Year - April 2024

MSC - Computer Science

SEM - IV

No of pages - 5

Paper / Subject Code: 92973 / Computer Science: Paper I - Robotics

MSC - Sem IV - CS

(Time: $2\frac{1}{2}$ hours)

[Total Marks: 60]

N. B. (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.

Q. 1. **Attempt *any two* of the following.** **12 Marks**

a. Define Robot. Explain MARS Rover robot and Baxter Robot in detail.
b. What are the key components that make up the internal mechanism of a washing machine, illustrated with a clear and labeled diagram?
c. How do motors function within various Robots and what are their different types?
d. What factors should be considered when selecting a Raspberry Pi model for a specific Robot?

Q. 2. **Attempt *any two* of the following.** **12 Marks**

a. What are the important steps and considerations involved in test-fitting components for a robot assembly?
b. How to add castor wheels and batteries to a Robot?
c. Explain color system in Robotics. Write down the steps to convert HSV to RGB.
d. What is line following? Explain its types.

Q. 3. **Attempt *any two* of the following.** **12 Marks**

a. Explain servo motor control loop.
b. How to detect the distance travelled by a Robot?
c. How to attach encoders to a Robot?
d. What are the differences and considerations between optical and ultrasonic sensor in a Robot?

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Q. 4. **Attempt *any two* of the following.** **12 Marks**

a. Explain the following fundamental concepts underlying a voice assistant in a Robot.
   1. Utterances
   2. Intent
   3. Dialog
   4. Vocabulary

b. Explain color tracking behavior in a Robot.

c. How can face tracking be effectively implemented using Python, emphasizing practical implementation steps?

d. How to attach camera to pan and tilt mechanism?

Q. 5. **Attempt *any two* of the following.** **12 Marks**

a. Explain the pin diagram of Raspberry Pi.

b. Explain the process of finding the line to follow.

c. How to secure sensor and power switch to a Robot?

d. Explain how to get color object information from a camera.

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MSC - sem IV - CS

Time: 2 ½ Hours **[Total Marks: 60]**

N.B: (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

Q.1 Attempt **any two** of the following **(12)**

a) What are some common challenges faced in the learning process of neural networks? **06**

b) Write a short note on **06**

i. Open source libraries for deep learning.
ii. Applications of Deep Learning

c) What is overfiting in Learning? How to detect and prevent overfitting in deep neural network.. **06**

d) Write a note on implementing single Neuron-Linear and Logistic Regression. **06**

Q.2 Attempt **any two** of the following **(12)**

a) What are hyper-parameters in machine learning model? Give some examples of hyper-parameters in fully connected network. **06**

b) Briefly outline the building blocks of Convolutional Neural Networks. State some applications of Convolutional Neural Networks. **06**

c) State the purpose of pooling layer in CNN. Compare between max pooling and average pooling. **06**

d) Outline the phylosophy and architecture Recurrent Neural Networks in deep learning. **06**

Q.3 Attempt **any two** of the following **(12)**

a) What are autoencoders? Briefly describe the autoencoder architecture. **06**

b) Explain about Deep Belief Network (DBN) in Deep Learning. Briefly outline the working of Deep Belief Network. **06**

c) Briefly describe Generative Adversarial Networks (GANs) in deep learning. Explain the process and components of GANs. **06**

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d) Write a note on conditional GANs. Give some application where conditional GANs can be used. 06

Q.4 Attempt **any two** of the following (12)

a) Describe the Reinforcement Learning in deepl learning. List and explain types of Reinforcement Learning. 06

b) Briefly describe the Deep Q-Networks. 06

c) What is Experience Learning? Discuss the significance of experience – based learning in Building Robust Game Playing AI Agents. 06

d) Write a note on deep learning for Language Modeling and speech Recognition. 06

Q.5 Attempt **any two** of the following (12)

a) Sate the advantages of additional hidden layers in neural network. 06

b) What is transfer learning? List some scenarios for using the transfer learning. 06

c) Brefly describe Restricted Boltzmann Machines. 06

d) Write a note on **(any two)** 06

i. LSTM
ii. Vanishing and Exploding Gradients.
iii. Denoising autoencoder
iv. RNN Topologies

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MSC-CS – Sem IV

Time :2 ½ Hours **[Total Marks: 60]**

N.B: (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

Q.1	Attempt **any two** of the following	**(12)**
a)	How Images are represented as Signals?	**06**
b)	Write a short note on autocorrelation of periodic signals.	**06**
c)	Write a short note on Brownian noise.	**06**
d)	What do you mean by frequency domain filtering?	**06**
Q.2	Attempt **any two** of the following	**(12)**
a)	Write a short note on sharpening of images.	**06**
b)	What do you mean by Image transformation? Explain any one type.	**06**
c)	Discuss the effect of noise on gradient computation.	**06**
d)	What are different image file formats?	**06**
Q.3	Attempt **any two** of the following	**(12)**
a)	Explain any one edge detection technique in detail.	**06**
b)	Explain the concept of Erosion and dilation	**06**
c)	What is Skeletonizing?	**06**
d)	Write a short note on Grayscale operation.	**06**
Q.4	Attempt **any two** of the following	**(12)**
a)	What do you mean by region splitting and merging?	**06**
b)	Write a short note on Watershed algorithm.	**06**
c)	Explain the concept of Scale-invariant feature transforms.	**06**
d)	How principal component plays role in image processing?	**06**
Q.5	Attempt **any two** of the following	**(12)**
a)	Explain Image Convolution with example.	**06**
b)	Write a short note on Histogram processing.	**06**
c)	Explain Image opening and closing in detail.	**06**
d)	Write a short note on Hough Transform.	**06**

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