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Roll No. : .....

**337831(37)**

**B. E. (Eighth Semester) Examination, Nov.-Dec. 2021**

**(New Scheme)**

**(Mechanical Engg. Branch)**

**ROBOTICS**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d). Give neat and clear diagrams whenever needed.***

**Unit-I**

1. (a) Write laws of Robotics. 2
  
- (b) Classify robots on the bases of Workspace geometry.  
Explain any one with neat sketch. 7

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- (c) Explain in brief what are the design and control issue in robotics. 7
- (d) Write short notes on any **two** : 7
- (i) Work Volume
  - (ii) Load carrying capacity
  - (iii) End Effector

**Unit-II**

2. (a) What do you mean by mapping in robotics? 2
- (b) Derive the fundamental rotation matrices about  $x$ ,  $y$  and  $z$  axis that is used to perform a rotation in fundamental space of classical geometry. 7
- (c) What is meant by homogeneous coordinate system for manipulator? 7
- (d) Write about different types of transformations and explain them briefly. 7

**Unit-III**

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3. (a) Draw a 3-DOF manipulator arm and show numbering of links and joints. 2
- (b) Explain DENAVIT HARTENBERG NOTATION. 7
- (c) Give brief introduction of inverse kinematic model. 7
- (d) Consider any manipulator of three degree of freedom and derive transformation matrix for it. 7

**Unit-IV**

4. (a) What are the basic guidelines for choosing the right sensors? 2
- (b) Explain various kinds of sensors used in robotics with suitable diagram and example. 7
- (c) Write a note on image processing. Also explain monochrome image and digital image. 7
- (d) Write short notes on any **two** : 7
- (i) Architecture of Robotic Vision System
  - (ii) Image acquisition in robotics
  - (iii) Template matching

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**Unit-V**

5. (a) Write about Dull, Dirty, Dangerous and Dear (four D's) in robotics. 2
- (b) Write about applications of robots in industrial inspection and testing. 7
- (c) Write about various material handling tasks performed by robots in industries. 7
- (d) Write short notes on any **two** : 7
- (i) Upcoming future of robots
  - (ii) Robot safety
  - (iii) Non industrial application of Robots.