

End-Term Examination, December - 2023

Programme : B. Tech.

Year/Semester : 3rd / 5th

Course Name : Introduction to Robotics

Course Code : ME1226

Time : 3:00 Hours

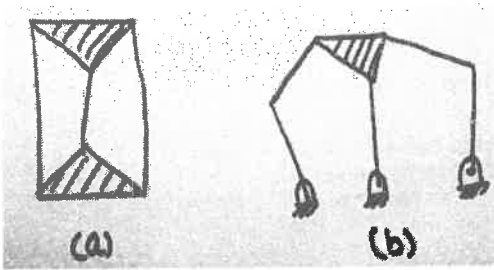
Maximum Marks : 60

Instructions to students:

Do not write anything other than your roll number on question paper.

Assume suitable data wherever required and mention it clearly.

Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q. No.	Question	Marks/ COs
Q 1.	i. State the significance of degree of freedom. Calculate the degree of freedom of flowing mechanisms.  (a) (b) ii. How grippers are classified and what are different selection criteria for such grippers.	4 ME1226.1 6 ME1226.1
Q 2.	Imagine you are a robotics engineer at Boston Dynamics designing a robotic system that requires precise control of velocity in different scenarios. Discuss the types of velocity sensors you would consider for this robotic system and explain the advantages and disadvantages of each.	10 ME1226.2
Q 3.	Material handling applications often involve dynamic forces that change rapidly. Explain how the robotic system can be optimized to respond dynamically to force changes using strain gauges and other force measuring sensors. What control strategies and algorithms would you implement to ensure the system's responsiveness to sudden changes in force?	10 ME1226.2 ME1226.3
Q 4.	What is a Robot Operating System (ROS)? How is data flow managed in the ROS using nodes and topics? Explain the basic architecture of ROS and discuss the message passing on ROS master using a suitable example.	2+4+2+2 ME1226.3

Q 5.	You are tasked to design a robot subsystem consisting of motion, recognition, and control subsystem for a pick-and-drop type of robot. Suggest motion (manipulator/end-effector/actuator(s)/transmission), recognition (sensors/vision), and control (linear/non-linear) system for the robot to move on a difficult terrain repetitively and justify their selection.	10 ME1226.2
Q 6.	Suppose you are a head of the robotics and automation division in a manufacturing industry. You are tasked to find the feasibility of installing a robot to increase the production and reduce the manpower. Examine the problem in detail and provide your recommendation considering the following aspects (assume a suitable task you would like the robot to perform): - Advantage and technical challenges of using the robot. - Payback time or economic viability. - Safety requirements - Socio-economic aspect of robotization.	2.5×4 ME1226.2 ME1226.3