

**END TERM EXAMINATION**

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: AIDS301/AIML-301****Subject: Operating Systems****Time: 3 Hours****Maximum Marks: 75**

**Note: Attempt five questions in all including Q. No. 1 which is compulsory. Select one question from each unit.**

**Q1 Answer the following in brief:- (25)**

- (a) What is an Operating System? Explain the main functions of an operating system. (5)
- (b) Explain the various states of a process with suitable diagram. (5)
- (c) What is Fragmentation? Compare External Fragmentation and Internal Fragmentation. (5)
- (d) Differentiate between logical address and physical address. (5)
- (e) Compare contiguous and linked allocation of disk. (5)

**UNIT-I**

**Q2 (a) Explain the various types of operating systems in detail. (7.5)  
(b) Discuss the performance criteria of scheduling algorithms. (5)**

**OR**

**Q3 (a) Consider the following set of processes, with the length of the CPU burst time given in milliseconds: (8.5)**

Process	Burst Time	Priority
$P_1$	2	2
$P_2$	1	1
$P_3$	8	4
$P_4$	4	2
$P_5$	5	3

The processes are assumed to have arrived in the order  $P_1, P_2, P_3, P_4, P_5$ , all at time 0.

- (i) Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, priority (a larger priority number implies a higher priority), and Round Robin (time quantum = 2)
- (ii) What is the average waiting time for each of these scheduling algorithms?
- (iii) Which of the algorithms results in the minimum average waiting time (over all processes).
- (b) Compare Preemptive and Non Preemptive Scheduling with examples. (4)

**UNIT-II**

**Q4 (a) Consider a system with five processes  $P_0$  through  $P_4$  and three resource types A, B, and C. Resource type A has ten instances, resource type B has five instances, and resource type C has seven instances. Suppose that, at time  $T_0$ , the following snapshot of the system has been taken: (8)**

	<u>Allocation</u>			<u>Max</u>			<u>Available</u>		
	A	B	C	A	B	C	A	B	C
$P_0$	0	1	0	7	5	3	3	3	2
$P_1$	2	0	0	3	2	2			
$P_2$	3	0	2	9	0	2			
$P_3$	2	1	1	2	2	2			
$P_4$	0	0	2	4	3	3			

**P.T.O.**

Using ~~K~~ ker's algorithm, answer the following questions:-

- (i) What are the contents of need matrix?
- (ii) Find if the system is in safe state. If it is, find the safe sequence.
- (b) Briefly explain Deadlock recovery. (4.5)

OR

- Q5 (a) Explain Producer Consumer Problem. (7.5)  
(b) Write short notes on the following:-(5)
  - (i) Critical section
  - (ii) Semaphores

### UNIT-III

- Q6 (a) What do you mean by Paging? Compare Paging and Segmentation. (7.5)  
(b) Explain contiguous memory allocation. (5)

OR

- Q7 (a) Explain FIFO and LRU page replacement algorithms with examples. (7.5)  
(b) Write short notes on:-
  - (i) Demand paging
  - (ii) Swapping(5)

### UNIT-IV

- Q8 (a) What is a file? Discuss various file operations. (5)  
(b) What is Disk scheduling? Explain any three disk scheduling algorithms with diagrams. (7.5)

OR

- Q9 (a) Explain the various directory structures in detail. (7.5)  
(b) Explain various file access methods. (5)

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# END TERM EXAMINATION

FIFTH SEMESTER (B.TECH) JANUARY-2024

**Paper Code: AIDS/AIML/IOT-303**

**Subject: Design & Analysis of Algorithm**

**Time: 3 Hours**

**Maximum Marks :75**

**Note: Attempt five questions in all including question no. 1 which is compulsory. Select one question from each unit. Assume missing data if any.**

- Q1**
- (a) Distinguish Big-oh(O) and Little-oh (o) notation. (3)
  - (b) Compare the Greedy Approach with Dynamic Programming. (3)
  - (c) Differentiate P and NP Problems with examples. (3)
  - (d) Explain the Convex Hull Approach with an example. (3)
  - (e) Compare Backtracking & Branch and Bound techniques. (3)

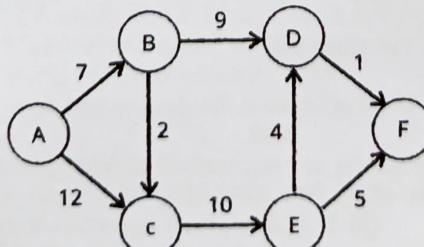
## UNIT-I

- Q2**
- (a) Solve the following recurrence relations using an appropriate method as indicated. (3+3+3=9)
    - 1.  $T(n) = 3T(n/4) + cn^2$  (Recurrence Tree Method)
    - 2.  $T(n)=2T(n/2) + n^2\log n$  (Master's Method)
    - 3.  $T(n)= 2T(n/2) +3n^2$ ,  $T(1)=11$  (Iteration Method)
  - (b) What is asymptotic analysis? Discuss the asymptotic notations used for representing the growth rate of functions. (6)

- Q3**
- (a) Solve the following recurrence relations using an appropriate method as indicated. (3+3+3=9)
    - 1.  $T(n)=2T(n/3) + cn$  (Substitution Method)
    - 2.  $T(n)=4T(n/2) + n^3$  (Master's Method)
    - 3.  $T(n)= T(n/3) + T(2n/3) + n$  (Recurrence Tree Method)
  - (b) Analyze the time complexity of Insertion Sort & Selection Sort. Perform step-by-step analysis (Insertion & Selection sort) on the following set of numbers [48, 23, 75, 16, 20, 52, 10, 69] (6)

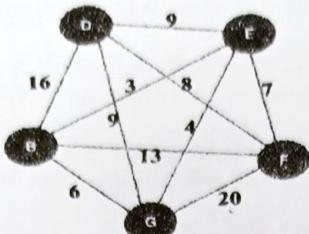
## UNIT-II

- Q4**
- (a) Compare Dijkstra and Bellman-Ford Algorithms with their advantages & drawbacks. Find out the shortest path on the following graph using Dijkstra's algorithm. (8)



- (b) Illustrate the Merge Sort algorithm and analyze its time complexity in best-case and worst-case scenarios. Perform Merge sort on the following numbers: [37, 15, 94, 73, 28, 54, 68] (7)

- Q5 (a) What is MST? Consider the given graph and find out the MST using Kruskal's & Prim's Algorithm. Also, calculate the weight of MST. (8)

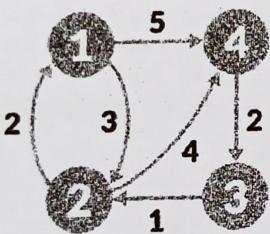


- (b) Discuss Strassen's Matrix multiplication and analyze its time complexity. (7)

### UNIT-III

- Q6 (a) Consider the following problem for 0/1 Knapsack having weights and profits as:  
Weights: {3, 4, 6, 5} and Profits: {2, 3, 1, 4}. The capacity of the knapsack is 8. Find out the total profit earned by the 0/1 Knapsack using the Dynamic Programming Approach. (8)  
(b) What is backtracking? In reference to this explain N-Queen's Problem with algorithm & example. Also, discuss its time complexity. (7)

- Q7 (a) Explain Floyd Warshall's algorithm. Find out all pairs' shortest path for the following graph using the Floyd-Warshall algorithm. (8)



- (b) Discuss the traveling salesman problem with an example. Also, analyze its time complexity. (7)

### UNIT IV

- Q8 (a) Illustrate several Graph traversal techniques. Also, discuss the real-life applications of graph traversal techniques. (8)  
(b) Discuss NP-complete and NP-hard problems with examples. (7)
- Q9 (a) Explain the Graph coloring problem with the algorithm and example. (8)  
(b) Discuss Cook's theorem and its applications. (7)

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: AIDS-305**

**Subject: Data Mining**

**Time: 3 Hours**

**Maximum Marks: 75**

**Note: Attempt five questions in all including Q.No. 1 which is compulsory.**  
**Select one question from each unit. Assume missing data, if any.**

**Q1** Attempt **any five** question **(3x5=15)**

- Define Data Mining and explain its primary objectives. How does it differ from traditional data analysis techniques?
- Where do we use Linear regression? Explain linear regression.
- Why do we need data transformation? What are the different ways of data transformation?
- Describe the concept of clustering in data mining. Provide an example of a real-world application where clustering is beneficial.
- An airport security screening station wants to determine if passengers are criminals or not. To do this, the faces of passenger are scanned and kept in a database. Is this a classification or prediction task? Justify.
- What is pattern evaluation? Define descriptive and predictive data mining?

## UNIT-I

**Q2** a) Discuss the challenges and ethical considerations associated with data mining. How can organizations ensure responsible and ethical use of data mining techniques? **(8)**  
 b) Describe the main steps involved in the data mining process. Provide an example to illustrate each step. **(7)**

**OR**

**Q3** a) Explore the role of data mining in the field of education. How can clustering or classification techniques be used to analyze student performance data? **(8)**  
 b) What is Knowledge Discovery in Databases (KDD)? Explain the stages involved in the KDD process. **(7)**

## UNIT-II

**Q4** a) Explain the significance of feature subset selection in the context of data mining. Discuss two different techniques for selecting feature subsets. **(7)**  
 b) A data set for analysis includes only one attribute X:  $X = \{7, 12, 5, 8, 5, 9, 13, 12, 19, 7, 12, 12, 13, 3, 4, 5, 13, 8, 7, 6\}$ 

- What is the mean of the data set X?
- What is the median?
- Find the standard deviation for X

**(8)**

**OR**

**Q5** a) Define Regression technique for predictive analysis of data. A set of data is given:  $A = \{115, 233, 484, 543\}$ . Normalize the data by Min-max normalization (range: [0.0, 1.0]). **(8)**  
 b) Describe the concept of noise in a dataset and its potential impact on data mining outcomes. Discuss any two noise removal techniques. **(7)**

**P.T.O.**

**UNIT-III**

- Q6 a) Consider a dataset with the following points in a 2-dimensional space:  
 $(1,2), (3,4), (5,6), (7,8), (9,10)$   
 $(1,2), (3,4), (5,6), (7,8), (9,10)$ . If  $k=3$  and the query point is  $(4,5)$ , calculate the predicted class using the KNN algorithm.
- b) What is a Bayesian Belief Network (BBN)? Provide a concise definition and explain the key components that constitute a BBN.

(7)

- Q7 a) Describe the data classification process with a neat diagram. How does the Naive Bayesian classification works? Explain.
- b) Explain the difference between supervised and unsupervised learning in the context of data mining. Provide examples of scenarios where each type of learning is most suitable, and discuss the challenges associated with each approach.

(8)

**UNIT-IV**

- Q8 a) Explain DBSCAN algorithm. State the pros and cons of DBSCAN method.
- b) What are the advantages of DBSCAN over k-Means clustering algorithm?

(8)

(6)

- Q9 a) Identify and explain various techniques used for data cleaning. How do these techniques address issues such as outliers, noise, And inconsistencies in the data?
- b) Write a short note on partitioning clustering and agglomerative hierarchical clustering.

(8)

(7)

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# END TERM EXAMINATION

FIFTH SEMESTER (B.TECH) JANUARY-2024

Paper Code: AIDS/AIML/ IOT/307 Subject: Computer Organization & Architecture

Time: 3 Hours

Maximum Marks :75

Note: Attempt five questions in all including. Q.no. 1 which is compulsory. Select one question from each unit.

- Q1 (a) Explain timing and control diagram with example. (2.5x6=15)  
(b) Explain RISC pipeline.  
(c) What are computer registers? How information is transfer from one register to another?  
(d) Differentiate between multiprocessors and multicomputer.  
(e) What is grain size and latency in computer architecture?  
(f) Subtract 24 from 15 using 2's compliment.

## Unit - I

- Q2 (a) Explain Instruction Cycle with phases in detail with diagram. (7)  
(b) Explain the various levels of programming languages. (8)
- Q3 (a) Explain bus architecture using multiplexer. (7)  
(b) Explain various micro-operations. (8)

## Unit-II

- Q4 Write short notes on following (7)  
(a) Instruction format. (7)  
(b) Addressing modes. (8)
- Q5 (a) Explain with diagram, the memory hierarchy in a computer system. (7)  
(b) Explain Set associative cache mapping in detail. (8)

## Unit-III

- Q6 (a) Differentiate between program partitioning and scheduling. (7)  
(b) How parallel processing enhances the system performance, explain. (8)
- Q7 (a) What are the conditions of parallelism in computer architecture? (7)  
(b) What is the classification of parallel computers? (8)

## Unit -IV

- Q8 (a) Explain the Flynn's classification of computer. (7)  
(b) Explain Instruction Cycle with phases in detail with diagram. (8)
- Q9 (a) Explain the hardware implementation of division arithmetic operation. (7)  
(b) Explain CPU performance and its factors. (8)

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] DECEMBER 2023 – JANUARY 2024

Paper Code: AIDS/AIML-309

Subject: Introduction to Internet  
of Things

Time: 3 Hours

Maximum Marks: 75

Note: Attempt five questions in all including Q. No. 1 which is compulsory. Select one question from each unit.

- Q1 Attempt all questions:- (5x3=15)  
(a) What is IOT. Explain main components of IOT.  
(b) Compare IPV4 and IPV6.  
(c) Write short note on IOT impact on real world.  
(d) Discuss IOT Challenges and benefits of IOT.  
(e) Explain e Health IOT applications.

## UNIT-I

- Q2 (a) Explain physical design of IOT. (7)  
(b) Explain Architecture Reference model of IOT. (8)
- Q3 (a) Define sensors in IOT. Explain different types of sensors and draw hardware circuit for sensor. (7)  
(b) Explain IOT architecture based on application. (8)

## UNIT-II

- Q4 (a) Explain Arduino code to communicate the microcontroller with actuators. (7)  
(b) Explain following Access Technologies:-  
1) Zigbee      2) RFID      3) Cellular (8)
- Q5 (a) What are IOT software platform. Explain with example. (7)  
(b) Discuss IOT design methodology steps. (8)

## UNIT-III

- Q6 (a) Explain physical layer, MAC layer and topology of IEEE 802.154 (7)  
(b) Explain IPv6 overlow power WPAN. (8)
- Q7 (a) Explain COAP & HQTT protocol. (7)  
(b) Describe Architecture of wireless sensor network (WSN). (8)

## UNIT-IV

- Q8 (a) Role of big data in IOT. (5)  
(b) Explain smart irrigation system with diagram. (10)
- Q9 (a) Explain cloud computing. (5)  
(b) Analyze case study of IOT with one example and find out the solutions of various deployment issues. (10)

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# END TERM EXAMINATION

FIFTH SEMESTER (B.TECH) JANUARY-2024

**Paper Code: AIDS/AIML/IOT-311**

**Subject: Principles of  
Entrepreneurship Mindset**

**Time: 3 Hours**

**Maximum Marks :75**

**Note: Attempt five questions in all including Q. no. 1 which is compulsory. Select one question from each unit.**

**Q1 Answer the following questions: (Any Six)**

- (a) What do you understand by the term, 'Entrepreneurship'? (2.5)
- (b) How is an Intrapreneur different from the Entrepreneur? (2.5)
- (c) Every business enterprise requires Key Resources and Key Activities. Discuss, in brief, the difference between the two, with suitable examples. (2.5)
- (d) Define 'Business Problem Statement'. Also, give a relevant example. (2.5)
- (e) What is a P&L Statement? What is its relevance to a business enterprise? (2.5)
- (f) Why is it important to understand customers' requirements? How far a survey can help in understanding customers' requirements? (2.5)
- (g) What is an 'Open Business Model'? Explain, in brief, with a suitable example. (2.5)
- (h) Suggest some basic requisites to start a startup. (2.5)

## UNIT- I

- Q2 (a) Explain, in detail, the various types of Entrepreneurship. (7)**  
**(b) How is conventional entrepreneurship different from social entrepreneurship? Substantiate your answer with some relevant examples in respect of any startup. (8)**
- Q3 (a) What is innovation? Shed light on the role of technology in innovation. (7)**  
**(b) 'Business idea generation helps to identify the opportunities that can be converted into a successful business venture.' Respectively, suggest some techniques of idea generation in initiating a business venture. (8)**

## UNIT- II

- Q4 (a) What is a 'Business Model Canvas'? Explain, in detail, its nine building blocks. (7)**  
**(b) What is the difference between 'Customer Acquisition' and 'Customer Retention' in 'Customer Relationships' with specific reference to 'Business Model Canvas'? (8)**
- Q5 (a) If Customer Segments comprise the heart of a Business Model, Revenue Streams are its arteries.' How far do you agree with the statement? Substantiate your answer with supporting examples. (7)**  
**(b) Prepare a business model canvas of a problem statement. (8)**

**UNIT- III**

- Q6 (a) What do you understand by 'Break-Even Analysis'? What is its significance? Also, provide a relevant example. (7)
- (b) What is the difference between CAGR and NPV? Explain the significance of both with respect to a business venture. (8)
- Q7 (a) Define 'Marketing Strategy'. Explain the 4 Ps of Marketing with relevant examples. (7)
- (b) What is debt funding? How is it different from angel funding? Discuss, in detail. (8)

**UNIT- IV**

- Q8 (a) Presentation of business plan is as important as its outline and preparation. Elucidate. (7)
- (b) What is business planning? What are the steps involved in the process of Business Planning? Support your answer with relevant examples. (8)
- Q9- (a) Create a business plan for incorporation of a new company in India highlighting the significance of 'Business Model Canvas'. (8)
- (b) Enlist the challenges faced and strategies implemented to overcome those in respect of any startup. (7)

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: AIML-305**

**Subject: Fundamentals of Deep Learning**

**TIME: 3 HOURS**

**MAXIMUM MARKS: 75**

**Note: Attempt five questions from each unit including Q.No.1 which is compulsory. Select one question from each unit. Assume missing data if any.**

**Q1** Attempt all questions.

(3x5=15)

- a) Differentiate between the term overfitting and underfitting. How it can affect model generalization?
- b) What is regularization? What is the need of regularization?
- c) How does learning rate affect the convergence of a machine learning model?
- d) Discuss the importance of pooling layer in Convolutional Neural Networks.
- e) Discuss about applications of Deep learning.

## UNIT-I

- Q2** a) Compare and contrast Machine learning and Deep learning technique along with applications. What are the advantages of deep learning over Machine learning? (6)
- b) What is the role of optimizers in deep learning? Explain different optimizers often used in deep learning. (6)
- c) How do Support Vector Machines (SVMs) function as linear classifiers, how do they find the optimal hyperplane? (3)

- Q3** a) Explain the various types of Gradient Descent techniques in detail along with their pros and cons. (6)
- b) What is the importance of loss functions in deep learning? Explain different types of loss functions along with their applicability in a specific scenario. (6)
- c) Explain the concept of Bayesian learning. (3)

## UNIT-II

- Q4** a) What is McCulloch-pitts neuron and how does it function as a basic computational unit in the context of neural network? Explain with help of an example. (5)
- b) Construct a single layer neural network for implementing Boolean AND, OR functions. (5)
- c) Explain exploding gradient and vanishing gradient issues often encountered in training neural networks. (5)

**P.T.O**

- Q5 a) What are the key components shared between biological neuron and artificial neuron, and how are they represented in artificial neural network models? Explain with the help of relevant diagrams. (5)
- b) Explain backpropagation algorithm. How weights are updated using backpropagation algorithm. Illustrate with the help of an example. (7)
- c) Differentiate Single layer and Multilayer perceptron. (3)

### UNIT-III

- Q6 a) List and explain various activation functions used in modeling of artificial neuron. Also explain their suitability with respect to different applications. (7)
- b) Explain how LSTM and Gated Recurrent Unit (GRU) work. Suggest which one is likely to perform better in different scenario and why? (8)
- Q7 a) Explain the importance of Hyperparameter-tuning in context of deep learning. List and explain different hyperparameters that can be tuned for optimizing Deep Neural Network (DNN)? (7)
- b) Explain the architecture of Recurrent Neural Networks (RNNs) with the help of a block diagram. Also compare RNNs with Bidirectional RNNs (8)

### UNIT-IV

- Q8 a) With the help of a diagram, explain basic building blocks of Convolutional Neural Network architecture. (9)
- b) i) Determine the shape of output matrix of an image of size  $19 \times 19$  that uses a padding size 2, stride size 2, and a  $5 \times 5$  filter.
- ii) Perform the computations for convolution operation on the given Input volume and the filter with Stride S=1; and no padding (6)

0	20	0	30
1	51	4	2
32	80	0	75
0	9	0	95

$\otimes$

-1	0	1
-2	0	2
-1	0	1

Input    Filter

- Q9 a) Draw and explain the block diagram of VGG-16 and ResNet. (9)
- b) Explain **any three**: (2x3=6)
- i) Transfer learning
  - ii) Natural Language Processing (NLP)
  - iii) Role of CNN in computer vision
  - iv) AlexNet

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: IOT-309**

**Subject: Machine Learning**

**Time: 3 Hours**

**Maximum Marks: 75**

**Note: Attempt five questions in all including Q.No. 1 which is compulsory.  
Internal Choice is indicated. Use of calculator is allowed.**

**Q1** Attempt **any five** from the following in brief: **(5x3=15)**

- a) Differentiate between Linear regression, Logistic Regression and Multiple Linear regression.
- b) Differentiate between classification and clustering.
- c) Differentiate between machine learning, Reinforcement learning and deep learning.
- d) What is Boosting? How it is different from Bagging?
- e) Differentiate between Supervised learning, unsupervised learning and Semi supervised learning.
- f) What is the hidden Markov model used for? Give one real life applications of hidden Markov model?
- g) The following data set is to be grouped into two clusters using k-means algorithm.

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

**Q2** How decision tree algorithms work? Explain Decision Tree algorithm working in simpler steps. With reference to the decision tree, explain following concepts: **(15)**

- a) Why Pruning required
- b) When to Stop Splitting?
- c) Difference between Pre-pruning and Post-pruning
- d) What is Entropy
- e) How do Decision Trees use Entropy

**Q3** a) What are the problems associated with data imbalancing? Discuss possible solutions. **[7]**  
 b) Below is the age of 25 students, Draw Box plots and find outliers  
 23, 24, 23, 23, 24, 35, 24, 23, 24, 26, 20, 22, 23, 23, 24, 40, 35, 24, 23, 27, 23, 23, 25 **[8]**

**P.T.O.**

- Q4** a) Write neat Apriori algorithm for association analysis and explain. [7]  
 b) Differentiate between Confidence and Support. Given the value of five transaction as: (A,B,C) (A,C,D) (B,C,D) (A,D,E) (B,C,E). Find the value of support and confidence for the following rules: [8]
- i) Rule 1 as  $A \Rightarrow D$
  - ii) Rule 2 as  $C \Rightarrow a$
  - iii) Rule 3 as  $A \Rightarrow C$
  - iv) Rule 4 as  $B \& C \Rightarrow D$
- Q5** a) Suppose the given data points are  $\{(1, 3), (2, 5), (6, 8), (7, 9)\}$  Define Fuzzy Clustering and apply on above data to form clusters. Why we need to defuzzify to get the answer. [7]
- b) Discuss the Advantages and Disadvantages of Fuzzy Clustering. [8]
- Q6** a) Discuss applications in several fields of Fuzzy clustering. [8]
- b) Write a detail note on naïve bayes linear models? [7]
- c) What is support vector machine? Discuss in detail? [8]
- Q7** a) Explain the main components of reinforcement learning and discuss its following four main elements: [7]
- i) a policy
  - ii) a reward function
  - iii) a value function
  - iv) a model of the environment.
- b) How machine learning can be helpful in email spam detection? Explain. [8]
- Q8** a) What is confusion matrix? Draw a confusion matrix and find accuracy, recall and precision formulas. [7]
- b) With reference to the Machine learning algorithms, explain following with Examples: [8]
- i) MBR
  - ii) Link Analysis
  - iii) Neural networks
  - iv) Genetic algorithms

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**END TERM EXAMINATION**

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: IOT-301****Subject: Data Transmission Methodologies****Time: 3 Hours****Maximum Marks: 75**

**Note: Attempt five questions in all including Q. No. 1 which is compulsory. Select one question from each unit.**

Q1 Attempt all questions:-

- (a) Explain the term "signal" in the context of transmission by communication systems. (3)
- (b) Highlight the importance of intentionally generated noise in data transmission in communication systems. (3)
- (c) Differentiate between telemetry and telecontrol. (3)
- (d) Does phase modulation have a modulation index similar to frequency modulation? Clarify it. (3)
- (e) For a QAM system with 16 different symbols, Calculate number of bits which can be represented by each symbol? (3)

**UNIT-I**

- Q2 (a) Explain the purpose of modulation in communication. If a carrier wave has a frequency of 1 MHz and an amplitude of 5 V, calculate the peak voltage of an AM signal with a modulation index of 0.8. (7.5)
- (b) State the sampling theorem. A signal with a frequency of 500 Hz is sampled at a rate of 1000 samples per second. Determine the Nyquist frequency and explain its significance in signal processing. (7.5)

**OR**

- Q3 (a) In what scenarios would you prefer digital communication over analog communication? Provide at least two examples. Also, define and write the formula of baud rate in the digital communication. (7.5)
- (b) Discuss the advantages and limitations of analog communication systems. If the signal-to-noise ratio (SNR) of an analog communication system is 20 dB, calculate the SNR in numeric form. (7.5)

**UNIT-II**

- Q4 (a) Compare and contrast with waveform patterns for frequency modulation (FM) and phase modulation (PM) in terms of their characteristics and applications. (7.5)
- (b) Explain what narrowband FM is and provide an application where NBFM is commonly used. Also, find that if FM signal with a carrier frequency of 200 MHz and a modulation frequency of 10 kHz, determine whether it falls under NBFM or WBFM category. (7.5)

**OR**

- Q5 (a) How does varying the modulation index affect the amplitude-modulated signal? Explain it with related waveform patterns. (7.5)
- (b) If a carrier signal of 100 kHz is modulated using DSB with a message signal of 5 kHz, determine the bandwidth occupied by the modulated signal. Also, draw waveform pattern of it. (7.5)

**UNIT-III**

- Q6 (a) Elaborate the companding process. If we use A-law companding and the input signal has a voltage of 0.5 V, what will be the output voltage after companding? (7.5)  
 (b) What is Quantization? Given an analog signal with a maximum amplitude of 5 V, if we use a 10-bit PCM, Calculate is the quantization step size. (7.5)

**OR**

- Q7 (a) Compare the characteristics of digital modulation schemes. If a binary FSK system has two frequencies, 1 kHz and 2 kHz, and the bit rate is 5 kbps, what is the minimum bandwidth required? (7.5)  
 (b) Discuss the various types of pulse modulation techniques. In a PWM system, if the pulse width is 20  $\mu$ s and the total period is 100  $\mu$ s, find out the duty cycle? (7.5)

**UNIT-IV**

- Q8 (a) What challenges are associated with radio frequency telemetering, and how can they be mitigated? (7.5)  
 (b) Describe the importance and role of a data receiver in telemetry systems with suitable diagram. (7.5)

**OR**

- Q9 (a) What are the key challenges associated with digital data acquisition systems and how it is different from analog data acquisition systems? (7.5)  
 (b) Explain how digital signal processing is employed in modern telemetry systems. (7.5)

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$$\delta \times \frac{8}{10^2} = Am$$

(Ans)

$$f \times \frac{3}{4}$$

$$1\frac{1}{4}$$

# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] JANUARY 2024

**Paper Code: IOT-305**

**Subject: Sensors & Control Systems**

**Time: 3 Hours**

**Maximum Marks: 75**

**Note: Attempt five questions in all including Q.No. 1 which is compulsory.**

**Select one question from each unit. Assume missing data, if any.**

**Q1** Attempt all questions:

- a) Define sensors and transducers. Highlight the key differences between these two terms. (3)
- b) Differentiate between static and dynamic characteristics of transducers with suitable example. (3)
- c) Outline the process of anodization in smart sensor fabrication (3)
- d) Discuss the importance of transfer function with suitable example. (3)
- e) Explore the importance of integrating various sensors in control systems. (3)

## UNIT-I

- Q2** a) Explain the working principle of a Linear Variable Differential Transformer (LVDT) for displacement measurement. Discuss the advantages and limitations of LVDT in displacement measurement. [7.5]
- b) Discuss the working principle of strain gauge with suitable diagram and also explain how strain gauge-based load cells operate. [7.5] -3-4

- Q3** a) Classify the different types of tachometers and also compare the electromagnetic tachometer with photoelectric tachometer [7.5]
- b) Define proximity sensors and discuss their working principle with suitable diagram. Provide applications of proximity sensors used in different industries. [7.5]

## UNIT-II

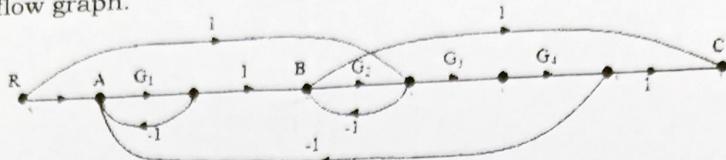
- Q4** a) Discuss the fabrication methods of sensing films in smart sensors. Compare physical vapor deposition and chemical vapor deposition methods. [7.5]
- b) Elaborate the importance of material selection for smart sensor electrodes. How the choice of electrode material significantly impacts sensor performance. [7.5]

- Q5** a) Assess the challenges associated with the sol-gel method in sensing film deposition. Provide insights into how these challenges can affect the performance of smart sensors. [7.5]
- b) List out the challenges in interfacing smart sensors and their electronic circuits and also provide solutions to overcome these challenges. [7.5] -3-

## UNIT-III

- Q6** a) Outline the difference between open loop and closed loop control system with suitable block diagrams. [7.5]

- b) Determine the transfer function  $C(s)/R(s)$  from the following signal flow graph. [7.5]



- Q7 a) Discuss the concept of steady state errors in control systems. For a unity feedback control system, calculate the steady state error for step and ramp input. [7.5]  
 b) Explain the role of controller in control system and also discuss in brief about the PID controller and its applications. [7.5]

#### UNIT-IV

- Q8 a) Describe the role of sensors and transducers in a two-tank system. Explain how level sensors contribute to the control of fluid levels in each tank. [7.5]  
 b) Explain how sensors and transducers are employed in the speed control of a DC motor. Discuss the type of sensor and its control strategy used in speed measurement. [7.5]
- Q9 a) Describe the integration of sensors and Apple iOS devices for a scope block application. [7.5]  
 b) Discuss how the brightness of an Arduino onboard LED is controlled using sensors and an Apple iOS device. [7.5]

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