Reg. No.



MANIPAL

(A constituent unit of MAHE, Manipal)

# V SEMESTER B.TECH (MECHANICAL / I&P ENGINEERING)

### END SEMESTER EXAMINATIONS MAKE-UP, DECEMBER 2018

## SUBJECT: CAD-CAM [MME 3103]

#### REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

#### Instructions to Candidates:

- > Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Draw the sketches using PENCIL only
- 1A What is the role of homogeneous coordinate system while carrying out transformations? Explain this by giving a suitable example.4M
- 1B With neat sketch and appropriate notations, derive the recursive equations for a parabola from its parametric equations. The parabola has X-axis as axis of symmetry.
  3M
- 1CWrite any 6 points that differentiate Constructive solid geometry from<br/>Boundary representation3M
- **2A** An approximation curve, with global control and parametrized in *u*, is circularly swept about a line collinear with the z axis. The first curve is defined by the position vectors  $\vec{p_0} = 0\hat{\imath} + 0\hat{j} + 2\hat{k}$ ,  $\vec{p_1} = 3\hat{\imath} + 0\hat{j} + 2\hat{k}$ ,  $\vec{p_2} = 5\hat{\imath} + 0\hat{j} + 6\hat{k}$ ,  $\vec{p_3} = 2\hat{\imath} + 0\hat{j} + 7\hat{k}$  and  $\vec{p_4} = 3\hat{\imath} + 0\hat{j} + 10\hat{k}$  respectively, where  $\hat{\imath}, \hat{j}$  and  $\hat{k}$  are the unit vectors along the x, y and z axes.
  - (a) Compute the position vector of a point on the curve at u = 0.6.
  - (b) Compute the position vector of a point on the circularly swept surface at u = 0.6 and  $\theta = +30^{\circ}$
- 2B Discuss any three sensors used in industrial robots
- **2C** A space curve P(u) is to be swept along a linear directrix so as to obtain a 3D surface. Derive the parametric equation for a 3D surface. Take the parameter *v* along the direction of sweep. **3M**
- **3A** A polygon is defined by the points (4,4), (7,7), (4,10) and (1,7). Reflect the parallelogram about the line Y= 0.7x + 2 and compute the coordinates of the transformed polygon. **5M**
- 3B Derive an expression for the position vector and tangent vector of a hermite cubic spline curve from fundamentals.
  5M
- 4A Define the following with respect to robot technical specification
  - i. Precision of movement
  - ii. Accuracy
  - iii. Repeatability and
  - iv. Resolution

4M

4M

3M

- **4B** Justify the statement "Adaptive control machining system makes machines more intelligent and machining process optimum".
- **4C** i. Sketch a Hermite bi-cubic surface patch showing the geometric conditions on it.
  - ii. Also write the parametric equation for the same in matrix form and explain each matrix involved.
  - iii. Write two important features of the Hermite bi-cubic surface patch.
- **5A** i. Determine the parametric representation of the line segment between the position vectors  $P_1 = [1 \ 1]^T$  and  $P_2 = [4 \ 5]^T$ . What is the tangent vector and slope for this line?
  - ii. A geometric model designer drawn a line between two position vectors  $P_1 = [2 \ 3]^T$  and  $P_2 = [80 \ 90]^T$ . Determine the equation of the line which the designer had drawn. Help the designer to find the coordinates and tangent vector at the midpoint of the line using parametric relationship.
- 5B Sketch and explain any three FMS layouts
- **5C** Write a part program for Multiple Turning operation for the component shown in the Figure 1. Take the length of the work piece = 100mm and diameter=30mm. Take finishing allowance of 500 microns along X and Z axis.



3M

3M

3M

4M 3M