at – 5°C is exposed to the atmosphere which is at 22°C. The ice melts and comes into thermal equilibrium with the atmosphere. (i) Determine the entropy increase of the universe. (ii) What is the minimum amount of work necessary to convert the water back into ice at – 5°C ? Cp of ice is 2.093 kJ/kg K and the latent heat of fusion of ice is 333.3 kJ/kg. [10][CO3]

Q.4 (a) Show that decrease in available energy is equal to increase in unavailable energy when heat is transferred through finite temperature difference. [5][CO2]

(b) Two heat sources (TER's) are at temperatures 500 K and 700 K. If 1234 kJ of heat is withdrawn from each source then calculate (i) AE (ii) UE for both. [5][CO3]

Q.5 (a) Calculate the available energy in 37 kg of water at 85°C with respect to the surroundings at 7°C, the pressure of water being 1 atm. [5][CO3]

(b) What is Gouy Stodala's Theorem? Derive and explain. [5][CO2]

Q.6 (a) A compressor operating at steady state takes in 1 kg/s of air at 1 bar and 27°C and compresses it to 8.1 bar and 162°C. Heat transfer from the compressor to its surroundings occurs at a rate of 98.1 kW. (i) Determine the power input in kW. (ii) Evaluate the second law efficiency for the compressor. Neglect KE and PE changes. Take T_0 = 27°C and P_0 = 1 bar. [5][CO3]

(b) Define (i) Dead state (ii) Maximum work (iii) Maximum useful work (iv) High grade energy and (v) low grade energy [5][CO1]

Q.7 (a) Two kg of air at 498 kPa, 82°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings which is at 100 kPa, 5°C. For this process, determine (i) the maximum work, (ii) the change in availability, and (iii) the irreversibility. For air, take Cv = 0.718 kJ/kg K, u = CvT where Cv is constant, and pV = mRT where p is pressure in kPa, V volume in m^3, m mass in kg, R a constant equal to 0.287 kJ/kg K, and T temperature in K. [5][CO3]

(b) Define second law efficiency and prove that it is related to first law efficiency and Carnot efficiency. [5][CO2]

Total No. of Pages: 2 | 04 Roll No. .....

III SEMESTER

M.Tech. (Thermal)

END SEMESTER EXAMINATION Nov-2022

THE6401 Advanced Power Plant Engineering

Time: 3 Hours *Max. Marks: 40*

Note: 1. Attempt all questions by selecting any two parts from each question
2. Assume suitable missing data, if any.

1	(a)	Specify the region where the water boils in the boiler and the reason for such boiling.	[4]	[CO2]
	(b)	Why water is not superheated in the boiler drum? Discuss	[4]	[CO2]
	(c)	What are the difficulties faced in coal crushing in the power plants and how it can be minimized? Explain	[4]	[CO3]
2	(a)	Describe the working and essential features requirements of any one advanced power cycle	[4]	[CO2]
	(b)	With the help of a simple diagram, explain the essential features of hydro power plant.	[4]	[CO2]
	(c)	Discuss the necessary aspects which direct the choice of particular type of power plant at a specified place. Substantiate your arguments with valid reasoning.	[4]	[CO3]

3 (a) Why Nuclear power reactor uses Control rods and nuclear reactor needs a moderator material? Explain [4][CO1,CO2]

(b) Explain the need of control system in power plants. Justify your answer with at-least one suitable practical example [4][CO4]

(c) How the various types of losses occurring in Steam Turbines can be minimized? [4][CO4]

4 (a) Discuss the various safety provisions necessary for the power plants. [4][CO4]

(b) Compare and contrast the scheduled maintenance and forced maintenance in the power plants [4][CO1,CO2]

(c) List the various project cost components specifying essential and non-essential. Also specify the critical component which can affect the cost/efficiency/power generation [4][CO1,CO2,CO3]

5 (a) How would you determine the Tariff for electric power? Discuss [4][CO1,CO3]

(b) Why achieving the Optimal Dispatch - Scheduling of Hydro-Thermal plants help in reducing the cost as well as resources. Explain [4][CO5]

(c) How load curve can help power plant engineer to design the power plant? Specify your answer is based upon base load/peak load/average load [4][CO5]

Total no. of Pages: 2 106 Roll no.....

1st SEMESTER

M.Tech. (SE)

END TERM EXAMINATION Nov/Dec-2022

SWE501 Software Requirement Engineering

Time: 03:00 Hours Max. Marks: 40

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

Q.1 What are the objectives of software design? How do we transform an informal design to a detailed design? What documents should be produced on completion of the design phase? [10][CO1]

Q.2 What are various activities during software project planning? Describe any two software size estimation techniques. It seems odd that cost and size estimates are developed during software project planning- before detailed software requirements analysis or design has been conducted. Why do we think this is done? Are there circumstances when it should not be done? [10][CO2]

Q.3 Why is maintenance of software important? Discuss the problems faced during software maintenance. Also, Explain the reuse maintenance model with the help of a diagram. [10][CO3]

Q.4 What is Software requirement Specification (SRS)? Why is it important? List the characteristic of a good quality SRS? Why is SRS also known as the blackbox specification of system? Discuss the important issues that an SRS must address. [10][CO4]

Q.5 a) You have been assigned to a team that is developing software for a fax modem. Your job is to develop the "phone book" portion of the application. The phone book function enables up to MaxNames people to be stored along with associated company names, fax numbers, and other related information. Using natural language, define

i. The data invariant.
ii. The state,
iii. The operations that are likely

b) A bubble sort algorithm is defined in the following manner:

```
procedure bubblesort;
var i, t, integer;
begin
repeat until t=a[1]
        t:=a[1];
      for j:= 2 to n do
          if a[j-1] > a[j] then begin
            t:=a[j-1];
            a[j-1]:=a[j];
            a[j]:=t;
            end
    endrep
end
```

i. Partition the design into subfunctions and define a set of conditions that would enable you to prove that this algorithm is correct.
ii. Document a correctness verification proof for the bubble sort discussed in above part.

[5*2=10][CO5]

Q.6 Write short notes on: (ANY TWO) [5*2=10][CO1,3]

a) Capability Maturity Model (CMM)
b) Throw-away prototyping & Evolutionary prototyping
c) Intermediate and Detailed COCOMO model
d) Structured analysis and Structured design.

Q4 (a) What is an activity diagram? What are the basic symbols used in the construction of such a diagram?

(b) Consider the process of maintaining course details in URS. Draw its activity diagram. [8][CO5]

OR

Q.5 (a) What are the various uses of an activity diagram?

(b) Consider the process of scheduling the courses in MyCourses. Draw its activity diagram. [8][CO5]

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FIRST SEMESTER

M.Tech.

END TERM EXAMINATION **Nov-2022**

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.

Q.1 (a) Describe various types of messages in sequence diagram with their notations.

(b) Write short notes on lifeline and focus of control in sequence diagram.

(c) Explain the fountain model with the help of a diagram. List the advantages and disadvantages of this model. [8][CO2, CO5]

Q.2 The goal of this project is to develop a course scheduler, MyCourses. MyCourses will make it possible to enter data and requirements in a simple way using a web-based interface, calculate and propose a schedule, enable manual updates, and finally present the schedule for the selected courses.

The program MyCourses provides as optimal as possible a plan for scheduling courses. Every university is faced each year with the same problem: How to schedule a large number of courses in an optimal way while fulfilling a number of constraints, such as available lecture rooms, limited availability of lecturers, students' selections of the courses, and similar. MyCourses should be implemented as an interactive program that (i) enables entering data, such as courses, the faculty members, the available facilities and some constraints related to the course scheduling, (ii) calculates and proposes a scheduling for courses, (iii) makes it possible to manually update the proposed schedule, but keeping track of the consistent

scheduling. Several users can run an (semi) automatic scheduling process that provides a schedule proposal for a course or a set of courses (e.g. the entire program, or selected courses): the days and time, and places should be scheduled, and (iv) provides a presentation of scheduled courses. Different users can use the program to present data. Examples of presentations: Availability and utilization of the facilities; Schedule of a particular course; Schedule for a faculty member; A schedule for a student (after she defines in which courses is she enrolled), and similar.

Draw the following using standard notations. If necessary, you can make suitable assumptions regarding the details of various features of MyCourses, but you must clearly write down the assumptions you make.

(i) Identify use cases and actors.
(ii) Draw use case diagram for MyCourses
(iii) Write use case description of "Schedule Course" use case. [8][CO5]

OR

Q.2 A university is organized in different teaching schools and each school conducts a variety of programmes. Students are registered in various schools manually based on the admission slips. Students are assigned courses depending upon the scheme of the selected programme. Every school is responsible for its registration process and following are prepared and maintained manually

- List of students registered in a programme.
- List of students registered for a particular course.
- List of courses offered in a particular semester.
- List of faculties in a school.
- Personal details of the students.
- Registration card for every registered student.

University decides to automate the manual registration process in order to improve the existing system. The proposed system should perform the following functions:

- Maintain the personal details of the students.
- Maintain the details of the faculty.
- Maintain the detail of the various courses as per the scheme of the programme.
- Issue of registration card to the student in every semester.
- Generate list of programmes offered by university.
- Generate list of courses offered in a particular semester for a particular programme.

Draw the following using standard notations. If necessary, you can make suitable assumptions regarding the details of various features of URS, but you must clearly write down the assumptions you make.

(a) Identify use cases and actors.
(b) Draw use case diagram for URS
(c) Write use case description of maintain course details use case. [8][CO5]

Q.3 (a) Identify entity class, interface class and control along with their relationships for the MyCourses given above.
(b) List and explain the different types of relationships used in the OOA phase along with their notations. [8][CO5]

OR

Q.3 (a) Identify entity class, interface class and control along with their relationships for URS given above.
(b) Explain multiplicity and its types with examples. [8][CO5]

Q.4 Draw sequence diagram of maintain course details (add and delete sub flows and alternative flows) use case of URS. [8][CO5]

OR

Q.4 Draw sequence diagram of any three use cases (basic flows and alternative flows) of MyCourses. [8][CO5]

Total no. of pages: 02 110 Roll no.....

1_SEMESTER

M.Tech.

END TERM EXAMINATION *Nov-2022*

SWE5405/DSC5405 Advanced Operating System

Time: 3 Hours *Max. Marks: 20*

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

Q.1 How does Peterson Solution provide access to critical section. How many processes does it provide solutions for? How does it provide bounded waiting time? [8][CO2]

Q.2 i. Consider a virtual page reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 Suppose a demand paged virtual memory system running on a computer system such that the main memory has 3-page frames. Then which of the page replacement algorithm has a minimum number of page faults out of FIFO, LRU, and Optimal? [6][CO4]

ii. What is a client-server architecture for communication? [2] [CO6]

Q.3 i) For a two-level paging scheme, the time to access memory access is 150 nanoseconds, the time to service a page fault takes 8 milliseconds, time for an average instruction is 100 nanoseconds of CPU time and two memory accesses. The TLB hit ratio is 90%, and the page fault rate is one in every 10,000 instructions. What is the effective average instruction execution time? [4][CO4]

ii) What is thrashing and how you can overcome it? [4][CO4]

Q.4 What is the requirement for structuring a Page Table and what are the techniques? Explain with examples. [8] [CO4]

Q.5 Disk requests come into the disk driver for cylinders: 82,170,43,140,24,16 and 190 in that order. The disk head is currently positioned over cylinder 50. What is the order of total seek time using each of the following algorithms: a)FCFS, b)SSTF , c) SCAN , d) LOOK ? [8][CO5]

Total no. of Pages: 2 1 / 2 Roll no.....

Third SEMESTER **M.Tech**

END TERM EXAMINATION Nov/Dec-2022

COURSE CODE SWE6205/ DSC6205

COURSE TITLE Statistical Tools

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 What is Sampling? What are the steps involved in the process of Sampling? Explain different sampling techniques with examples. [10]

Q.2 What is statistical testing? Explain the two types of hypotheses. Briefly describe the statistical tools and their advantages. [10]

or

Two snack foods are made and sold in 30 gm packets. Random samples of size 12 are taken from the production line of each snack food, and means and variances obtained viz.: $mean_1$ 31.75 gm, $variance_1$ 112.25 gm^2; $mean_2$ 28.67 gm, $variance_2$ 66.64 gm^2. What can be said about the two production processes in relation to the weight of packets? [10]

Q.3 What is an identifier in python? Which of the following are valid or invalid identifiers: my_school, 1my_school, my1school, my@school, along with reason? What is the output of print str[2:5] if str='Hello World!'? [10]

Q.4 What is the difference between a programming and a scripting language? Write a python program to input 10 numbers and count the number of even and odd numbers from those inputted by the user. Print the even and odd numbers. [10]

or

Why is Python a powerful language? What are its data types? What is the role of comments and indentation in the Python program? [10]

Q.5 Explain bias and its types with examples from your field. Also Explain bias/variance tradeoff. [10]

Total no. of Pages: 2 1/4 Roll no.....

3rd SEMESTER

M.Tech.

END TERM EXAMINATION **Nov/Dec-2022**

SWE6307 Software Reliability

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 What is software reliability? Can software testing improve software reliability? If yes, then explain the ways software testing improves software reliability. [10] [CO1]

Q.2 What are the major areas of uncertainty that make accurate software reliability predictions problematic to obtain? Summarize each area. [10] [CO2]

Q.3 What are the assumptions of the execution-time component model? Compare the execution-time component for basic model and the logarithmic Poisson model. [10] [CO3]

Q.4 Assume a program will experience a total of 200 failures. Initial failure intensity is 16 failure/ CPU hr. It has now experienced 50 failures. Determine the following after specifying the formula. [3+3+4= 10] [CO3]

a) Current failure intensity.
b) Decrement of failure intensity.
c) Failure intensity at 100 CPU hr.

Q.5 Checkpointing and restart implemented in distributed transaction processing environments can allow a system to tolerate certain software faults. What are the reasons for the software fault tolerance? What are the factors that determine the level of software fault tolerance achieved with the technique in such environments? What are the advantages and disadvantages of using the above technique as compared with using the techniques such as N-version programming and recovery blocks? [10][CO4]

Q.6 Write a short note on: [4+3+3=10][CO4]

a) Markovian Models
b) Okumoto Model
c) Yamada delayed S-shaped Models

Total No. of Pages 01 116 Roll No. .....

THIRD SEMESTER M.Tech. (SWE/DSC)

END SEMESTER EXAMINATION NOV-2022

SWE-6405 THINGS OF INTERNET/DSC-6405 INTERNET OF THINGS

Time: 3:00 Hours *Max. Marks: 40*

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

1. [a] Draw and discuss IoT data lifecycle . [4][CO1]
   [b] Explain conceptual view of IoT? [4][CO5]

2. [a] Enlist and explain four design tool of IoT platform. [4][CO2]
   [b] What is loop functions used in Arduino IDE. Maximum how many times per second the loop function run and why? [4][CO1]

3. [a] Draw component diagram of Arduino bread board and Nano. [4][CO2]
   [b] Elaborate SOAP protocol and their characteristics. [4][CO3]

4. [a] Explain the IoT design methodology and security solutions. [4][CO5]
   [b] Explain architecture of Wireless Sensor Network technology [4][CO4]

5. [a] Discuss Industrial IoT and Automotive IoT. [4][CO3]
   [b] Discuss IoT cloud-based services. [4][CO5]

1st SEMESTER **M.Tech./PhD** 117

END TERM EXAMINATION *Nov-2022*

COURSE CODE :SPD-501 COURSE TITLE:Advanced DSP

Time: 3 Hours *Max. Marks: 100*

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

Q.1 **(a)** Give two examples of Minimum, Maximum and Mixed Mode Systems and give details about one application where one of them can be used.

(b) How do we mitigate the limited register length problem.

[10+10][CO-6]

Q.2 **(a)** Design a Wiener filter for prediction.Mention all quality issues.

(b) Write the way ESPRIT Algorithm detects harmonics.

[10+10][CO-1,3]

Q.3**(a)** When does Quadrature Mirror Filter becomes an ideal filter . Show all design equations and prove mathematically.

(b) . Write the difference between Pisarenko and MUSIC methods for harmonic analysis. [10+10][CO- 2,6]

Q.4 **(a)** What is different about adaptive filters.Give detailed design of RLS Algorithm and comment on the Kalman Gain.

(b) Design 3rd order Linear Prediction Filter.

[10+10][CO- 1,3]

Q.5 (a) Use Levinson and Durbin algorithm to design second order Linear filter.

(b) . Write note on the following two:

(i) Comb Filter

(ii). Interpolators

[10+10][CO- 5]

Total no. of Pages:2 118 Roll no.....

1st SEMESTER

M.Tech

END TERM EXAMINATION *Nov/Dec-2022*

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 Answer all the questions

a. Define Hit and miss transformation [1.5][CO5]

b. Differentiate between patterns and pattern classes [1.5][CO6]

c. Analyse the burtterworth LPF and Gaussian LPF in the frequency domain and draw their transfer function [2][CO5]

d. differentiate between image enhancement and image restoration [1.5][CO4]

e. Define brightness, hue and saturation [1.5][CO1]

Q.2

a. For a 3 bit image having 4096 pixels with the gray levels as 0, 1, 2, 3, 4, 5, 6 and 7. The corresponding number of pixels in image are 790, 1023, 850, 656, 329, 245, 122, 81.
   i. Compute and show the histogram of the image
   ii. Compute and show the equalized histogram
   iii. Compare and comment over both the histograms [6][CO3]

b. Discuss the histogram processing of color image [2][CO2]

Q.3

a. Explain about Boundary Extraction and Region Filling Algorithm [3][CO5]

b. What do you understand by the opening and closing operation. And what will be the use case of each. If opening operation is performed 5 times to an image, what will be its effect. [2.5][CO5]

c. What do you understand by adaptive median filter and discuss the algorithm steps [2.5][CO4]

Q.4

a. Consider a 8 bit image of size 4x8

25	25	25	100	165	245	245	245
25	25	25	100	165	245	245	245
25	25	25	100	165	245	245	245
25	25	25	100	165	245	245	245

i. Calculate the entropy of the image
ii. Compress the image using Huffman coding
iii. Compute the compression achieved and the effectiveness of the Huffman coding.
iv. Consider coding the differences between adjacent pixels. What is the entropy of the new difference image? Compare and examine the results with earlier.

[4][CO5]

b. Explain the Canny edge detector in detail and the use of double thresholding in it

Or

Explain the segmentation by region growing and also discuss region splitting and merging

[4][CO5]

Q.5

a. Derive the image restoration technique of weiner filtering and what is the advantage of weiner filtering over inverse filtering.

[6][CO4]

b. A sinusoidal periodic noise is available in the image. Recommend the filter which can be used to remove this noise. Justify your answer.

[2][CO4]

1st SEMESTER
M.TECH

120

END TERM EXAMINATION NOV 2022

COURSE CODE: **SPD5303 Wavelets in Signal Processing**

TIME: 3:00 Hours Max. Marks: 50

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

Q1:

(a) What are the similarities between wavelet and Fourier transforms?

(b) What are the dissimilarities between wavelet and Fourier transforms?

[2 Marks][CO3]

Q2:

(a) What is your understanding of a lossy compression and why is it important?

(b) Why is wavelet-based compression useful?

[2 Marks][CO4]

Q3:

How are the problems of redundancy and impracticality in wavelet transforms solved?

[2 Marks][CO4]

Q4:

Describe the Coiflet wavelet using both mathematical and diagrammatic representations in your description.

[2 Marks][CO3]

Q5:

Differentiate resolution properties of wavelet transform and short time fourier transform (STFT).

[2 Marks][CO2]

Q6:

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.

[2 Marks][CO4]

Q7:

Develop the edge detection of image similarity application of wavelets.

[2 Marks][CO5]

Q8:

Describe modeling and seismic studies similarity application of wavelets.

[2 Marks][CO6]

Q9:

What is the significance of using the multiscale/multiresolution technique?

P. T. O

[2 Marks][CO3]

Q10:

(a) Describe briefly, by using both Haar and Daubechies-2 wavelets, what is the rough definition of wavelets.

(b) What are the vanishing moments of them?

[2 Marks][CO2]

Q11:

(a) Are there cases when orthogonality may be required in order to improve image compression and reconstruction performance?

(b) How can orthogonality be achieved in this case?

[4 Marks][CO2]

Q12:

(a) Describe the ECG signal.

(b) Name the different types of features and noises that may distort the ECG signal.

(c) Describe the application of the decomposition of the first-level DWT to the ECG signal.

[1+2+1 = 4 Marks][CO5]

Q13:

Draw flowchart that can be used in the calculation and in the removal of noise from an ECG signal.

[4 Marks][CO6]

Q14:

(a) Why is image segmentation important?

(b) What are some of the applications of image segmentation?

(c) What are the different types of image segmentation processes?

(d) What is image segmentation thresholding? What are the three types of thresholding?

[4 Marks][CO5]

Q15:

(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][CO5]

Q16:

Write the abstract on identified the three latest trends with the need in the field of (i) signal and (ii) image processing using wavelet transforms

[10 Marks][CO6]

Q.11) For a flat fading channel having gain α with the probability of channel in the fading condition as follows: [4 Marks][CO5]

[α_1=0.05 Pr(α_1)=0.1], [α_2=0.5 Pr(α_2)=0.5], [α_3=1.0 Pr(α_3)=0.4]

The transmit power is 10mW with bandwidth of 30kHz and channel is corrupted by AWGN noise with power spectral density No/2, where No=10^{-9} W/Hz.

a.) Find Shannon capacity of channel when receiver has knowledge of CSI but transmitter doesn't know CSI.

b.) Compare the capacity obtained in (a) with the capacity of AWGN channel with same average SNR.

Q.12) Using SVD, find the equivalent parallel channel model for a MIMO channel with channel gain matrix given as [4 Marks][CO6]

$$H = \begin{bmatrix} .1 & .3 & .7 \\ .5 & .4 & .1 \\ .2 & .6 & .8 \end{bmatrix}$$

----------END OF PAPER----------

Total no. of Pages: 04

Roll no.....

SEMESTER I

M.Tech.

END TERM EXAMINATION **Nov-2022**

SPD5401 Wireless Communication

Time: 3:00 Hours *Max. Marks: 40*

Note : Attempt any 10 questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1) Explain the following terms: [4 Marks][CO1]

a.) Cyclic Prefix

b.) Frequency Selective and Frequency Flat Fading

c.) Brewster Angle

d.) Rayleigh and Rician Fading

Q.2) Consider an AWGN channel with N branch diversity combining and Υ_i = 10 dB per branch. Assume MQAM modulation with M = 4 and use the following approximation for bit error probability, where Υ is the received SNR. [4 Marks][CO4]

$$P_b = .2e^{-1.5\gamma/(M-1)}$$

(a) Find P_b for N = 1.

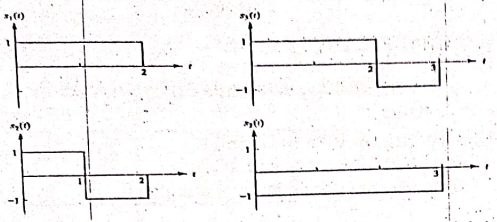
(b) Find N so that under MRC, $P_b < 10^{-6}$.

Q.3) Consider a time-invariant block fading channel with frequency response. For a transmit power of 10mW and a noise power spectral density of 0.001 μ W per Hertz, find the optimal power allocation and corresponding Shannon capacity of this channel. [4 Marks][CO2]

$$H(f) = \begin{cases} 1 & f_c - 20\text{MHz} \le f < f_c - 10\text{MHz} \\ .5 & f_c - 10\text{MHz} \le f < f_c \\ 2 & f_c \le f < f_c + 10\text{MHz} \\ .25 & f_c + 10\text{MHz} \le f < f_c + 20\text{MHz} \\ 0 & \text{else} \end{cases}$$

Q.4) Consider the signal waveforms as shown below. Orthogonalize them using Gram Schmidt Process and obtain their basis functions.

[4 Marks][CO3]



Q.5) Derive the probability of error expression for Rayleigh Faded channel. **[4 Marks][CO2]**

Q.6) In an additive white Gaussian noise channel with noise power-spectral density of No/2, two equiprobable messages are transmitted by

$$s_1(t) = \begin{cases} \frac{At}{T}, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$$

$$s_2(t) = \begin{cases} A\left(1 - \frac{t}{T}\right) & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$$

Determine the probability of error if the two equiprobable signals have the same energy and therefore the optimal receiver bases its decisions on the rule: **[4 Marks][CO3]**

$$\int_{-\infty}^{\infty} r(t)s_1(t)dt \underset{s_2}{\overset{s_1}{\gtrless}} \int_{-\infty}^{\infty} r(t)s_2(t)dt$$

Q.7) What is OFDM? With help of suitable block diagram, describe its functioning. **[4 Marks][CO6]**

Q.8) A received signal vector y is described as follows:

$$Y = [2+j\ 1-2j] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + n$$

where x_1, x_2 are transmitted symbols, n is the AWGN noise vector. Using Alamouti scheme, decode x_1, x_2 and find out its BER. **[4 Marks][CO4]**

Q.9) Consider a set of M orthogonal signal waveforms S_m (t), $1 \le m \le M$, $0 \le t \le T$, all of which have the same energy E. Define a new set of M waveform as: **[4 Marks][CO3]**

$$s'_m(t) = s_m(t) - \frac{1}{M}\sum_{k=1}^{M} s_k(t), \quad \begin{matrix} 1 \le m \le M \\ 0 \le t \le T \end{matrix}$$

Show that the M signal waveform {s'm(t)} have equal energy

$$\mathcal{E}' = (M-1)\mathcal{E}/M$$

Prove that the two sets are equally correlated, with correlation coefficient

$$\gamma_{mn} = \frac{1}{\mathcal{E}'}\int_0^T s'_m(t)s'_n(t)\,dt = -\frac{1}{M-1}$$

Q.10) Two independent random variables X and Y have following density functions: **[4 Marks][CO1]**

$f_X(x) = \begin{cases} a.e^{-2x}, & x \ge 0 \\ 0, & \text{else} \end{cases}$

$f_Y(y) = \begin{cases} b.y.e^{-3y}, & y \ge 0 \\ 0, & \text{else} \end{cases}$

Compute:

a.) Value of a and b.

b.) P(X+Y>1)

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Total no. of Pages:02 Roll no.....

III-SEMESTER (M.Tech.)

END TERM EXAMINATION *Nov/Dec-2022*

COURSE CODE: SPD 6203 COURSE TITLE: MULTIRATE SIGNAL PROCESSING

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 What is Multirate signal processing (MSP) and explain MSP operations with suitable example and mathematical derivations. [5] [CO1]

Q.2 Explain need of sampling and derive interpolation formula for reconstruction. [5][CO2]

Q.3 Explain the need of polyphase representation by interpolation and decimation operations. [5][CO2]

Q.5 Design a quadrature mirror filter bank using polyphase representation. [5][CO3]

Q.5 Write short notes on the balanced and symmetrical Multirate Filters. [5][CO3]

Q.6 Derive the distortion and aliasing transfer functions for two-channel QMF bank. [5][CO4]

Q.7 Consider the system shown in Fig. 1. Simplify it for distortion and aliasing transfer functions and comments on the outcomes. [5][CO4]

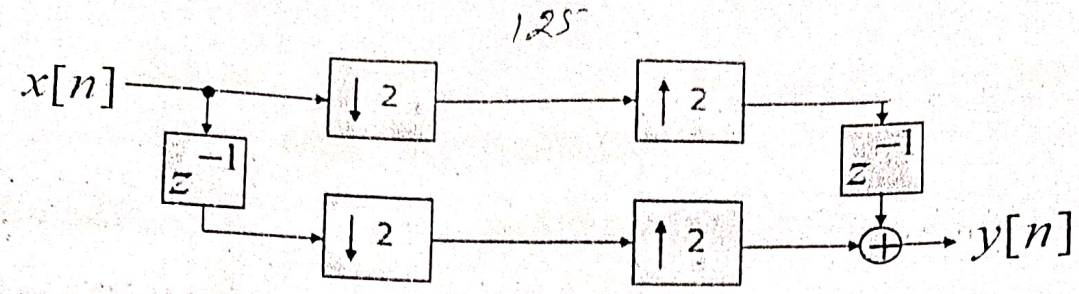


Fig. 1

Q.8 What is paraunitary filter banks and explain their properties. [5][CO4]

Q.9 Explain Cosine modulated filter bank and design by polyphase decomposition. [5][CO4]

Q.10 Explain quantization effects with types. [5][CO5]

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Total No. of Pages: 5 *Roll No. .....*

THIRD SEMESTER **M. Tech.SPDD**

END TERM EXAMINATION *Nov-2022*

SPD 6301 : Data Analytics

Time: 3:00 Hours *Max. Marks: 50*

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

Q.1 a) For a frequency distribution, the coefficient of skewness is 1.2. If the sum of the 1st and 3rd quarterlies is 200 and median is 76, find the value of the third quartile. [2] [CO-2]

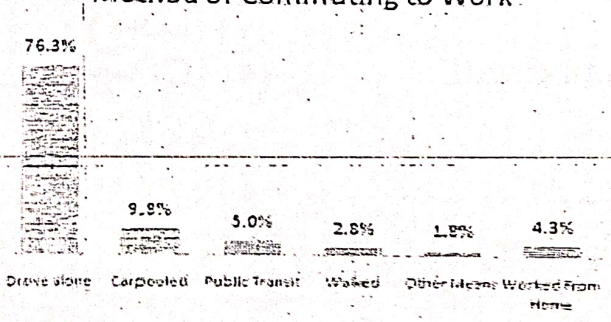
b) Why do we use feature engineering in data science? [2] [CO-1]

c) Apply linear regression using the method of least squares to the following data and predict the crop yield for rainfall of 5 cm.

Rain fall in (cms)	10.5	8.8	13.5	12.5	18.8	10.3	7	15.6	16
Paddy yield (Quintel per acre)	30.3	46.2	58.8	59.0	82.4	49.2	31.9	76	78.8

[6] [CO-4]

Q.2 a) In the 2010 United States census, data was collected on how people get to work i.e., their method of commuting. The results are shown in the graph below. A sample of 1000 workers is taken from Santa Clara County. Results are shown in the table below. Conduct a Chi-square goodness-of-fit test to check whether people living in the area commute with similar proportions. Design and conduct a hypothesis test at the 5% significance level. [5] [CO-3]



Method of Commutation	Frequency
Drive Alone	764
Carpooled	105
Public Transit	34
Walked	20
Other Means	30
Work from Home	47

b) Suppose the National Transportation Safety Board (NTSB) wants to examine the safety of compact cars, midsize cars, and full-size cars. It collects a sample of three for each of the treatments (car types). Using the hypothetical data provided below, test at 5% level, whether the mean pressure applied to the driver's head during a crash test is equal for each type of car. Use $\alpha = 5\%$

	Compact cars	Midsize cars	Full-size cars
	643	469	484
	655	427	456
	702	525	402
$\bar{X}$	666.67	473.67	447.33
S	31.18	49.17	41.68

(i) State the null and alternative hypotheses
(ii) Calculate the appropriate test statistic and construct the one-way ANOVA table for the data.
(iii) Obtain the Critical Value (Use F-table, see appendix)
(iv) Decision Rule
(v) Interpretation

[5] [CO-3]

Q.3 a) Why is the KNN Algorithm known as Lazy Learner? [2] [CO-5]

b) Define Information Gain and Gini Index. What are these parameters used for? What does Zero and One values of Entropy signifies? [3] [CO-5]

c) Compute the Linear Discriminant projection for the following two-dimensional dataset:

- X1= (x1, x2) = {(4,2),(2,4),(2,3),(3,6),(4,4)}
- X2= (x1, x2) = {(9,10), (6,8), (9,5), (8,7), (10,8)} [5] [CO-5]

Q.4 a) Derive an expression of linear discriminant function for a linear decision boundary. [4] [CO-5]

b) What are different types of Kernels used in support vector machines to solve the problem of nonlinearity in the data set? [2] [CO-6]

c) Discuss perceptron neural network in detail. [4] [CO-5]

Q.5 a) Consider the following one-dimensional data set: 12, 22, 2, 3, 33, 27, 5, 16, 6, 31, 20, 37, 8 and 18. Given k = 3 and initial cluster centers to be 5; 6 and 31; what are the cluster centres obtained on applying the k-means algorithm after second iteration? [5] [CO-5]

b) For the statement given below, say whether it is true or false, and give a one or two sentence justification of your answer.

a. Adding more training data always reduces overfitting

b. A linear SVM will find the same decision boundary as logistic regression. [3] [CO-6]

c) What is the purpose of cross validation? [2] [CO-2]

Q.6 a) Explain Reinforcement Learning and its applications. [5] [CO-5]

b) Discuss about ensemble learning. Also Compare Bagging, Boosting and Stacking. [5] [CO-6]

Appendix: F-Distribution Table and Chi-Square distribution Table

DF1 $\alpha = 0.05$

DF2	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	Inf
1	161.45	199.5	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.1	251.14	252.2	253.25	254.31
2	18.513	19	19.164	19.247	19.296	19.33	19.353	19.371	19.385	19.396	19.413	19.429	19.446	19.454	19.462	19.471	19.479	19.487	19.496
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	8.7855	8.7446	8.7029	8.6602	8.6385	8.6166	8.5944	8.572	8.5494	8.5264
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.041	5.9988	5.9644	5.9117	5.8578	5.8025	5.7744	5.7459	5.717	5.6877	5.6581	5.6281
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	4.7351	4.6777	4.6188	4.5581	4.5272	4.4957	4.4638	4.4314	4.3985	4.365
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.099	4.06	3.9999	3.9381	3.8742	3.8415	3.8082	3.7743	3.7398	3.7047	3.6689
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.866	3.787	3.7257	3.6767	3.6365	3.5747	3.5107	3.4445	3.4105	3.3758	3.3404	3.3043	3.2674	3.2298
8	5.3177	4.459	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.2839	3.2184	3.1503	3.1152	3.0794	3.0428	3.0053	2.9669	2.9276
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.0729	3.0061	2.9365	2.9005	2.8637	2.8259	2.7872	2.7475	2.7067
10	4.9646	4.1028	3.7083	3.478	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.913	2.845	2.774	2.7372	2.6996	2.6609	2.6211	2.5801	2.5379
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.948	2.8962	2.8536	2.7876	2.7186	2.6464	2.609	2.5705	2.5309	2.4901	2.448	2.4045
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.6866	2.6169	2.5436	2.5055	2.4663	2.4259	2.3842	2.341	2.2962
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	2.671	2.6037	2.5331	2.4589	2.4202	2.3803	2.3392	2.2966	2.2524	2.2064
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	2.6022	2.5342	2.463	2.3879	2.3487	2.3082	2.2664	2.2229	2.1778	2.1307
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	2.5437	2.4753	2.4034	2.3275	2.2878	2.2468	2.2043	2.1601	2.1141	2.0658
16	4.494	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	2.4935	2.4247	2.3522	2.2756	2.2354	2.1938	2.1507	2.1058	2.0589	2.0096
17	4.4513	3.5915	3.1968	2.9647	2.81	2.6987	2.6143	2.548	2.4943	2.4499	2.3807	2.3077	2.2304	2.1898	2.1477	2.104	2.0584	2.0107	1.9604
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	2.4117	2.3421	2.2686	2.1906	2.1497	2.1071	2.0629	2.0166	1.9681	1.9168
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	2.3779	2.308	2.2341	2.1555	2.1141	2.0712	2.0264	1.9795	1.9302	1.878
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.599	2.514	2.4471	2.3928	2.3479	2.2776	2.2033	2.1242	2.0825	2.0391	1.9938	1.9464	1.8963	1.8432
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.366	2.321	2.2504	2.1757	2.096	2.054	2.0102	1.9645	1.9165	1.8657	1.8117
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	2.2967	2.2258	2.1508	2.0707	2.0283	1.9842	1.938	1.8894	1.838	1.7831
23	4.2793	3.4221	3.028	2.7955	2.64	2.5277	2.4422	2.3748	2.3201	2.2747	2.2036	2.1282	2.0476	2.005	1.9605	1.9139	1.8648	1.8128	1.757
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	2.2547	2.1834	2.1077	2.0267	1.9838	1.939	1.892	1.8424	1.7896	1.733
25	4.2417	3.3852	2.9912	2.7587	2.603	2.4904	2.4047	2.3371	2.2821	2.2365	2.1649	2.0889	2.0075	1.9643	1.9192	1.8718	1.8217	1.7684	1.711
26	4.2252	3.369	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	2.2197	2.1479	2.0716	1.9898	1.9464	1.901	1.8533	1.8027	1.7488	1.6906
27	4.21	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	2.2043	2.1323	2.0558	1.9736	1.9299	1.8842	1.8361	1.7851	1.7306	1.6717
28	4.196	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.236	2.19	2.1179	2.0411	1.9586	1.9147	1.8687	1.8203	1.7689	1.7138	1.6541
29	4.183	3.3277	2.934	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229	2.1768	2.1045	2.0275	1.9446	1.9005	1.8543	1.8055	1.7537	1.6981	1.6376
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	2.1646	2.0921	2.0148	1.9317	1.8874	1.8409	1.7918	1.7396	1.6835	1.6223
40	4.0847	3.2317	2.8387	2.606	2.4495	2.3359	2.249	2.1802	2.124	2.0772	2.0035	1.9245	1.8389	1.7929	1.7444	1.6928	1.6373	1.5766	1.5089
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2541	2.1665	2.097	2.0401	1.9926	1.9174	1.8364	1.748	1.7001	1.6491	1.5943	1.5343	1.4673	1.3893
120	3.9201	3.0718	2.6802	2.4472	2.2899	2.175	2.0868	2.0164	1.9588	1.9105	1.8337	1.7505	1.6587	1.6084	1.5543	1.4952	1.429	1.3519	1.2539
Inf	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8799	1.8307	1.7522	1.6664	1.5705	1.5173	1.4591	1.394	1.318	1.2214	1

F-Distribution Table

	Chi-Square Right-Tail Probability ($\geq \chi^2$)									
DF	0.995	0.99	0.975	0.95	0.9	0.1	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Chi-Square Distribution Table

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III-SEMESTER

M.Tech. (SPDD)

END TERM EXAMINATION Nov-2022

SPD-6407 Digital Design and Verification

Time: 3:00 Hours *Max. Marks: 40*

Note : Attempt any five questions

Q1. (a) What is Drain Induced Barrier Lowering. Explain it in detail with a diagram and mathematical expression. Explain the ways to reduce the same. (4) (CO1)

(b) What is Noise Margin? Derive the expression of the same for Resistive Load Inverter. (4) (CO3)

Q2. (a) What is MOSFET scaling? Explain the types of the sample with examples? (4) (CO2)

(b) Derive an expression for the switching Power Dissipation of CMOS inverter. (4) (CO3)

Q3. (a) Explain CMOS Transmission gates and applications of the same. (4) (CO4)

(b) Implement and explain in detail CMOS D Latch. (4) (CO3)

Q4. (a)Explain the behavior of Bistable elements with diagram. (4) (CO3)

(b) Explain the behavior of MOSFET under different bias condition with expressions along with the band diagram ? (4) (CO1)

Q5. (a) Implement Two-Input NOR and NAND Gate with Depletion NMOS Load. (4) (CO4)

(b) Draw and explain layout of CMOS NAND2 and NOR2 gate. (4) (CO5)

Q6. (a) Implement the following Boolean function expression using CMOS logic circuits : (4) (CO4)

$$Z = \overline{(D+E+A)(B+C)}$$

Calculate the (W/L) ratio of the same.

(b) Explain MOSFET capacitances with diagram and mathematical expressions. (4) (CO2)

Total No. of Pages 03

Roll No. .....

FIRST SEMESTER

M.Tech.(C&I)

END SEMESTER EXAMINATION Nov/Dec 2022

C&I 501 System Theory

Time: 3:00 Hours. *Max. Marks :40*

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

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

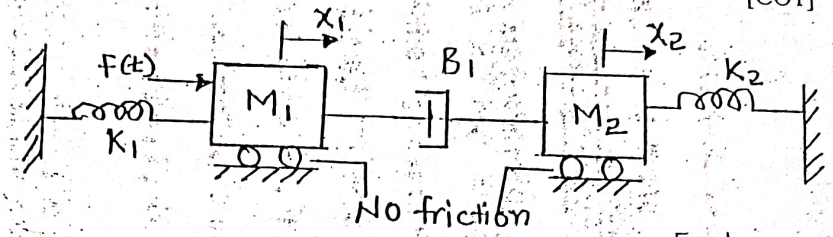


Fig.1

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

$$\frac{d^3x(t)}{dt^3} + 3\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 4x(t) = u_1(t) + 4u_2(t) + 6u_3(t)$$

Outputs are

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

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

2 [a] Solve the difference equation [CO2]

$$c(k+2) + 3c(k+1) + 2c(k) = u(k);\ c(0) = 1$$

$$c(k) = 0\ for\ k < 0.$$

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2 [b] For the sampled-data control system shown in Fig.2, find output c(k) for r(t)=unit step input. [CO2]

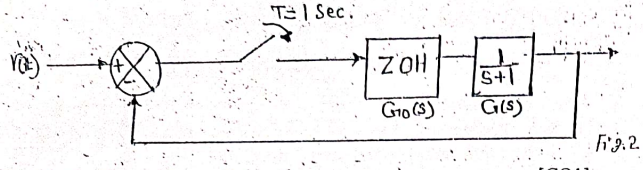


Fig.2.

3 [a] For a system represented by the state equation [CO1]
$\dot{X}(t)=AX(t)$, *the response of*

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

And

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

Determine the system matrix A and state transition matrix.

3[b] Find the transfer function from the data given below for continuous system. [CO3]

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

4 [a] Discuss the advantages of modern control theory over the classical control theory. [CO1]

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]

5[a] Check the stability of the following characteristic equation using Jury's stability test. [CO2]

$$5Z^2-2Z+2=0$$

5[b] Consider the dynamics of a non-homogeneous system as [CO4]

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

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 STM of the following system

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

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

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

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

$$y(k+2)+5y(k+1)+6y(k)=u(k)$$
$$y(0)=y(1)=0; T=1\ sec.$$

(a) Determine the state model in canonical form
(b) Find state transition matrix
(c) Determine the state model in phase variable form
(d) For input u(k)=1 for k≥0, find output y(k). [CO3]

8. Discuss the concept of controllability and observability in control system with the help of neat diagrams. Discuss the Kalman's method for determining controllability and observability using a suitable example. [CO4]

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Total no. of Pages: 2 Roll no.....

1st SEMESTER M. Tech (C&I)

END TERM EXAMINATION Nov/Dec-2022

COURSE CODE: C&I-503 COURSE TITLE: Measurement & Instrumentation

Time: 03:00 Hours Max. Marks: 40

Note: 1. Total 8 questions are there. All questions are compulsory.
2. Assume suitable missing data, if any.
3. CO means course outcome number

Q.1 A dynamometer arm makes contact with the piezoelectric load cell as shown in Fig 1. The g-constant of the piezoelectric material is 50×10^{-3} Vm/N and the surface area of the load cell is 4 cm^2. If a torque $\tau = 20$ Nm is applied to the dynamometer, find the output voltage V_o of the load cell.

[6][CO4]

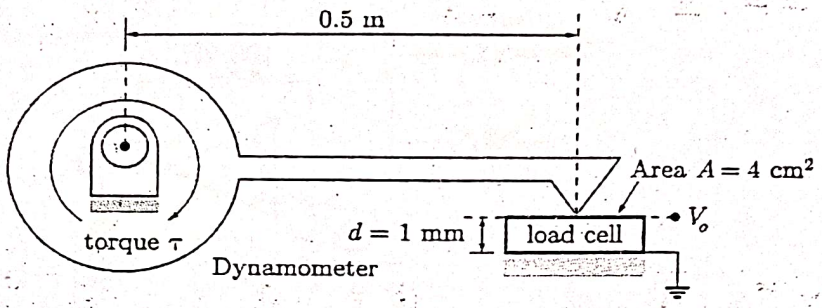


Fig. 1

Q.2 A resistance R_T of a resistive transducer is modeled as $R_T = R(1 - Kx)$ where K is the constant of transformation and x the input quantity being sensed. The resistor is connected to an ideal op-amp as shown in Fig 2. The value of R is 100 Ω, K is 0.004 and x is 75. Find the output voltage V_o.

[6][CO4]

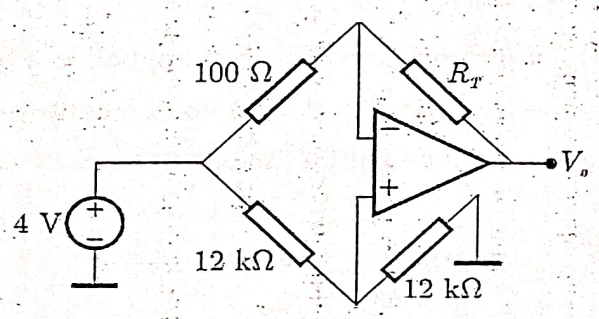


Fig. 2

P.T.O

Q.3 Define piezo-resistive effect. Derive the relationship between the Gauge factor and the ratio of the strain produced in metallic wire resistance to the strain produced in its length. Assume tensile force (is applied to the metallic wire). [5][CO4]

Q.4 Describe the working of the DC tachometer for measuring the angular speed of the shaft with the help of a suitable schematic diagram. [6][CO4]

Q.5 Describe the working of the R-2R ladder DAC converter with the help of suitable circuits diagrams. Assume a 3-bit input signal. [6][CO4]

Q.6 If $V_1 = 0.2$ V, $V_2 = 0.6$ V and $V_o = -7$ V and the op-amp is ideal. Find the value of resistance R_1 in Fig. 3 [4][CO4]

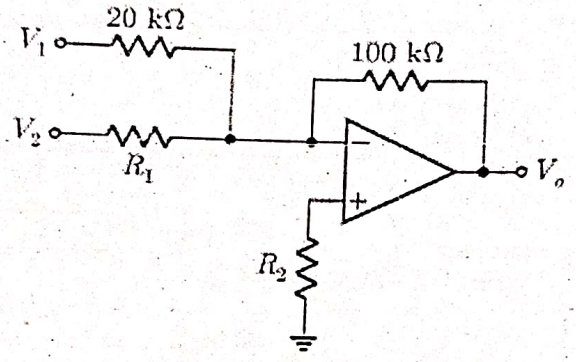


Fig. 3

Q.7 An 8-bit DAC produces $V_o = 0.02$ volts corresponding to digital input signal equal to 00000001. Find the full-scale output and its resolution. Find V_o if the input signal is 00101011. [4][CO4]

Q.8 Let $V_N = 0.2$ volts and $V_p = 4$ volts is applied to a basic Opamp. Let the common mode signal is $V_{cm} = 0.04$ volts. Let the open loop gain is 1000. Find the common mode gain if the output of this basic Opamp is V_o=10 volt [3][CO4]

********** END OF QUESTION PAPER **********

Total no. of Pages: 2

ROLL NUMBER: _ _ _ _ _

END TERM EXAMINATION(M.Tech)

Nov/Dec-2022

COURSE CODE : C&I 5205(a)

COURSE TITLE : NETWORKED CONTROL SYSTEMS

Time: 03:00 Hours *Max. Marks: 40*

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

Q.1 Given an undirected, connected graph with each node dynamics governed by a double integrator model. Sate and prove the agreement protocol for the network. [10 Marks][CO 3, 4]

Q2. Given a static network (undirected and time-invariant) of 5 robots formulate a problem and solution such that all the robots move along same direction with same speed, For the solution consider any graph of your choice, mention the mathematical model of the agents and prove that your solution will work. [10 Marks][CO 1,2]

Q.3 Find a decentralized optimal control law for a network of linear time invariant systems such that the systems achieve consensus. [10 Marks][CO 4,5]

Q.4 Find the condition under which the following system is Asymptotically Stable. The functions h(.) and f(.) are nonlinear; α, β are constants.

$$\dot{x}_1 = x_2 - h(x_1)$$
$$\dot{x}_2 = -(\alpha + \beta)x_2 - x_1 - tanh(x_2)f(x_2)$$

[10 Marks][CO 1,2]

Q.5 Given a network (undirected, connected and time invariant) of three systems (agents) with the dynamics described as:

$$\dot{x}_i = sin(x) + 2u$$

where x and u are scalar variables. Design u such that all the three system states converge to a same value asymptotically. [10 Marks][CO 4, 5]

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Total No. of Pages 02 137 Roll No. .....

M.Tech (C&I) FIRST SEMESTER

End Term Examination (Nov.–2022)

C&I 5303 NON-LINEAR CONTROL THEORY

Time: 03 Hours *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] Draw the output of the following nonlinear element, whose input (x) vs output(y) characteristicss are shown in Fig.1. Assume sinusoidal input $x(t) = X\sin t$.

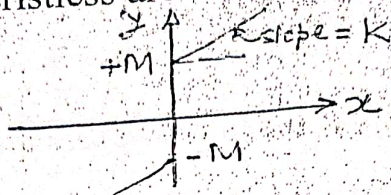


Fig.1.

[b] Determine the equilibrium states of the nonlinear system represented by the following state equations.

$$\dot{x}_1 = x_2$$
$$\dot{x}_2 = -x_1 - x_1^2(x_2 - 1)$$

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

$$V(x) = -x_1^2 - 3x_2^2 - 6x_3^2 + 2x_1x_2 - 4x_2x_3 - 2x_1x_3$$

[d] Draw the phase plane trajectory of the following first order linear system.

$$\dot{x} + x = 0$$

[e] Write the equation of a second order nonlinear oscillator and show that there exists a limit cycle. **2x5**

2 [a] Using Krasovskii's method to assess the stability of nonlinear system described as: **05**

$$\dot{x}_1 = -5x_1 + 4x_2$$
$$\dot{x}_2 = x_1 - 2x_2 - x_2^5$$

[b] Derive the describing function for the continuous nonlinearity described by the following input and output relation. **05**

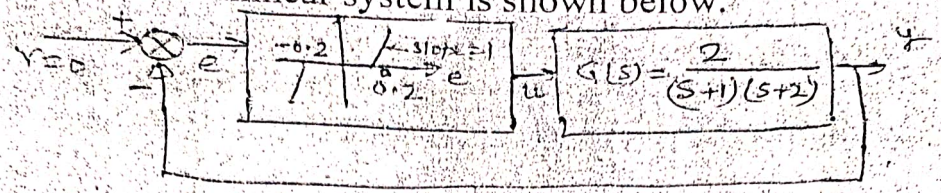
$y = k x^3$ where x is the input and y is the output.

3. For the nonlinear system described as follow

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

(a) Find the equilibrium points.
(b) In this system determine the type of singular points and their stabilty. **10**

4. A second order nonlinear system is shown below.



Write the equation of isocline and sketch phase plane trajectory. **10**

5. [a] Use the Lyapunov direct method to construct suitable Lyapunov function and determine the stability of the LTI system described by

$$\dot{x} = \begin{bmatrix} -1 & 1 \\ -1 & -1 \end{bmatrix} [x] + \begin{bmatrix} 1 \\ 1 \end{bmatrix} [u]$$

05

[b] Find sign definiteness of the scalar function.

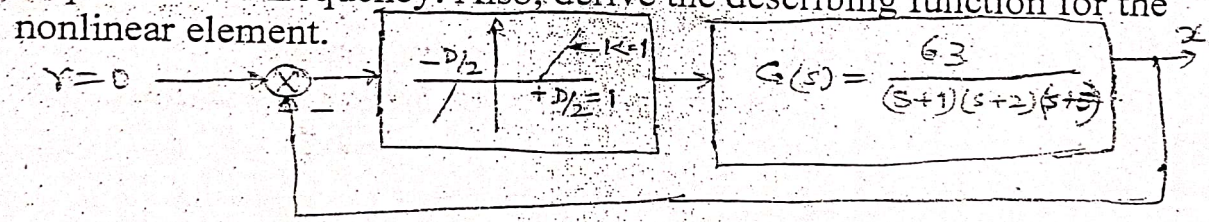
$$V(x) = x_1^2 + x_2^2 + 2x_1x_2$$ **05**

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

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

Show that the origin is a globally stable equilibrium state of the system. **10**

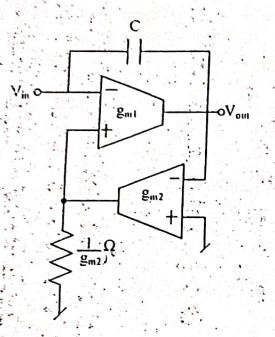
7. For the Nonlinear system shown below, check if a limit cycle is Predicted. If limit cycle exits assess its stability and determine its amplitude and frequency. Also, derive the describing function for the nonlinear element. **10**



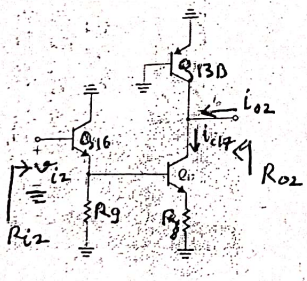
[b] Draw the circuit diagram of the bipolar Wilson current mirror and derive an expression for its output resistance and therefrom state the conditions under which it can be approximated by (β/2) times the output resistance of a simple current mirror. **4.0**

7 [a] Design a circuit using OTAs only (Try to use as few of them as possible) to realize the output voltage $2V_1 - 3V_2$ **3.0**

[b] Determine the transfer function of the circuit shown below in Fig. 4 and identify the filter circuit filter realized by the circuit. **3.0**



8 The following figure shows the intermediate stage of the opamp IC uA741. Perform a small signal analysis of this circuit and determine (i) the transconductance (ii) input impedance and (iii) output impedance. **6.0**



Total No. of Pages: 04 *Roll No.....*

First Semester
M. Tech (C&I)

End Semester Examination **Nov/Dec-2022**

C&I- 5401 ANALOG AND DIGITAL ELECTRONICS

Time: 03 Hours **Max. Marks: 40**

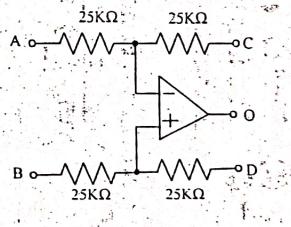
Note: Question No. 1 is compulsory
Answer any **Five** questions from the remaining 7 questions
All parts of must be attempted at same place.
Assume suitable value for missing data (if any) by giving suitable reasons.

1 List down the values of the following parameters for the operational amplifier IC uA741: **10**

(i) DC value of open loop gain
(ii) Input impedance
(iii) Output Impedance
(iv) Slew rate
(v) Unity gain Bandwidth
(vi) 3-dB bandwidth
(vii) Bias current
(viii) Input offset voltage

Also, give the ideal values for the corresponding parameters.

2 The circuit shown below can be configured for a variety of applications by the appropriate interconnection of terminals A, B, C, D and O.



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Show

(i) how the circuit can be used to implement a difference amplifier of unity gain.

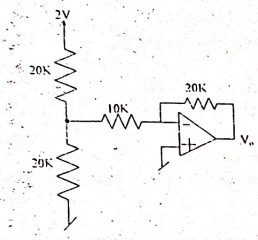
(ii) how the circuit can be used to implement single ended amplifiers with gain of -1V/V

(iii) how the circuit can be used to implement single ended amplifiers with gain of +1V/V

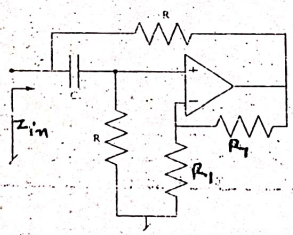
(iv) how the circuit can be used to implement single ended amplifiers with gain of +2V/V

(v) how the circuit can be used to implement single ended amplifiers with gain of +0.5V/V. **6.0**

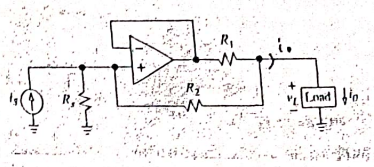
3[a] Determine the voltage gain of the circuit shown below. Open loop gain of the opamp may be taken as infinite. **2.0**



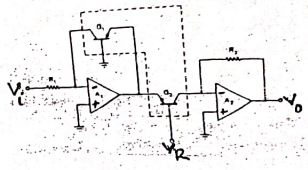
[b] Assuming ideal opamps, determine the input impedance of the circuit shown below. **4.0**



4 Determine the current gain and the output impedance of the current amplifier circuit shown below. **6.0**

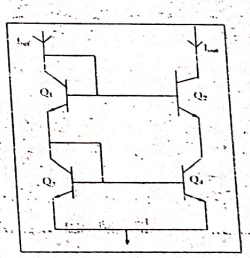


5 [a] Derive an expression for the output voltage for the circuit shown below. Also determine the range of voltage gain if $R_1 = R_2 = 10M\Omega$ and V_R is varied between 0 to 200mV. **3.0**



[b] Draw the circuit and explain the working of a log amplifier in which the output does not depend on the saturation current of the transistors employed and is temperature insensitive. **3.0**

6 [a] Determine the current transfer ratio for the circuit shown below. All the transistors are identical with finite value of 'β'. **2.0**



Total No. of Pages 2 Roll No. .....

M.Tech III SEMESTER(C&I)

END SEMESTER EXAMINATION (Nov.-2022)

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 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. 5[CO1]

[b] Consider the system defind by

$$x(k+1)=\begin{vmatrix} 0 & 2 \\ -0.2 & -3 \end{vmatrix} x(k)+\begin{vmatrix} 0 \\ 1 \end{vmatrix} u(k)$$

$$y(k)=|1\ 0|\ x(k) \quad \text{and} \quad u(k)= K_0 r(k)-Kx(k)$$

Design a state feedback control system with refrence input such that desired characteristic equation are at $z=0.2\pm j0.2$ 5 [CO4]

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

[b] The Dynamics of the system is

$$X(k+1) = GX(k) + H\,U(k) \text{ and output is } Y(k) = C\,X(k)$$

Where $G = \begin{vmatrix} -1 & 0 & 1 \\ 1 & -2 & 0 \\ 0 & 0 & -3 \end{vmatrix}$ $H = \begin{vmatrix} 0 \\ 1 \\ 1 \end{vmatrix}$

$$C = [1 \quad 1 \quad 1]$$

By using this system design a state observer. It is desired that the error vector exhibit deadbeat response. 5[CO2]

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

$0.0 \le x(k) \le 1.5$; $k=0,1,2$

And $-1.0 \le u(k) \le 1.0$; $k=0,1$

Quantize the state values in to the step of 0.5 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. What is the optimal control sequence if $x(0)=1.5$ 10 [CO3]

4[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 $x_1(0)=0$, $x_1(\frac{\pi}{4})=1$, $x_2(0)=0$, $x_2(\frac{\pi}{4})=-1$ 5[CO1]

[b] Find the extremal of the functional

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

The boundary conditions are $x(0)=1$, $x(1)=$free 5[CO1]

5[a] 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. 5[CO2]

[b] Consider the following model of dynamical system

$\dot{X}=\begin{vmatrix}0 & 1\\ -10 & 0\end{vmatrix}X+\begin{vmatrix}0\\ 10\end{vmatrix}U$, which is to be controlled to minimise the performance index

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

Find optimal control input u^* using Hamiltonian method. 5[CO2]

6[a] Derive the expression for feedback gains of a sliding mode controller so that the closed loop system is stable to the sliding surface. 5[CO4]

[b] By considering linear quadratic regulator problem derive expression for Algebraic Riccati Equation. 5[CO4]

7 Write short notes on following: 5,5[CO3]

[a] Tracking Problem

[b] Tuning of PID controller

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Total No. of Page – 2

Roll No. .....

Third Semester

M. Tech. C&I/ PSY

End Term Examination

November – 2022

C&I/ PSY 6401 SCADA AND ENERGY MANAGEMENT SYSTEM

Time: 3:00 Hours *Max. Marks: 40*

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

1. (a) Describe the voltage to current converter and current to voltage converter with suitable diagrams. [4] CO1

   (b) Differentiate between guided and unguided transmission media. Give one example of each. [4] CO3

2. (a) Explain the concept of configuring a process picture at MTU for the monitoring and control of an oil pipe line, which has the following major components: - [4] CO2

   (i) 3 RTUs (ii) one pump (iii) 3 block valves (iv) 2 flow meters and (v) 3 low pressure switches.

   (b) Briefly explain the application layout to detect an oil leakage in the above oil pipeline system from MTU. [4] CO2

3. (a) Explain the 7-layer ISO-OSI model for data Transmission [4] CO4

   (b) Write a brief note on the following network interconnecting devices: - [4] CO4
   (i)Hub (ii) Switch (iii) Bridge (iv) Gateway

4. (a) Describe the salient features of the Electricity Act 2003. [4] CO5

   (b) Elaborate on the Energy Audit and Energy Conservation aspects of Energy Management System. [4] CO5

5. (a) Explain the dual redundant SCADA system employed for a real time process application. [4] CO6

   (b)The number of 40 W tube lights in various parts of an organization working 8 hours a day and 340 days in a year are as follows: [4] CO6
   Main office 70, Security Office 20, Electronics Lab 60, Computer Lab 40, Machine Lab 40, corridors 50, Canteen 25. Consider that 40W tube lights have to be replaced by 28W energy efficient tube lights. The cost of each 40W tube light is ₹40 and each 28W tube light is ₹650. The cost per unit of

electricity is ₹5. Ballast loss in 28W tube lights can be neglected and assuming a 20% power loss in the ballast of 40W tube lights, calculate: -

(i) The annual savings in the electricity bill (ii) The total cost of replacement (iii) the payback period.

6. (a) Explain the need of incorporating a CRC in a message. [4 CO

(b) Explain the procedure to calculate CRC for an eight-bit data word 0110 0000 using BCH [4 CO

7. Write short notes on any two of the following: - [4×
(a) Describe the Distribution and Transmission Automation Functions. CO
(b) Modbus and Profibus Protocol CO
(c) Major design characteristics of safety instrumented systems CO

Total no. of Pages: 2 145 Roll no.....

I SEMESTER M.Tech [PES]

END TERM EXAMINATION *Nov/Dec-2022*

COURSE CODE :PES-501_ COURSE TITLE__Modeling of Electrical Systems_____

Time: 03:00 Hours *Max. Marks: 40*

Note : Symbols have usual meanings.
Assume suitable missing data, if any.

Q.1 For a overhead transmission line with parameters R=0.028Ω/ km, xl=0.325 Ω/ km and wC= 5.2μS/km, compute the values for (i) α (ii)β (iii)Zc, (iv) SIL and (v) Charging MVA/km

[5][CO1]

Q.2 Give the analysis of symmetrical transmission line which is connected to two identical sources at sending and receiving end. Show V, I plots vs distance [5][CO1]

OR

Draw the zero sequence impedance for the two winding transformer for cases (i) star-star (ii) star grounded on both sides (iii) star grounded-delta (iv) delta-star grounded (v) delta-delta

[5][CO1]

Q.3 A full bridge inverter produces a square wave across R-L load. Analyze this system to show expressions for load current waveform. If switching frequency=60Hz, Vdc=100V, R=20Ω and L=50mH determine (i) expression for load current and (iii) power absorbed by the load.

[5][CO2]

Q.4 Discuss the importance of PWM inverters and their realization

[5][CO2]

OR

Represent the model of buck-boost converter, mention suitable assumptions and show relevant waveforms

[5][CO2]

Q.5a Discuss the different circuits involved in the analysis of synchronous machines with suitable diagram [2.5][CO4]

Q.5b Show the rotor circuit equations in the modeling of synchronous machines [2.5][CO4]

Q6. What are the different self-leakage stator inductances and stator mutual inductance terms considered in the modelling of synchronous machines. Show how these are computed. [5][CO4]

Q.7 Discuss the transformations needed from stationary to rotating reference frame mentioning the advantages involved. [5][CO3]

Q.8a Give the expressions for electrical power and torque developed in reference to 3 phase synchronous machines [2.5][CO3]

Q.8b Compute the sequence components of phase currents in a Y connected unbalanced load having currents Ia=44-33j, Ib=-32-24j, Ic= -40+25j [2.5][CO3]

Total Number of Pages 2

Roll No.....

M.Tech POWER ELECTRONICS SYSTEMS 174

I SEMESTER

END SEMESTER EXAMINATION (Nov- 2022)

PES503-POWER ELECTRONIC CONVERTERS

Time: 3:00 Hours **Maximum Marks:40**

Note: Question No. 1 and 2 are compulsory
Answer any 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?

[a] Diode bridge rectifiers operate with unity *dpf*.

[b] Triplens (3rd harmonics & its multiples) are not found in line voltages of three phase inverters.

[c] Ćuk and Sepic converters exhibit improved output response when compared with buck-boost converter.

[d] Valley fill circuit for the diode bridge rectifier improve the *pf* only in the limited range.

[e] The dead zone for the boost PFC is very low as compared to buck type PFC.

[f] CC-VSI with interface inductor exhibits bidirectional power flow capability.

[g] Constant band hysteresis control of sinusoidal current output VSI deals with variable frequency whereas, sinusoidal band hysteresis deals with variable current ripple.

[h] Harmonics on AC side of the AC-DC converter are odd whereas, on the DC side are always even.

1x8

2 [a] Using fourier analysis derive the equation of the voltage output of a diode bridge rectifier without a capacitive filter. 4

[b] The bridge rectifier circuit fed from 230V,50hz if in turn supplying a series RL load (R =50Ω and L =10 mH). Estimate the peak-to-peak variation in load current and determine the power absorbed by the load. 4

3 [a] Derive the design equations for the LC output filter for the single phase diode bridge rectifier. 4

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

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

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.

4 [a] Estimate the steady state output voltage of the circuit in Fig. 4(a). 1

[b] Derive the equation for voltage gain for the Ćuk derived converter shown in Fig. 4(b). 1.5

[c] Draw a neat circuit for Cock Croft Walton voltage tripler AC-DC converter indicating voltage across each branch and output port. 1.5

[d] Design a boost converter having following specifications for CCM mode: V_{in}=48V[40V-75V]; V_{out}=110V; P_{out}=900W[150W-1200W]; f_s=100kHz, η=85%. 4

5 [a] Derive the condition for elimination of triplen harmonics from the output of single phase inverter with one pulse per half cycle. 2

[b] Draw a neat diagram with transformer connections with inverter blocks for a 12 pulse inverter. Briefly explain the scheme through phasor diagram. 2

[c] Derive the load voltage equations for the three phase load fed from 180° square wave three phase inverter. 4

6 Write short notes on any TWO of the following.

[a] For a multilevel inverter having three separate dc sources of 48V each, and having chopping angle to each level square waveform respectively:
α_1= 15°, α_2= 25°, and α_3= 55°.
Sketch the output voltage waveform and determine Fourier coefficients through n =9. Also determine the modulation index M_I which is expressed as the ratio of the amplitude of the fundamental frequency component to the amplitude of the fundamental frequency component of a square wave.

[b] Compare the unipolar and bipolar PWM switching scheme for single phase inverter. 2

[c] Briefly discuss the operational modalities of CC-VSI and VC-VSI. 2

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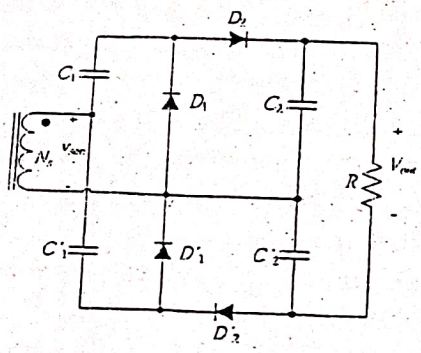


Fig.4(a)

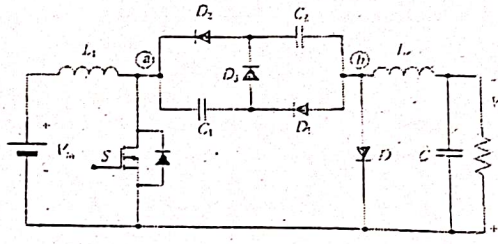


Fig.4(b)

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END SEMESTER
M.Tech. (EE)

Total no. Pages(1) Roll no.....

END TERM EXAMINATION 30th November 2022

COURSE CODE- PES5203 COURSE TITLE - RENEWABLE ENERGY SYSEMS

Time: 3 Hour Max. Marks 50

Note: Answer any five questions. Each question carries equal marks. Assume the missing data suitably (if any).

1. Define the benefits of SHP and classify such projects in respect of its installed capacity and how to determine the installed capacity of a SHP. Draw the basic configuration of a small HEP under run-of-the river scheme, describing its' various components. 3+2

   A small hydro power plant located at a site having a stream of water flow $5x10^9 m^3$/year at a gross head of 30m, supplies electricity to the local area. Calculate the average power generated and determine the installed capacity of the power plant. Assume 40% load factor (ratio of average load and peak load) and 70% overall efficiency. 5

2. A 30 m-diameter wind turbine is placed on a 50m tower in terrain with a power law coefficient (α) of 0.2. Find the ratio of available power in the wind at the highest point the rotor reaches to its lowest point. 5

   Find the size/diameter of a wind turbine rotor that will generate 100kW of electrical power in a steady wind (hub height) of 7.5 m/s. Assume that the air density is $\rho = 1.225$ kg/m^3, Cp = 16/27 and $\eta = 1$. 5

3. According to the Rayleigh probability density function, the average power in the wind is equal to the power found at the average windspeed multiplied by $6/\pi$. Explain. 5

   Estimate the average power in the wind at a height of 50 m when the windspeed at 10 m averages 6 m/s. Assume Rayleigh density function, standard friction coefficient $\alpha = 1/7$, and standard air density $\rho = 1.225$ kg/m^3. 5

4. What is Biomass energy and Biogas and how to select a site for biogas plant? Explain the working of a Biogas plant stating the requirement of raw materials and end products of the plant. 2+3

   Calculate the bio-gas generated for a village having 49- families with total population of 245. The cattles' population in the village are 51- cows, 62-Oxes, and 26-Buffalos and the quantity of dung available from them are 10kg/day/cow, 12kg/day/oxe and 15kg/day/buffalo. Design the optimal size of two cylindrical floating drum digester units in the biogas plant, considering the following data:

150

(i) Gas produced on an average from 1-kg dung = 42 litres
(ii) Gas required for cooking/person/day=0.227m3
(iii) Gas required for lighting 2-lamps /family for an hour per day =0.252m3
(iv) Gas required for lighting 5 -street lamps for an hour per day =0.63m3
(v) Retention time for slurry (density-1090kg/m3) in digester= 30-days
(vi) Temperature maintained in the digester = 35° C 5

5. State the merits and demerits of fixed speed and variable speed wind turbine systems. Give a general topology to feed the output of a variable speed WT into the grid. Explain the power electronics components and control mechanisms of the grid connected DFIG. 3+3+4

6. Write short notes:
(i) HAWT and VAWT (ii) State-of-the-art Wind turbine Generators (iii) Wind Turbine Control Systems 3+4+3

Total no. of Pages: 02 157

Roll no.....

1st SEMESTER

M.Tech.(PES)

END TERM EXAMINATION Nov/Dec-2022

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

Time: 03:00 Hours Max. Marks: 50

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

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. [10]

Q.2 Discuss the working principle of solar photovoltaic energy conversion. Explain the various performance evaluation parameters of SPV and how they are dependent on environmental conditions? [3+3+4=10]

Q.3 (a) Explain the different building blocks of hybrid solar photovoltaic system. Why the power electronics interface is required in harvesting SPV Energy?

(b) Assume a PV module has its MPP at $V_{PV} = 17$ V and $I_{PV} = 6$A at a given level of solar irradiance. The module has to power a load with a resistance $R_L = 10\ \Omega$. Calculate the duty cycle of the DC-DC converter, if a buck-boost converter is used. [5+5]

Q.4 Discuss the systematic approach for designing an off-grid SPV system. An AC computer and TV set are connected to the PV system. The computer, which has rated power 40 W, runs 2 hours per day and the TV set with rated power of 60 W runs for 3 hours per day in operation. If these loads are to be fed at 12V, then calculate the daily energy requirements of the devices expressed in DC Ah while

considering 15% overall losses in system. If the equivalent sun hour on the same location are 3 hours, then determine the no. of solar panels required while assuming the rated current of 3.15 A at 12 V for each panel. [4+3+3]

Q.5 (a) Discuss the various factor on which the output power of wind turbine depends. Derive the expression for the coefficient of power in wind turbine.

(b) Draw the complete block diagram of PMSG based wind turbine. Also thoroughly explain the control of generator side converter control incorporating MPPT and Grid side converter control incorporating reactive power as well as harmonic control of load connected at point of common coupling. [4+6]

Q.6 (a) If the wind speed is 11.5m/s before striking turbine and the speed after leaving turbine is 8m/s, what is the power extraction coefficient of this wind turbine? (air density 1.225 kg/m^3)

(b) The rated output power for a turbine model at 15 m/s is 3 MW. The rotor diameter is 90m. The rotor rotates at a constant frequency of 0.198 Hz. Then calculate the tip to speed ratio and power conversion coefficient of this model while assuming air density 1.225 kg/m^3.

(c) Also calculate the expected output power of the above turbine [6 (b)] at 8m/s while assuming the power coefficient of 0.48. The rotor rotates at the same constant frequency. In addition, what do you expect about the output power at this wind speed? Is it more than the output power at 15m/s? Give your arguments. [3+4+3]

Total no. of Pages:2 153 Roll no.....

I SEMESTER M.Tech.[PES]

END TERM EXAMINATION Nov/Dec-2022

PES5405 Switch Mode Power Converters

Time: 03:00 Hours Max. Marks: 40

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

Q.1 Explain the static and dynamic characteristics of DC-DC Voltage regulators. [5 marks] [CO1]

Q.2 (a) Draw the circuit diagram of the SEPIC converter and explain its operation with respect to the continuous current mode.

(b) The controlled switch of the ideal SEPIC converter operating in CCM is turned on for 0.01ms and turned off for 0.02ms in a periodic manner. For an input voltage of 15V and load resistance of 5Ω, find out the output voltage and switching frequency of the converter. [3+2 marks] [CO2]

Q.3 Draw the circuit diagram of a non-ideal boost converter. Explain the conduction losses and switching loss with respect to the non-ideal boost converter. [5 marks] [CO2]

Q.4 (a) Explain the concept of ringing in a flyback converter.

(b) Design a flyback converter in continuous current mode to produce an output voltage of 24V from a 5V source. The output current is 0.2A, output voltage ripple is 1 percent of the output voltage. The switching frequency is 50kHz. Neglect the ESR of the capacitor. Calculate the value of capacitance. Mention the voltage and current ratings of the components used in this converter. Assume missing data. [1+4marks] [CO3]

Q.5 Draw the circuit diagram of the push-pull converter and explain its operation with respect to continuous current mode. Plot the

waveforms of voltage across the controlled switch, flux in the core, and inductor voltage in all operating modes. [5 marks] [CO3]

Q.6 (a) Explain any three merits of isolated converters over non-isolated converters.

(b) Mention the buck-derived topologies and buck-boost-derived topologies in isolated converters. [3+2marks] [CO3]

Q.7 (a) Define discontinuous current mode (DCM) in a DC-DC converter. Plot the inductor current waveform and inductor voltage waveform for a buck converter in DCM.

(b) The inductor current of buck converter rises from zero to its maximum value in 5μS and falls from its maximum value to zero in 7μS and the switching period is 20μS. If the input voltage is 20V and the load resistance of 1Ω, find out the output voltage.

[3+2 marks] [CO2]

Q.8 (a) Draw the circuit diagrams of half-bridge and full-bridge DC-DC converters. Indicate the difference(s) between these converters in terms of ratings of the devices.

(b) What is the maximum duty ratio desired for the operation of the forward converter? Justify the answer. [3+2 marks][CO3]

Q.9 (a) Mention the advantages of soft-switching DC-DC converters over hard-switching DC-DC Converters.

(b) Explain the modes of operation of ZCS buck converter with necessary waveforms. [2+3 marks] [CO4]

Q.10 (a) Explain the significance of controller design in the DC-DC converter.

(b) Derive the state space equations of the boost converter during the turn-on and turn-off of the controlled switch.

[2+3 marks] [CO5]

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Total no. of Pages: 2 Roll no.....

3rd Semester

M.Tech

END TERM EXAMINATION NOV/DEC-2022

PES 6209 ARTIFICIAL INTELLIGENCE

Time: 03:00 Hours Max Marks: 40

Note : All questions carry equal marks (10 marks).
Attempt "ANY 4" questions
Assume suitable missing data, if any.

1. A. Write short notes on Gradient Descent Algorithm? Explain with a pseudo code? [5] [CO3 & 5]

B. Run the Gradient Descent algorithm on the error function $F(w_0, w_1) = \frac{1}{2}w_0^2 + w_1^2$ starting at the point $W^{(0)} = [3,3]^T$ and using step size of $\frac{1}{2}$. Output the weight parameters $W^{(1)}$, $W^{(2)}$, $W^{(3)}$, where W vector corresponds to $[w_0, w_1]^T$. [5] [CO3 & 5]

2. A. Why is feature normalization necessary in Machine Learning? Suggest some techniques? [5] [CO4]

B. Consider a two-class classification problem of predicting whether a photograph contains a man or a woman. Suppose we have a test dataset of 10 records with expected outcomes and a set of predictions from our classification algorithm.

	Expected	Predicted
1	man	woman
2	man	man
3	woman	woman
4	man	man
5	woman	man
6	woman	woman
7	woman	woman
8	man	man
9	man	woman
10	woman	woman

Compute the confusion matrix for the data. Also, Compute the accuracy, precision, and recall of the data. [5] [CO4]

3. Let Y be a (N, 1) matrix containing N ground truth points in a linear regression problem. Let X be a (N, M+1) input matrix and W be the weight parameter (M+1, 1) such that they follow Y = XW; then derive the analytical solution of "W" in terms X and Y? [10] [CO3 & 5]

4. A. What are the differences between supervised and unsupervised learning? [5] [CO 5]
   B. What is a binary classification problem? Explain with an example. Also, Give an example for a classification problem which is not binary. [5] [CO 5]

5. A. Explain k-means algorithm with a pseudo code. Also discuss some of its drawbacks. [5] [CO2 & 5]
   B. Use k-means clustering algorithm to divide the following data into two clusters:- [5][CO2,3 & 5]

x_1	1	2	2	3	4	5
x_2	1	1	3	2	3	5

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Total no. Pages: 02 *Roll no.....*

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

END TERM EXAMINATION *Nov.-2022*

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 Answer the following:

(a) Define and explain the unimodal function mathematically and graphically. [CO3]

(b) Compare the intervals of uncertainty (L_n/L_0) obtainable in the following methods for 5 number of experiments:
   i) Exhaustive Search Method
   ii) Interval Halving
   iii) Dichotomous Search
   iv) Golden Section [CO3]

(c) What are the roles of exploratory and pattern moves in Hook and Jeeves method. [CO4]

(d) State mathematically the unconstrained and constrained NLP. [CO5]

(e) Define the saddle point and explain its significance. [CO1]

(2X5)

Q.2 Solve the following LPP using Dual Simplex method

$$\begin{aligned} \text{Minimize} \quad & Z = 2x_1 + 2x_2 + 4x_3 \\ \text{s.t.} \quad & 2x_1 + 3x_2 + 5x_3 \geq 2 \\ & 3x_1 + x_2 + 7x_3 \leq 3 \\ & x_1 + 4x_2 + 6x_3 \leq 5 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

[CO2] **(10)**

Q.3 Find the minimum of

$$f = x^2 - 1.6x \quad \text{in the interval } [0,1]$$

by Fibonacci method using n=6. Show the interval graphically at the end of each experiment. [CO3] **(10)**

Q.4 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 $\mathbf{X}_1 = \begin{bmatrix}0\\0\end{bmatrix}$. Perform two iterations. [CO4] **(10)**

Q.5 Using Lagrange multiplier method find the solution of following function:

Maximize $f(X) = 2x_1 + x_2 + 10$

s.t. $g(X) = x_1 + 2x_2^2 = 3$

Also find out the effect of changing RHS of the constraint on the optimum value of f. [CO1] **(10)**

Q.6 What are the various techniques used to solve Constrained NLP. Discuss the Penalty function methods in detail. [CO5] **(10)**

Q.7 Minimize the following function using univariate method

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

starting from the point $\mathbf{X}_1 = \begin{bmatrix}0\\0\end{bmatrix}$. Take probe length $\varepsilon = 0.01$. Perform two iterations. [CO4] **(10)**

XXXXXXX

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Total No. of Pages: 1 *Roll No. .....*

THIRD SEMESTER **M.Tech. (PES)**

END TERM EXAMINATION **NOV-2022**

PES-6403 Non–Linear Control of Power Electronic Converter

Time: 3:00 Hours ***Max. Marks: 40***

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

Q(1)(a) What is a nonlinearity? Explain what you mean by nonlinearity. Determine the all fixed points and stability for a nonlinear system $\dot{x} = x - cosx$

(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. $\dot{x} = sinx$

ii. $\dot{x} = x - x^3$

iii. $\dot{x} = e^x sinx$ [4+4 =8M][CO1]

Q(2) Discuss the existence and uniqueness of the solution of the initial value of the dynamical system $\dot{x} = 1 + x^2$ at an initial condition $x(0) = \pm\frac{\pi}{2}$ [8M][CO2]

Q(3) (a) Explain Tent map and its graphical iterations and Computing Lyapunov Exponents from Iterative maps?

(b) Explain and derive the Ad Hoc Derivation of the discrete time iterative map for the Boost Converter? [4+4=8M][CO2]

Q(4)(a) Explain 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][CO3]

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

(b) Explain about the Current Mode Control? And implement the Current mode control on 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]

Total no. of Pages:2 | 60 | Roll no_____

THIRD SEMESTER

M.Tech. (Power Electronics & Systems)

END TERM EXAMINATION *Nov/Dec-2022*

COURSE CODE: PES6409 COURSE TITLE: Resonant Power Converters

Time: 03:00 Hours *Max. Marks: 40*

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

Q.1 Discuss the influence of following during turn-on and turn-off at below resonance. [10] [CO1]

a. Miller's Effect;
b. Output capacitance of MOSFET.

Q.2 Discuss the operation of class-D current driven half wave rectifier shown in Fig. 1 below. Draw the waveforms for v_R, i_{D1}, i_{D2}, v_{D1}; where $i_R = I_{Rm} \times \sin\omega t$ and derive the following parameters: [10] [CO2, CO3]

a. Input power factor
b. Conduction loss in the single diode (assume on-state voltage drop V_D and resistance R_D)
c. Efficiency (η_R) of the converter

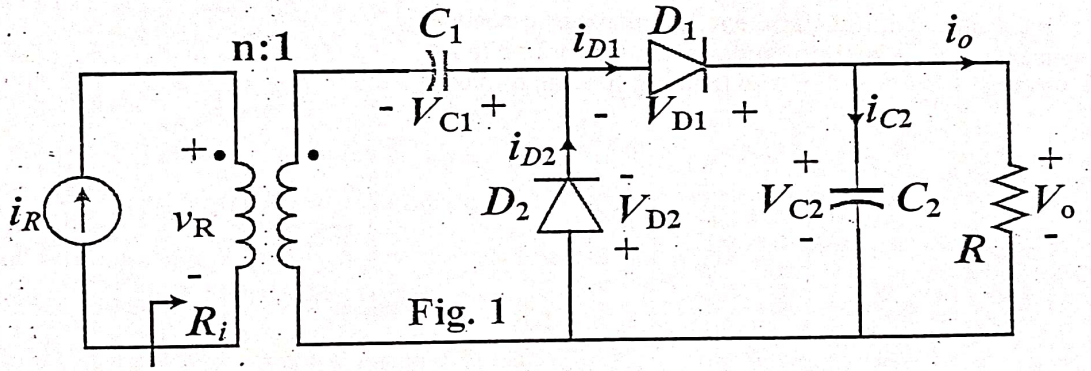


Fig. 1

Q.3 A series-resonant circuit consists of an inductor $L = 84$ μC and a capacitor $C = 300$ pF. The ESRs of these components at the resonant frequency are $r_L = 1.4\ \Omega$ and $r_C = 50\ m\Omega$, respectively. The load resistance is $R_i = 200\ \Omega$. The resonant circuit is driven by a sinusoidal voltage source whose amplitude is $V_m = 100$ V. Find the resonant frequency f_o, characteristic impedance Z_o, loaded quality factor Q_L, unloaded quality factor Q_o, quality factor of the inductor Q_{Lo}, and quality factor of the capacitor Q_{Co}. [10] [CO4]

Q.4 Explain zero current switching (ZCS) technique and draw the current and voltage waveforms (i.e., v_s, i_s) in the class E ZCS inverter shown in Fig. 2 below. Design a Class E ZCS inverter to meet the following specifications: $V_I = 180$ V, $P_{RI} = 250$ W, and $f = 200$ kHz. [10] [CO2, CO5]

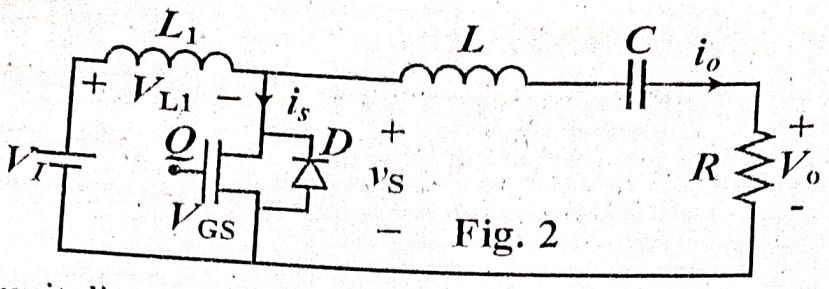


Fig. 2

Q.5 Draw the circuit diagram, output waveforms and explain the working principle of the following resonant converters: [10] [CO2]

a. Class D series resonant converter;
b. Class D parallel resonant converter.

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Total No. of Pages: 02 *Roll No.....*

I SEMESTER
M.Tech (ISY)
END-TERM EXAMINATION Nov/Dec- 2022
ISY-501 – Linear Algebra and Probability

Time- 03:00 Hours Max. Marks: 40

Note: Attempt any Five questions.
Each question is 08 marks.
Assume suitable missing data; if any.

1. a. Which values of 'a' and 'b' lead to row exchanges and which makes matrices singular? (CO1)[4 marks]

$$A = \begin{bmatrix} 1 & 2 & 0 \\ a & 8 & 3 \\ 0 & b & 5 \end{bmatrix}$$

b. Give all values of 'x' for which A has an eigenvalue of 2 ? (CO1)[4 marks]

$$A = \begin{bmatrix} 3 & 2 & -1 \\ 2 & x & 2 \\ x & -2 & 3 \end{bmatrix}$$

2. Using the Gram-Schmidt procedure to find an orthonormal basis of C(A) where (CO2)[8 marks]

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

3. a. A fair coin is tossed 10,000 times. What is the probability that the number of heads is between 4900 and 5100?

x	0.5	1.0	1.5	2.0	2.5	3.0
erf(x)	0.19146	0.34134	0.43319	0.47726	0.49379	0.49865

(CO3)[4 marks]

b. A system consisting of one original unit plus a spare can function for a random amount of time X. If the density of X is given(in units of months) by (CO3)[4 marks]

$$f(x) = \begin{cases} Cxe^{\frac{-x}{2}} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Find C ? Also calculate the probability that the system functions for at least 2 years?

4. Find the distribution and density function of transformed random variable Y =a X+b when X is $N(0,1)$. Find mean and variance of Y ? (CO3)[8 marks]

5. a. Suppose the data $x_1, x_2, x_3 \ldots x_n$ is drawn from $N(\mu, \sigma^2)$ where μ and σ are unknown. Find the maximum likelihood estimate for the pair(μ, σ^2) ? (CO5)[4 marks]

   b. Suppose $X_1, X_2, X_3 \ldots X_n$ are i.i.d Poisson random variables with parameter λ.Obtain an estimator for λ when $x_1 = 1, x_2 = 2, x_3 = 4, x_4 = 2$ using method of moments method. (CO5)[4 marks]

6. A random process is defined by $X(t) = T + (1 - t)$
   Where T is a uniform random variable in (0,1).
   a. Find the cdf of $X(t)$ (CO4)[4 marks]

   b. Find $m_X(t)$ (CO4)[4 marks]

7. Suppose $X_1, X_2, X_3 \ldots X_n$ are i.i.d random variables with probability density function

$$f(x/\sigma) = \frac{1}{2\sigma}\exp(-\frac{|x|}{\sigma})$$

Find the estimate of σ using method of moments. (CO5)[8 marks]

---END----

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Total No. of Pages:02 *Roll No.....*

I[st] SEMESTER M. Tech.(ISY)

END SEMESTER EXAMINATION Nov Dec.-*2022*

ISY503 Data Structure and Algorithm

Time: 3:00 Hours *Max. Marks: 40*

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

Q.1 [A] Write an algorithm using stacks that accepts an infix string and forms an equivalent infix string will all superfluous parenthesis removed. Example in expression (A*B)+C the parenthesis surrounding A*B are superfluous and removing them will leave the expression unchanged i. e. A*B+C. [4] [CO1]

[B] Find the run time complexity of following: [4] [CO3]

(i)

```
void function(int a)
{     if (a<=1)
return;
   if (a>1)
    {
      printf ("**");
      function (a/2);
      function(a/2);
  }
}
```

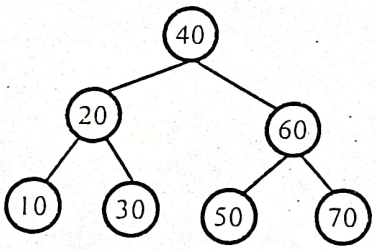
(ii)

```
function (int n )
{
   int i=1;
   while (i<n)
   {
     j=n;
     While (j>0)
      { j=j/2; }
       i= 2*1;
   }
}
```

(iii) $T(n)= 2T(\sqrt{n}) + \log n$

(iv) $T(n) = \begin{cases} 2T(n-1)-1, & if\ n > 0. \\ 1, & otherwise \end{cases}$

Q.2 [A] What are the advantages of circular doubly linked list over single circular linked list? Write an algorithm to convert a sorted doubly linked list to a balanced binary search tree for example sorted doubly linked as 10, 20, 30, 40 50, 60, 70 then their balanced binary search tree will be: [5] [CO2]



[B] Write an algorithm to find second largest element in a single pass in singly linked list. [3] [CO2]

Q.3 [A] Write an algorithm that finds all the node with height [+1, -1] in the AVL tree. Also, find the time complexity of your algorithm. [4][CO3]

[B] How many different binary trees are possible with n nodes? Explain with the suitable example. [4][CO3]

Q.4 [A] Write an algorithm to find the Hamiltonian path in the given Directed Acyclic Graph (DAG's). [4][CO4]

[B] Write an algorithm to delete all the nodes whose out-degree is zero in the directed acyclic graph. [4] [CO4]

Q. 5 [A] What are the advantages of Dynamic programming? Given a chain of four matrices A1, A2, A3, and A4 with P0=5, P1=4, P2=6, Pp3=2 and P4=7. Find the value of m[1, 4] using dynamic programming approach. [4] [CO5]

[B] How we can solve traveling salesman problem using Dynamic programming explain with suitable example. [4] [CO5]

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Total No. of Pages _02__ Roll No. .....

_FIRST__ SEMESTER M.Tech [ISY]

END SEM EXAM Nov-2022

ISY 5301 ARTIFICIAL INTELLIGENCE

Time: 3:00 Hours Max. Marks : 50

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

Q.1 a) Discuss how autonomous taxi is an AI agent and classify its type of agent-environment behaviour into different categories. s (5) [CO#1]

b) How does ALPHA-BETA pruning enhance the result of minimax algorithm in the example of the two-ply problem? (5) [CO#2]

Q.2 a) Write the First Order Logic (FOL) for the following English statements: 1) *Mary is mother of Harry but not of Peter* 2) *Mary is sister of Peter but not of Harry* 3) *Harry is not brother of Peter* 4) *John is brother of Peter* 5) *John is brother of Mary.* 6) *Mary is a mother and a sister*

b) Wite and explain four FOL statements for the Wumpus world problem. (6+4) [CO#3]

Q.3 a) Write the First Order Logic (FOL) for the following: 1) *All mammals are animals* 2) *All animals have four legs* 3) *Whales are mammals* 4) *Whales do not have any legs* 5) *Tom is a whale and also an animal* 6) *Teddy is not a whale but is a mammal.*

b) Draw the semantic net for the knowledge base in Q. 3 a).

c) Use inheritance algorithm to find how many legs Teddy has.

(6+3+1)

[CO#4]

Q. 4 Apply RESOLUTION, showing all the detailed steps (convert entire knowledge base to FOL and solve step-by-step), to solve for the validity of the test sentence: **Apple is a fruit**, given the Knowledge Base; 1. *Apple is not a vegetable* 2. *Vegetable is not a fruit* 3. *Fruits are red in colour* 4. *Apple is red in colour* (10)

[CO#4]

Q. 5 a) Draw a probabilistic Bayesian network for the following events:

Event	Leads to event (with probability)
A	B (0.72), E (0.28)
B	C (0.15), D (0.85)
C	D (0.92), E (0.08)
D	E (1)

b) What is the probability that the event A will ultimately lead to D?

(4+6)

[CO#5]

Q. 6 Describe any two diverse applications of modern AI from recent research papers using appropriate illustrations. (10)

[CO#6]

Total No. of Pages: 02

Roll No.

FIRST SEMESTER

M.Tech. (ISY)

END SEMESTER EXAMINATION

NOV./DEC.-2022

ISY-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 image of size 1024×1024. If this image is transmitted to a WI-FI channel of **25Mbps**. Determine the transmission time required to transmit the following images:

[a] The original image is converted into a gray scale image of size half of the original image. [CO2]

[b] Gray scale image is converted into a binary image of size half of the gray scale image. [CO2]

Question No. 2 **[4x2=8]**

[a] Consider an image infected with "salt and pepper noise". Demonstrate with the help of example that the effect of noise can be minimized using median filter. [CO3]

[b] Consider the image $f(x,y)$ having gray values between 0 to 15. Perform the image stretching of the gray value uniformly and linearly within the entire image.

$$f(x,y) = \begin{bmatrix} 10 & 11 & 12 & 11 & 10 \\ 12 & 12 & 13 & 5 & 4 \\ 13 & 12 & 5 & 3 & 5 \\ 13 & 12 & 4 & 3 & 5 \\ 12 & 4 & 5 & 4 & 4 \end{bmatrix}.$$ [CO3]

Question No.3 **[4x2=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 last bit plane is removed. Do the followings:

[a] Represent the image after removing the plane. [CO4]

[b] Compare the original histogram of image with histogram of removed plane image. [CO2]

Question No. 4 **[2+3+3=8]**

Consider an image of distribution as given in Table I.

Table I: Image gray level distribution

Gray Levels (r_k)	0	1	2	3	4	5	6	7
No. of pixels (p_k)	8	10	10	2	12	16	4	2

Do the followings:

[a] Compute the size of image in bits. [CO4]

[b] Perform histogram equalization. [CO4]

[c] Perform histogram matching with a target image gray level distribution as given in Table II. [CO4]

Table II: Image gray level distribution

Gray Levels (r_k)	0	1	2	3	4	5	6	7
No. of pixels (p_k)	0	0	0	0	20	20	16	8

Question No. 5 **[4x2=8]**

[d] What is a high-boost filter? Why do we not prefer higher order derivative filters? [CO1]

[e] 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 $0 \le r \le 1$.

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

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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3rd SEMESTER

M.Tech.

END TERM EXAMINATION Nov/Dec-2022

ISY6321 Malware Analysis

Time: 3 Hours Max. Marks: 50

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

Q.1 Answer the following in brief:
i. What are Packed and Obfuscated malwares? [2]
ii. Discuss the difference between Basic and Advanced Static Analysis in brief. [2]
iii. Explain User mode of operation of a CPU. [2]
iv. What are Hardware Breakpoints? [2]
v. What is IPC in Android? [2]
[CO1,CO2,CO4,CO5,CO6]

Q.2 a. What are Fileless Malwares? Give two examples. [5]
b. Design a PE file for Windows? Explain different section of a PE file with the help of a diagram. [5]
[CO1,CO2]

Q.3 a. Develop a procedure for online publication of Hash code. Discuss its significance in Static Analysis. [5]
b. What is Virtualisation? Explain different Virtualization approaches and 3 Common uses of Virtualization. [5]
[CO2,CO3]

Q.4 a. Describe design of Linux Kernel? What is "Shell" and how is it helpful in CPU operations? [5]
b. Differentiate between a Debugger and a Disassembler. Which Malware Analysis tool is the best in market currently and why? [5]
[CO3,CO5]

Q.5 a. Design an experiment using Wireshark tool to capture UDP packtes. What are Packet sniffers used for? [5]
b. Discuss salient features of mobile computers. Why is there a need for studying mobile security separately? Explain in detail. [5]
[CO5,CO6]

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I SEMESTER **Ph.D.**

END SEMESTER EXAMINATION **November-2022**

AM-501C **Introduction to Mathematical Software**

Time: 3 Hours **Max. Marks: 50**

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

1) What are the various functions of an operating system? Explain them in detail with suitably examples. (10)

2) (i) Write a program to approximate the root of a function by secant method in MATLAB. (6)
(ii) What is the use of following commands in MATLAB, Explain with example?
a) Subplot b) Mesh c) Surfl d) Semilogx (4)

3) (i) Write a program to solve the system of linear equation using Gauss Jacobi method in MATLAB. (5)
(ii) Write a program to plot the functions f(x)= x^2 and g(x) = e^(x^2) for x= -1...1 on the same axis. Label the x and h axes and create a legend indicating which graph is which. (5)

4) (i) Find the zeros of the polynomial f(x) = x^5-4 x^4 +12 x^2 -9 x + 1 in Mathematica. Convert the result to a list of numbers. Also compute the zeros of sum of f. (6)
(ii) Differentiate the use of command **piece wise** and **which** in Mathematica with example. (4)

5) (i) Create a LaTex document that formats like the text shown below: (5)

Mathematica uses the percent sign (%) to refer to the previous result and curly brackets ({}) for grouping.
See the two instructions below:

```
Sin[x]/x
Plot[%, {x,-3,3}];
```

(ii) Write the following table in LaTex formatting: (5)

	Probabilities		
Blood Type	Males	Females	Total
O	0.21	0.21	0.42
A	0.215	0.215	0.43
B	0.055	0.055	0.11
AB	0.02	0.02	0.04
Total	0.5	0.5	1.00

6) In LaTex (10)

Explain how to format the following formula.

$$f(x) = \begin{cases} 1 & \text{if } x \neq 0, \\ \frac{\sin x}{x} & \text{otherwise} \end{cases}$$

Explain how to format the following rule of partial integration.

$$\int_a^b f'(x)g(x)\,dx = f(x)g(x)\Big|_a^b - \int_a^b f(x)g'(x)\,dx$$

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

Total No. of Pages: 02 172 Roll No. :_____

FIRST SEMESTER PhD[AM]

END TERM EXAMINATION Nov.-2022

AM 502B: GENERAL RELATIVITY AND COSMOLOGY

Time: 3:00 hours *Max. Marks: 50*

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

Q.1[a] What are inertial and non-inertial frames? Give an example of each. How has it been established that earth is not an inertial frame?

[b] Show that $ds^2 = dx^2 + dy^2 + dz^2 - c^2dt^2$ is invariant under Lorentz transformation.

Q.2[a] Discuss the concept of space and time in special relativity theory? Discuss Minkowski's four dimensional space-time continuum.

[b] Explain the principle of equivalence and the principle of general covariance.

Q.3 [a] Write the Einstein's field equations for the perfect fluid and discuss its geometrical and physical significances.

[b] Derive the conservation or fluid equation for a perfect fluid from first law of thermodynamics.

Q.4 [a] Derive the acceleration equation from Friedmann equation and discuss its significance.

[b] Using Friedmann equation and conservation equation, prove that $\rho \propto a^{-3}$ and $a \propto t^{2/3}$ for the matter-dominated phase of the universe.

Q.5 [a] Obtain the line element for Robertson's non-static cosmological model. Show how this model reveals that universe is expanding.

P.T.O.

[b] Write the Einstein equation with the cosmological constant term. Explain why such a term is interpreted as the vacuum energy momentum source of gravity in explaining the accelerated expansion of the universe.

Q.5 [a] Discuss the geometry of the universe using the curvature parameter. Sketch the diagram.

[b] Establish the relation between redshift and the scale factor of the universe, $1 + z = \frac{a_0}{a}$.

Q.6 Write the short notes on **any two** of the following.

[a] The Hubble law and its significance

[b] Density parameter

[c] Cosmological principle

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Total No. of Pages: 01 *Roll No:.....*

MATHEMATICS Ph.D.

END SEMESTER EXAMINATION (NOV, 2022)

AM-503A, GEOMETRIC FUNCTION THEORY

Time: 3 Hours Max. Marks: 100

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

(1) (a) Define a starlike function with an example. Show that

$$f \in S^* \Leftrightarrow \Re \frac{zf'}{f} \geq 0.$$

(b) State and prove the growth theorem.

(2) (a) State and prove Rogosinski theorem?
(b) State and prove Lindelof Principle?

(3) (a) State and prove Little wood's theorem?
(b) State and prove Herglotz representation formula?

(4) (a) State and prove Bernstein's theorem?
(b) Define α-Convex function. If $f(z)$ is α-Convex for any arbitrary real number α then show that $f(z)$ is convex for $\alpha \geq 1$ and is starlike for $\alpha < 1$.

(5) (a) Show that $f \in S$ maps the disk $|z| < \rho$ onto a convex domain for every positive number $\rho \leq 2 - \sqrt{3}$ but not for $\rho > 2 - \sqrt{3}$.

(b) What are close to convex functions? Also prove that every starlike function is close to convex.

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End Term Examination
I Semester (Ph.D.), November 2022
Fuzzy Logic and Applications (AM 503sE)

Max Marks: 50 Time: 3 Hours

Note: Attempt all questions. Each question carry equal marks.

Q 1. (a) Let fuzzy relation $\widetilde{R}(x,x)$ and $\widetilde{Q}(y,y)$, $x \in X$ and $y \in Y$ be defined on the sets $X = \{a,b,c,d,e,f\}$ and $Y = \{\alpha,\beta,\gamma\}$ as:

$$\begin{pmatrix} - & a & b & c & d & e & f \\ a & 0.8 & 0.5 & 0 & 0 & 0 & 0 \\ b & 0 & 0.5 & 0 & 0.7 & 0 & 0 \\ c & 0 & 0 & 0.3 & 0 & 0 & 0 \\ d & 0 & 0.4 & 0 & 0 & 0.9 & 0.5 \\ e & 0 & 0 & 0 & 1 & 0 & 0 \\ f & 0 & 0.4 & 0 & 0 & 1 & 0.8 \end{pmatrix}$$

$$\begin{pmatrix} & \alpha & \beta & \gamma \\ \alpha & 0.7 & 0 & 0.9 \\ \beta & 0.5 & 0.8 & 0 \\ \gamma & 1 & 0 & 1 \end{pmatrix}$$

Let $h(a,b) \to \alpha$, $h(c) \to \beta$ and $h(d) \to \gamma$.
Check whether the mapping $h : X \to Y$ is homomorphic or not. Comment for strong homomorphism also.

(b) i. Explain Possibility theory. Discuss with suitable example.
ii. Give a short note on fuzzification and defuzzification.

Q 2. (a) Explain intuitionistic fuzzy variable . What do you mean by intuitionistic Fuzzy Relation. If R and S be two intuitionistic fuzzy relations on two sets XxY and YxZ respectively, then prove that

i. $R^{-1^{-1}} = R$
ii. $(SoR)^{-1} = R^{-1}oS^{-1}$

(b) Explain the following and give example of each also.

i. Min-Max in Intuinistic fuzzy environment.
ii. Max-Min operation in Intuinistic fuzzy environment.

Q 3. (a) What do you mean by transitive closure of a fuzzy relation $\widetilde{R}(X, X)$. Compute transitive max-min closure $\widetilde{R}_T(X, X)$ for the fuzzy relation $\widetilde{R}(X, X)$ given as:

$$\begin{pmatrix} 0.8 & 0.6 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0.5 & 0 & 0 \\ 0 & 0 & 0.9 & 0 \end{pmatrix}$$

(b) Let $\tilde{A} = [2,5;\ 7,9]$, $\tilde{B} = [-1,3;\ 6,10]$ and $\tilde{C} = [3,6;\ 7,8]$ are three fuzzy relations. Solve the following fuzzy relational equation:

$$\tilde{A}\tilde{X} + \tilde{B} = \tilde{C}$$

Q 4. (a) Consider fuzzy sets $\tilde{A}$ & $\tilde{B}$ defined on the set of real numbers in the interval $[0,10]$ with membership function as: $(i)\ \mu_A(x) = \frac{x}{x+2}$, $(ii)\ \mu_B(x) = \frac{1}{[1+10(x-1)^2]}$. What do these fuzzy sets physically represent? Evaluate compliment, Union, intersection and Difference of these fuzzy sets.

(b) Let $\tilde{A} = (-2,\ 1,\ 3)$ be a triangular fuzzy number. Compute triangular approximation of $\tilde{A}^{-1}$. Also, compute error approximation of $\tilde{A}^{-1}$. Show the result diagrammatically also.

Q 5. (a) Consider the following two discrete fuzzy sets defined on universe $X = \{-5,5\}$

$$\tilde{A} = \text{“zero”} = \left\{\frac{0}{-2} + \frac{0.5}{-1} + \frac{1}{0} + \frac{0.7}{1} + \frac{0.1}{2}\right\}$$

$$\tilde{B} = \text{“positive medium”} = \left\{\frac{0.6}{1} + \frac{1.0}{2} + \frac{0.6}{3} + \frac{1.1}{4}\right\}$$

Construct the relation for the rule *If* $\tilde{A}$, *then* $\tilde{B}$ (if x is ‘zero’, then y is ‘positive medium’). Calculate $\mu_R(x,y)$ using max-min composition.

(b) If we change

$\tilde{B} == \left\{\frac{0.6}{1} + \frac{1.0}{2} + \frac{0.6}{3} + \frac{1.1}{4}\right\}$ to $\widetilde{B'} == \left\{\frac{0.8}{1} + \frac{0.9}{2} + \frac{0.6}{3} + \frac{1}{4}\right\}$, then define new relation $\mu_{R'}(x,y)$.

Total No. of Pages: 02

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SECOND SEMESTER — PhD [AM]

END SEMESTER EXAMINATION — Nov. 2022

AM-504C, Numerical Method for PDE

Time: 3.0 Hours — Max. Marks: 100

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

1. Define the following:
   (i)Shock wave
   (ii)Rarefaction wave
   (iii) Contact discontinuity
2. Find the solution of scalar conservation law by the method of characteristics
$$u_t + au_x = 0, \quad u(x,0) = u_0(x)$$
3. Define Lax-Wendroff scheme for advection equation. Also discuss its consistency.
4. Prove that Lax-Friedrich scheme is conditionally stable for advection equation. Find stability condition.
5. For the problem
$$\begin{aligned} u_{tt} &= a^2 u_{xx} \quad \forall (x,t) \in (0,1) \times (0,t_F) \\ u(x,0) &= f(x)\,; u_t(x,0) = g(x) \ \ \forall x \in [0,1] \\ u(0,t) &= u(1,t) = 0 \quad \forall t \in [0,t_F]. \end{aligned}$$
Where $a > 0$ is a constant . Prove that the energy
$$E(t) = \int_0^1 (a^2 u_x^2 + u_t^2) dx$$
is conserved for all time if u is a smooth solution.
6. Discuss the concept of weak solution to
$$u_t + f(u)_x = 0$$

7. Prove the convergence of the explicit scheme
$$\frac{u_{i,j+1} - u_{i,j}}{\Delta t} = \frac{u_{i-1,j} - 2u_{i,j} + u_{i+1,j}}{\Delta x^2}$$
8. Calculate the local truncation error at the point (ih, jk) of the Crank-Nicolson approximation to $u_t = u_{xx}$
9. Perform a von Neumann stability analysis of the following difference scheme
$$\frac{u_{i,j+1} - u_{i,j}}{k} = \frac{u_{i-1,j} - 2u_{i,j} + u_{i+1,j}}{h^2} \quad i = 1,2,...N-1$$
$$u_{0,j} = u_{1,j}, \quad u_{N,j} = 0$$
10. Compute the numerical solution of
$$u_{xx} + 3u_{yy} = -16$$
with boundaries $u = 0$ on $x = \pm 1$, $\frac{\partial u}{\partial y} = -u$ *on* $y = 1$; $\frac{\partial u}{\partial y} = u$ *on* $y = -1$
11. Use the Crank-Nicolson method to calculate a numerical solution of
$$\begin{aligned} u_t &= u_{xx}, \ \in (0,1). \quad t > 0 \\ u(x,0) &= 2x \quad 0 \le x \le \frac{1}{2} \\ u(x,0) &= 2(1-x) \quad \frac{1}{2} \le x \le 1 \\ u(0,t) &= u(1,t) = 0 \quad t > 0. \end{aligned}$$

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Ist SEMESTER

M.Tech.(Env. Engg.)

END-TERM EXAMINATION

November-2022

ENE- 501 Water Pollution

Duration: 3:00 Hours

Maximum Marks: 40

Note: All questions are compulsory. **Assume suitable missing data, if any.**		**Marks**
Q 1(a)	What do you mean by stream standards? Give classification and zoning of water bodies as per CPCB.	4
(b)	Distinguish between oligotrophic and eutrophic lakes. Discuss various preventive measures to control eutrophication.	4
Q2(a)	What are heavy metals? How does heavy metal pollution affect the environment?	4
(b)	What are various sources of organic pollution? Discuss various zones and associated conditions in a stream after addition of an organic waste.	4
Q3(a)	Differentiate between biomagnification and bioaccumulation. Also discuss the role of bioaccumulation and biomagnification in long term effects of water pollution?	4
(b)	Discuss the characteristics of the ideal pathogen indicator and indicate which organisms most nearly exhibit these characteristics?	4
Q4(a)	What are various physicochemical characteristics of waste water? Explain at least five chemical characteristics along with their methods of measurements	4

(b)	What are various methods of water pollution management? Discuss waste water treatment plant with the help of a neat flow diagram. OR What is the need of water quality modelling? Discuss the modelling of Dissolved Oxygen in streams?	4
Q5	Differentiate between (any two):	
(a)	Slow Sand Filters and Rapid Sand Filters	4
(b)	Aerobic Degradation and Anaerobic Degradation	4
(c)	Flocculation and Coagulation	4

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FIRST SEMESTER

M.Tech.

MID TERM EXAMINATION Nov.-2022

EN503 AIR POLLUTION AND CONTROL

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 Answer the following:

(i) In stack sampling, large sized particles are collected on filter paper when:

(a) stack gas flow rate > sampling flow rate

(b) stack gas flow rate < sampling flow rate

(c) stack gas flow rate = sampling flow rate

(d) none of these

(ii) Most of the wind motions in the atmosphere is:

(a) Vertcial (b) Horizontal (c) Oblique (d) None

(iii) Ground level concentration is minimum, when the plume shape is:

(a) Looping (b) Coning (c) Fanning (d) Fumigating

(iv) For legal compliance, one of the following sampling methods is used:

(a) Grab (b) Continuous (c) Intermittent (d) Integrated

(v) In elevated inversion condition, the fumigation plume occurs if:

(a) Stack height < Mixing height (b) Stack height > Mixing height

(c) Stack height = Mixing height (d) None of these [1x5] [CO1]

Q. 2 (a) What is Dry Adiabatic Lapse Rate and how is it different than Saturated Adiabatic Lapse Rate. Describe with sketch. [2] [CO1]

(b) Show by derivation that Dry Adiabatic Lapse Rate is -1°C/100m. [3][CO1]

Q.3. (a) What is the effective stack height at 1000 m downwind from a buoyant plume emission source stack if the stack height is 40 m and plume rise at 1000 m downwind is 200 m? [2][CO2]

(b) Under what conditions the Gaussian dispersion equation for a continuous point source is valid? [3][CO2]

Q.4. (a) Explain how stratospheric Ozone remains in dynamic equilibrium of chemical processes of formation and destruction? [3][CO1]

(b) What is the unit to measure thickness of Ozone? Express the unit in millimeters. [1][CO1]

(c) What are the different type of UV rays? Which type of UV rays have the increased tendency to reach the earth's surface owing to Ozone hole? [1][CO1]

Q.5. (a) 189 g/s of SO_2 is emitted from a stack that is 39.6 m high. What is the SO_2 concentration in μgm^{-3} at a receptor located 1 km downwind, 100 m crosswind from the plume centerline and 50 m above ground? Use the following information: Plume rise at 1 km is 225 m, wind speed at the emission height = 4.02 m/s. Stability class is B having dispersion in the vertical and crosswind directions as 300 m and 220 m respectively. [3][CO4]

(b) If σ_z = 120 m, at what vertical distance above or below the emission plume centerline will the pollutant concentration be ~15% of the concentration at plume centerline? [2][CO3]

Q.6. What do you understand by local, urban, regional, continental and global scales pollution. Explain them with neat sketch. Give at least one example of each of local, regional and global scale pollution problems. [5][CO1]

Q.7. (a) Enumerate and describe various natural actions which clean the ambient air over time by removing various pollutants. [2][CO1]

(b) Write a note on air pollution caused by automobiles and its control. [3][CO5]

Q.8. Explain the working of any <u>two</u> of the following with neat sketch and with special mention of where these control equipments may be used:

(i) Electrostatic precipitators

(ii) Cyclone Collectors

(iii) Fabric Filters

(iv) Settling Chambers [2.5x2] [CO5]

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Total No. of pages: 01 182 Roll No.....

I SEMESTER
M.Tech. (ENE)

END TERM EXAMINATION Nov/Dec.-2022
ENE 5301 - Environmental Chemistry & Microbiology

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) Describe the concept and components of aquatic chemistry. [4][CO2]

b) Differentiate between soaps and detergents. What are the environmental problems associated with detergents. Discuss. [4][CO2]

Q.2 a) Calculate the equilibrium concentration of oxygen in water (mg/L) at 25°C at an altitude of 2000 meters. (Henry's law constant (K_H) is 13.84×10^{-4}). [4][CO1]

b) Discuss the chemical mechanism of formation of photochemical smog in Delhi. [4][CO3]

Q.3 Write short notes on

a) Biofilters [4][CO5]

b) Acid rain [4][CO4]

Q.4 a) Describe the key phases of microbial growth and dynamics. [4][CO4]

b) Discuss the environmental consequences of residual pesticides in environment. [4][CO2]

Q.5 (a) What is green house effect? Define green house gases. What are the environmental consequences of global warming? Discuss. [4][CO3]

b) Can microorganisms be used for the treatment of wastewater? Explain the working of a microbe-based unit for treatment of high-strength wastewater. [4][CO5]

Q.6 a) Derive the role of pH in removal of ammonia from wastewater. The equilibrium constant for dissolution of NH_3 in water is 1.82×10^{-5} at 25°C. [4][CO1]

b) The doubling time of a bacterium is 2 hours. If the culturing in exponential phase starts with 5 cells, how many microbial cells will be present after 2 days? [4][CO4]

Total no. of pages: 02 183 Roll No.....

FIRST SEMESTER

M.Tech (ENE)

END TERM EXAMINATION *DEC-2022*

ENE5401 INDUSTRIAL WASTEWATER TREATMENT

Time: 3:00 Hours *Max. Marks: 40*

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

Q.1 (a) Briefly explain the processes used for the removal of suspended solids from the industrial wastewater. [04][CO1]

(b) Explain the necessity of equalization and proportioning for Industrial waste water treatment. [04][CO1]

Q.2 (a) With the help of flow diagram, discuss the operations/processes use in urea manufacturing plant. [04][CO2]

(b) Discuss the manufacturing processes involved in pharmaceutical industry. [04][CO2]

Q.3 (a) Define volume reduction. Briefly explain the different methods of volume reduction. [04][CO3]

(b) Discuss the conditions under which joint treatment of domestic wastewater and industrial wastewater is recommended. [04][CO3]

Q.4 (a) Explain the characteristics of wastewater generated from dairy industry. And discuss the environmental effects if dairy waste is discharged to public sewers. [04][CO4]

(b) What are the various sources of pollution in cotton textile mill? Give a plan for the management of pollution in cotton textile mill. [04][CO4]

Q.5 (a) What are effluent standards? How these are beneficial in industrial wastewater treatment? Explain with example. [04][CO5]

(b)Explain the sources of Petroleum refinery waste and the recommended process for their treatment. [04][CO5]

Q.6 (a) Describe briefly with the help of block diagram different treatment units used for the treatment of industrial wastewater. [04][CO1]

(b) Describe the pollution potential of pulp and paper mill wastes and their remedial measures. [04][CO5]

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Total no. of Pages: 02 *Roll no.....*

Fifth Semester

M. Tech.

End Term Examination **Nov/Dec/-2022**

EN6201 Hazardous Waste Management

Time: 03 hrs **Marks: 50**

Attempt any five questions. Draw neat and labeled diagrams wherever necessary. Assume suitable missing data

Q.1(a) Define hazardous waste and discuss sources of hazardous waste. [5, CO1]

Q.1(b) Explain how the disposal of hazardous waste poses a problem? [5, CO1]

Q.2(a) State the method of storage of hazardous waste. [5, CO2]

Q.2(b) Explain the various factors considered in the selection of site for hazardous waste management. [5, CO2]

Q.3(a) Specify the hazard occurrence in electroplating industry. [5, CO3]

Q.3(b) How phosphorus is hazardous to human life ? [5, CO3]

Q.4(a) Explain the classification and source of hazardous waste. [5, CO1]

Q.4(b) Define pyrolysis and explain the process in brief. [5, CO4]

Q.5(a) Write down the characteristics of hazardous waste. [5, CO1]

Q.5(b) Describe the various techniques of hazardous waste processing and methods of disposal. [5, CO4]

Q.6(a) Compare the various thermal processes used in hazardous solid waste treatment. [5, CO5]

Q.6(b) Discuss TCLP test [5, CO4]

Q.7(a) Specify the hazard occurrence in electroplating industry. [5,CO5]

Q.7 (b) Discuss briefly the characterization of industrial hazardous wastes. [5, CO1]

...rd Semester

Roll No. .....

M.Tech.

END SEMESTER EXAMINATION
November 2022

ENE – 6301 AIR QUALITY MODELING

Time: 3:00 Hours *Maximum Marks: 40*

Note: Answer any 4 questions.
Question No. 6 is compulsory.
Assume suitable missing data, if any. (Calculator is allowed)

1. Estimate the rise of plume above the stack by using Holland as well as Davidson equation, given the following data: (10) [CO # 2]
   (i) Physical stack is 180 m tall with a 1.35 m inside diameter.
   (ii) Wind velocity is 2.55 m/s
   (iii) Air temperature is 25 °C
   (iv) Barometric pressure is 1000 millibars
   (v) Stack gas velocity is 14.75 m/s
   (vi) Stack gas temperature is 140 °C
2. Calculate the following: (10) [CO # 2]
   (a) Emission rate of CO in g/mile-s, if Vph = 1000 & E_f = 0.891 g/km-hr
   (b) Standard deviation of vertical plume concentration, if a = 34, c = 62.6, x = 3, d = 0.180 and f = - 48.6
   (c) Standard deviation of horizontal plume concentration, if a = 156, b = 0.894, c = 44.5, x = 0.5, d = 1.149 and f = 2
   (d) Significance and application areas of air pollution models
3. What do you understand by ventilation factor? Discuss the breakpoints for AQI of USEPA along with the banding index and associated health effect in UK. (10) [CO # 1]
4. Assume a city is of approximately rectangular in shape with dimensions of 4. miles by 3.1 miles. The topographical nature of the area is such that th effective mixing height is 1.2 miles. A particle of a certain pollutant is emitte at the south-eastern corner of the city. [CO # 3]
   (a) Find the maximum distance taken by the particle to travel out of the bo (2.5)
   (b) If the wind speed is 3.5 mph in a SE-NW direction, find the maximum tim and the average time taken by a particle of the pollutant emitted from an section of the city to clear the mixing box.
   (c) If 2000 gm of the pollutant is released in bursts every 2 hours, find th maximum concentration of the pollutant at any given time. (5 (2.5
5. (a) Explain the role of meteorological elements in the dispersion of ai pollutants. (5) [CO # 1
   (b) Based on state of matter. classify the air pollutants and indicate their source along with health effects. (5) [CO # 1]
6. Nitric oxide (NO) is emitted at 110 g/s from a stack with physical height of 8 m. The wind speed is 5 m/s on an overcast morning (stability class D). Plum rise is 20 m. If the following data has been given, [CO # 4]

Values of Curve Fit Constants

			x<1 km			x>1 km		
Stability	a	b	c	d	f	c	d	f
A	213	0.894	440.8	1.941	9.27	459.7	2.094	-9.6
B	156	0.894	106.6	1.149	3.3	108.2	1.098	2
C	104	0.894	61.0	0.911	0	61.0	0.911	0
D	68	0.894	33.2	0.725	-1.7	44.5	0.516	-13
E	50.5	0.894	22.8	0.678	-1.3	55.4	0.305	-34
F	34	0.894	14.35	0.740	-0.35	62.6	0.180	-48.6

Then calculate
   (a) The ground-level centreline concentration (in $\mu g/m^3$) 2.0 km downwin from the stack. (6)
   (b) The concentration at 100 m off the centreline at the same x distance. (4)

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III - SEMESTER M.Tech.(Env. Engg.)

END-TERM EXAMINATION November-2022

ENE6401 Environmental Impact Assessment & Audit

Duration: 3:00 Hours Maximum Marks: 50

Note: All questions are compulsory.

Assume suitable missing data, if any.

		Marks
Q1	Explain any two of the following:-	
	(i) Types of Environmental Audit	5
	(ii) Stages of EIA process	5
	(ii) Steps for Overlay Analysis	5
Q 2(a)	Write the names of major methodologies for EIA.	3
(b)	Explain any one major methodology for EIA	5
(c)	Define Fuzzy Overlay.	2
Q3(a)	Write the advantages and disadvantages of Checklist method of EIA.	5
(b)	Explain the types of Checklist method of EIA.	5
Q4	Write short notes on any two of the following:-	
	(i) Monitoring process for EIA	5
	(ii) Mitigation process for EIA	5
	(iii) Objectives of Environmental Management Plan	5
Q5(a)	What are the benefits of EIA?	5
(b)	Write the stages of Social Cost-Benefit Analysis(SCBA) method of EIA.	5

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Ph.D

END TERM EXAMINATION ***Nov/Dec-2022***

DD901 Design for All

Time: 03:00 Hours *Max. Marks: 40*

Note: All questions are compulsory.

Q1. What is Universal Design and its principles? How Universal Design is different from Assistive Technology? Explain with example? (10 Marks)

Q2. Do you agree with " There is no universality without any social justice" support your answer with proper justification? (5 Marks)

Q3. How do you integrate social justice into your approach to Product Design, Visual Communication, and user experience? (5 Marks)

Q4. Is this exam that you are giving today is meeting the criteria of design for all? justify your answer with a proper explanation. (5 Marks)

Q5. Gauge universality of the product (select any product) based on Universal Design. (5 Marks)

Q6. Explain any 5 attributes associated with Universal Design in detail. (5 Marks)

Q7. Explain types of needs and how we can prioritize them? (5 Marks)

Total No. of Pages: 01 *Roll No.....*

1st Semester

Ph.D

End Term Examination Nov/Dec-2022

DD 903 Applied Ergonomics

Time: 03 Hours Max. Marks: 40

Note: Assume suitable missing data; if any

Attempt any four questions. **[10 marks each]**

Q1: Describe the sitting and standing anthropometric measures and their applications along with their suitable diagram.

Q2: Compare and contrast between static and dynamic muscular load.

Q3: Explain the factors influencing human performance at work.

Q4: What is organizational ergonomics? Review the key features of it.

Q5: Distinguish between the terms 'Ergonomics' and 'Human factors engineering.

Q6: Discuss how the following cognitive factors affect the human work:

i) Perception ii) Memory iii) Decision-making

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SEMESTER

M.Tech./Ph.D.

END TERM EXAMINATION *Nov/Dec-2022*

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 (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]

Q.2 Consider the regression model:

$$Y_i = \alpha + \beta X_i + u_i \quad \text{Where } u_i \sim N(0,\sigma^2)$$

(a) Find the least Square estimators for α and β.

(b) Prove that the estimator of β is linear and unbiased. [15 Marks]

Q.3 Explain the problem of multicollinearity. Discuss how you would detect multicollinearity. Suggest 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 (1) In order to assess the returns to English ability in the job market, the following regression model is estimated for males aged 15 to 65 years.

Dependent Variable: log of Annual Wages

English Ability is a categorical variable with 3 categories, "None", "Little", "Fluent".

	Model 1		Model 2			
	Coeff.	P-value	Coeff.	P-value		
None	-1.48	0.000	10.26	0.000		
Little	-0.87	0.000	10.87	0.000		
Fluent			11.74	0.000		
Intercept	11.74	0.000				

Define the dummy variables and give the difference between Models 1 and 2 using econometric equations. Why is there a blank row in model 1 and model 2?

[15 Marks]

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Total no. of Pages : 01 Roll no.....

I SEMESTER

M.Tech/MBA/Ph.D

END TERM EXAMINATION *Nov/Dec-2022*

HU-708 Gender and Technology

Time: 03:00 Hours *Max. Marks: 70*

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

Q1: Can ICT bridges the Gender Gap for women workers residing in slums? Discuss. [CO-3]

Q2: Is STEM really male dominated? Discuss. [CO-1]

Q3: Discuss growth of Women in STEM education in India since Independence. [CO-1]

Q4: Discuss Economic theories on Women. [CO-3]

Q5: Discuss Economic theories on Technology. [CO-3]

Q6: Beside economics and sociology, sex is a biological variable too, Discuss. [CO-2]

Q7: Discuss factors affecting low participation of Indian women engineers in R&D. [CO-1]

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Roll No.....

M.Tech. (DSC)

FIRST SEMESTER

END SEMESTER EXAMINATION

NOV-2022

DSC501-Mathematics and Foundation in Computer Science

Time: 3:00 Hours

Max. Marks: 40

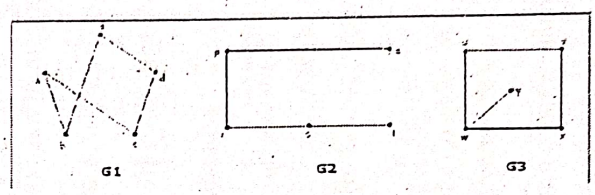
Note: Answer ALL questions. All questions carry equal marks.
Assume suitable missing data, if any.

Q.1

A. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has [2] CO(V)

(i) no girls,
(ii) at least one boy and one girl,
(iii) at least three girls

B. Which of the following graphs is isomorphic? [2] CO(IX)



Q.2 Define Confusion matrix and its inclusive components: [5] CO(V)

a. Accuracy
b. Precision
c. Recall
d. F1-score

Q.3 An unfair coin is flipped 100 times, and 61 heads are observed. The coin either has a probability of 1/3, 1/2 or 2/3 of flipping a head each time it is flipped. Which of the three is the MLE. [5] CO(V)

Q.4 Let X be a continuous random variable with the PDF given by: [5] CO(VII)

$$f(x) = \begin{cases} x; & 0 < x < 1 \\ 2 - x; & 1 < x < 2 \\ 0; & x > 2 \end{cases}$$

Find $P(0.5 < x < 1.5)$.

Q.5 Explain Maximum Likelihood Estimation and explain its usefulness as a tool for supervised machine learning. [5] CO(IX)

[8] CO(V)

Q.6 Differentiate between
a. Supervised Learning & Unsupervised Learning
b. Overfitting & Underfitting
c. Classification & Regression
d. Planar & Non-planar graphs

[2+6] CO(V)

Q.7 Define Decision Tree classifier and its splitting measures. Also, calculate the Gini Index from the following table for
a. Past Trend
b. Open Interest
c. Trading Volume

Past Trend	Open Interest	Trading Volume	Return
Positive	Low	High	Up
Negative	High	Low	Down
Positive	Low	High	Up
Positive	High	High	Up
Negative	Low	High	Down
Positive	Low	Low	Down
Negative	High	High	Down
Negative	Low	High	Down
Positive	Low	Low	Down
Positive	High	High	Up

Total No. Of Pages: 3 *Roll no.....*

FIRST SEMESTER
M. TECH

END SEMESTER EXAMINATION Nov/Dec- 2022

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. Consider the following schema for (a) and (b) and answer the queries in Relational Calculus:

Employee (Fname, Minit, Lname, SSN, Bdate, address, Gender, Salary, Super_ssn, Dno)

Department (Dname, Dnumber, Mgr_ssn, Mgr_start_date)

Dept_Locations (Dnumber, Dlocation)

Project (Pname, Pnumber, Plocation, D num)

Works_on (Essn, Pno, Hours)

Dependent (Essn, Dependent_name, Gender, Bdate, Relationship)

(a)Find the Fname of each employee who works on some project controlled by department number 5.

(b) List the Fname of managers who have atleast one dependent.

[CO 2,3] [2.5*2=5]

Q2. Consider the following schema for (a) and (b) and answer the queries in SQL:

Employee (employee-name, street, city)

Works (employee-name, company-name, salary)

Company (company-name, city)

Manages (employee-name, Manager-name)

(a)Find the names of all employees who earn more than the average salary of all employees of their company?

(b) Write a SQL statement to display salesman_id, name, city and commission who gets the commission within the range more than 0.10% and less than 0.12%. **[CO 3,4] [2.5*2=5]**

Q3. Consider the following relations answer the queries in Relational Algebra:

Doctor (SSN, FirstName, LastName, Specialty, Years_Of_Experience, Phone_Num)
Patient (SSN, FirstName, LastName, Address, DOB, PrimaryDoctor_SSN)
Medicine (TradeName, UnitPrice, GenericFlag)
Prescription (Id, Date, Doctor_SSN, Patient_SSN)
Prescription_Medicine (Prescription Id, TradeName, NumOfUnits)

a) List the trade name of generic medicine with unit price less than $50.
b) List the first and last name of patients whose primary doctor named 'John Smith'.
c) List the first and last name of doctors who are not primary doctors to any patient. **[CO 2,3,4] [5]**

Q4. (a) When are two schedules conflict equivalent? What is conflict serializable schedule?
(b) Differentiate between Recoverable Schedule, Cascadeless Schedule and Strict Schedule with an appropriate example.
[CO 5,6] [2+3 = 5]

Q5. (a) Explain the ethical issues related to data collection and data storage.
(b) Describe the important aspect of data ethics. **[CO 8] [3+2 = 5]**

Q6 (a) What are the different ideas for building ethics into culture.
(b) What are the Coffman necessary conditions for deadlock to occur.
[CO 8,9] [2.5*2 = 5]

Q7. (a) Explain Ostrich algorithm used for deadlock handling.
(b) Why recovery is needed in transaction. Explain? **[CO 6,7][2.5*2 = 5]**

Q8. (a)What are the five framing guidelines who help us to think about building data projects.
(b) Explain the schemes used in deadlock prevention.
[CO 5,6] [2.5*2 = 5]

Q9. Explain the following:
a) Time based protocol
b) Graph based protocol
c) Thomas Write rule
d) System log
e) View Serializability **[CO 3,4,5] [1*5 = 5]**

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Total no. of Pages: Roll no.....

3rd SEMESTER **M.Tech**

END TERM EXAMINATION *Nov/Dec-2022*

COURSE CODE DCS6309 COURSE TITLE Swarm and Evolutionary Computing

Time: 03:00 Hours *Max. Marks: 50*

Note : Assume suitable missing data, if any.

Q.1 Simulate a Genetic Algorithm to maximize a function,

$$F(X) = x^2$$

Where x is permitted to vary between 0 to 31. [5][CO4]

Q.2 How are social behaviours of living organisms helpful in developing optimization techniques? [5][CO2]

Or

Q.2 Explain the working of Cuckoo Search Algorithm. [5][CO1]

Q.3 Can it be said that PSO implements a form of [5][CO2]

(a) competitive coevolution?

(b) cooperative coevolution? Justify your answers.

Or

Q.3 Write a short note on [5][CO2]

a) Fitness Function

b) Parameter Control

Q.4 Minimize $f(X) = x_1^2 + x_1x_2 + x_2^2 + 2x_1 + 4x_2 + 3$ with the help of the firefly algorithm. [10][CO3]

Where, $-5 \leq x_1, x_2 \leq +5$.

Q.5 Explain the working rule of Artificial Bee Colony (ABC) algorithm. [5][CO4]

Q.6 Maximize $f(X) = x^2 + y^2$ using Cuckoo Search Algorithm. Where $1 \leq x \leq 15$ and $y \geq 3$ with $x + y = 7$. [10][CO3]

Q.7 Find the minimum of the function $f(X) = -x^2 + 5x + 20$

Using PSO algorithm. Use 5 particles with initial positions. [10][CO3]

Total No. of Pages: 01 199 Roll No. .....

Ph.D

FIRST SEMESTER

END SEMESTER EXAMINATION *Nov/Dec-2022*

ACPT-901 Spectroscopy: Application for Structure Determination

Time: 3 Hours *Max. Marks: 50*

Note: Assume suitable missing data, if any.

[1] Define Beer-Lambert Law. Write its four limitations. [3+2]

[2] Draw and label the block diagram of double-beam UV-visible spectrophotometer. Which light sources used in this. [4+3]

[3] Define the following: Chromophore, Auxochrome, Bathochromic shift, and Hyperchromic shift. [10]

[4] Write short note on **any one** of the following: (a) Molecular vibrations in IR spectroscopy (b) Coupling Constant in NMR. [4]

[5] How will you differentiate between the following molecules based FTIR spectroscopy: Acetone (CH_3COCH_3), Chloroacetone (CH_3CO CH_2Cl), Dichloro acetone ($CH_3COCHCl_2$), and Tetrachloro acetone ($Cl_2CH_2COCHCl_2$). [4]

[6] What do you understand by figure print region in IR spectroscopy? Write four important application of IR spectroscopy. [2+2]

[7] 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? [2+2+2]

[8] What do you understand by McLafferty rearrangement? Explain. [5]

[9] A compound having molecular formula $C_5H_{10}O$ shows peaks in FTI at 2964, 2878, 1718, and 1365 cm^{-1}. In ^1H NMR, the data obtained 0.9 (t), 1.6 (m), 2.1 (s), and 2.4 (t) ppm. Fins the chemical structure the molecule. [5]

Total no. of Pages: 02 200 Roll no.....

FIRST SEMESTER

Ph.D. (Course work)

END TERM EXAMINATION *Nov/Dec -2022*

COURSE CODE: SM 901

COURSE TITLE: RESEARCH METHODOLOGY AND IPR

Time: 03:00 Hours *Max. Marks: 50*

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

Q.1 (i) Does primary data collection always produce qualitative data? Explain in detail. [5] [CO1]

(ii) Differentiate between Reliability and Validity [5] [CO1]

Q.2 (i) Which sampling technique would you apply to analyze the efficiency of a new teaching pedagogy introduced among undergraduate engineering students of Delhi Government institutions? You are free to make suitable assumptions. [5][CO2]

OR

A researcher wants to test the effect of the "pill" on the running speed of the athletes. What research design would be suitable? Explain [5][CO2]

(ii) What are the considerations you would keep in mind while making a questionnaire? [5][CO2]

Q.3 (i) Two urns contain respectively 2 red, 5 black, 7 green and 1 red, 4 black, 9 green balls. One ball is drawn from each urn. Find the probability that both the balls are of the same colour. [2][CO3]

(ii) The length of bolts produced by a machine is normally distributed with mean 4 and standard deviation 0.5. A bolt is defective if its length does

the interval (3.8, 4.3). find the percentage of defective bolts produced by the machine.

[Given: $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{0.6} e^{-\frac{t^2}{2}}dt = 0.7257$, $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{0.4} e^{-\frac{t^2}{2}}dt = 0.6554$] [5][CO3]

(iii) An ambulance service claims that it takes, on the average, 8.9 minutes to reach its destination in emergency calls. To check on this claim, the agency which licenses ambulance services had them timed on 50 emergency calls, getting a mean of 9.3 minutes with a standard deviation of 1.8 minutes. At the level of significance of 0.05, does this constitute evidence that the figured claimed is too low? [3][CO3]

Q.4 (i) What are the objectives of literature review? Mention the steps involved in conducting a literature review. [5][CO4]

(ii) What points we should keep in mind to write a good abstract of Ph.D. thesis? Explain in detail. [5][CO4]

Q.5 (i) What is intellectual property? Mention the items that can be protected in intellectual property system. [5][CO5]

OR

Write five key features of intellectual property system. [5][CO5]

(ii) Write short notes on Copyright and Patents. [5][CO5]

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Total no. of Pages: 01

Roll no.....

SEMESTER 1 - **Ph.D.**

END TERM EXAMINATION

Nov/Dec-2022

COURSE CODE- SM903 COURSE TITLE – RESEARCH AND PUBLICATION ETHICS

Time: 03:00 Hours *Max. Marks: 50*

Note: All questions carry equal marks.
Attempt all questions

Q.1 Explain the difference between applied and basic research [CO#1]

Q.2 Explain with figures the relationship between 'truth', 'belief' and 'knowledge' [CO#2]

Q.3 Explain the moral dilemmas in data cleaning and reporting results. [CO#3]

Q.4 What is the role of the editor *or* the publisher in publication standards? [CO#4]

What is the phenomenon of plagiarism and the role of 'Creative Commons?' [CO#5]