

2122

B. E. (Mechanical Engineering)
Fifth Semester
MEC-503: Robotics

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

X-X-X

1. Attempt the following:-

- a) Why do we require Jacobians in studying robot dynamics?
- b) In which application does a robot require an auditory sensor?
- c) What is a tactile robot sensor?
- d) Briefly differentiate between inverse and forward kinematics.
- e) What is the Lagrangian principle? (5x2)

UNIT - I

- H. Explain in detail the Robot characteristics and applications of Robots. (10)
- III. By taking an example of a robotic manipulator involving rotary and reciprocating joints, explain in detail the procedure of affixing frames to the links. (10)
- IV. Given

$${}^A_B T = \begin{bmatrix} 0.866 & -0.500 & 0.000 & 10.0 \\ 0.500 & 0.866 & 0.000 & 0.0 \\ 0.000 & 0.000 & 1.000 & 5.0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

If the velocity vector at the origin of frame {A} is

$$A_v = \begin{bmatrix} 0.0 \\ 2.0 \\ -3.0 \\ 1.414 \\ 1.414 \\ 0.0 \end{bmatrix}$$

Find the velocity vector with reference point the origin of {B}. (10)

P.T.O.

(2)

UNIT - II

- V. Explain in detail the trajectory following control in robots. (10)
- VI. What are different robot sensors? Give a comprehensive description of each type using schematic diagrams. (10)
- VII. What is Newton-Euler Dynamic formulation? Explain in context of Manipulator dynamics. (10)

x-x-x