Total No. of Questions : 8] **SEAT No. :**

P431 **[Total No. of Pages : 2**

[6003]-528
T.E. (Robotics & Automation)
ROBOT PROGRAMMING
(2019 Pattern) (Semester - II) (311508 (A))

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Assume suitable data if necessary.***
5) ***Use of Logarithmic Table, Slide rule in Electronic pocket calculator is allowed.***

Q1) a) Differentiate between the command structure of VAL-I and VAL-II language in Robot Programming. **[8]**

b) Explain various program instructions used in VAL-II. **[9]**

OR

Q2) a) Develop a program using VAL II robot programming language for a PUMA 560 robot when setting output signal at 5th port of controller it unloads a cylindrical part of 10mm diameter, from Machine l positioned at point P1 with coordinates(100, 200, 0)mm and orientation(0, 90, 0)º and load the part on Machine2 positioned at P2 with coordinates (100, 200, 50)mm and orientation (0, 90, 0)º. The speed of robot motion is 40 in./s. However, because of safety precautions, the speed is reduced to 10 in./s while moving to a machine for an unloading or loading operation. **[9]**

b) Explain the following instruction in VAL-II with example: **[8]**

i) LISTL
ii) PCABORT
iii) RENAME
iv) DISABLE

Q3) a) Develop a program using RAPID robot programming language using RAPID procedure for pick and place operation from point P1(500, 500, 50)mm to P2(-500, 500, 50)mm such that it starts from *home* position and ends at *home* position. While executing the program the orientation of end effector remains same as (0, 90, 0)º. **[9]**

b) Define Motion Command. Explain at least four Move Motion Commands used in RAPID language. Explain with examples for each Motion Command. **[9]**

OR

P.T.O.

Q4) a) Explain the Position Instructions and Input/Signal Instructions in RAPID with the help of examples of programs. **[9]**

b) Define Data types. Explain any four data type used in RAPID with the help of examples of programs. **[9]**

Q5) a) Explain the following instruction in AML with example: **[9]**

i) ACCEL
ii) WAITMOVE
iii) SETTLE
iv) QGOAL
v) DEFIO
vi) ENDMONITOR

b) Explain the following code & output when executed in AML: **[9]**

i)
```
MONITOR (LED, 2, 0, 0, 1.5, 'passed');
MOVE (ARM, fgoal, LED);
```

ii)
```
ATTN: SUBR;
MOTPARMS: NEW STOPMOVE;
WAITMOVE;
BREAK (EOL, 'ATTENTION REQUESTED');
APPLY ('AMOVE', MOTPARMS);
END;
```

iii) DMOVE (<4, 5, 6>, <30, -60, 90>);

iv) SPEED (0.8)

OR

Q6) a) Define Sensor Instruction. Explain any four sensor instructions with examples used in AML. **[9]**

b) Define Motion Control. Explain any four motion controls with examples used in AML. **[9]**

Q7) a) Define the concept of singularities. Explain the methods of detecting possible collision of robots and what are the features added to avoid it. **[9]**

b) Write a short note on "Robot Economics". **[8]**

OR

Q8) a) Explain in detail about "Robot cycle time analysis". **[9]**

b) Explain the "repeatability measurement of robot". **[8]**

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