Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AE) (2011 Onwards)   (Sem.–4)
MECHANICS OF MACHINES
Subject Code : BTAE-402
M.Code : 54123

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
 1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
 2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
 3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**

   a. Distinguish between lower pair and higher pairs giving examples.

   b. What is Kutzback's criterion for degree of freedom of plane mechanisms?

   c. What is meant by the term "Crowning of Pulleys"? Why is it done?

   d. What is the difference between simple and compound mechanism?

   e. Why cycloidal motion of follower is preferred for high speed engines?

   f. Distinguish between the working of a flywheel and a governor.

   g. Define coefficients of fluctuation of energy and speed.

   h. Is it possible to give the same equilibrium speed as in case of porter governor, balls of smaller mass will be required in proell governor?

   i. Differentiate between completely constrained motion and successfully constrained motion with the help of suitable example.

   j. State D'Alembert's principle and its significance.

SECTION-B

2. The crank length of a petrol engine is 50 mm and the connecting rod is 175 mm long and the crank rotates at a uniform speed of 400 r.p.m. calculate the velocity and acceleration of the piston at different positions of the piston along its stroke and plot the curves. Also find the crank position at which the piston's acceleration is zero.

3. Four masses A, B, C and D are carried by a rotating shaft at radii 80 mm, 100mm, 160mm and 120mm respectively are completely balanced. Masses B, C, D are 8kg, 4kg and 3 kg respectively. Determine the mass A and the relative angular positions of the four masses if the planes are place 500mm apart.

4. A belt 100 mm wide and 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on slack side. If the safe permissible stress on the belt section is 1.6 N/mm^2, calculate the max. power that can be transmitted at this speed. Assume density of the leather as 1 kg/m^3. Calculate the absolute max. power that can be transmitted by this belt and the speed at which this can be transmitted.

5. What is meant by Inversion of a mechanism? Describe any one Inversion of slider crank chain mechanism with the help of neat diagram.

6. A cast iron flywheel is fitted to a punch press to run at 90 r.p.m and must supply 12000 N-m of energy during 1/5th revolution and allow 15% change of speed. The ring speed is limited to 350 m/min. Find the mean diameter, mass of flywheel and the motor power. Assume overall efficiency as 80%.

SECTION-C

7. The length of the connecting road of a gas engine is 500 mm and its centre of gravity lies at 165 mm from the crank pin centre. The rod has a mass of 80 kg and radius of gyration of 182 mm about an axis through the centre of mass. The stroke of the piston is 225 mm and the crank speed is 300 rpm. Determine the Inertia forces on crankshaft when the crank has turned 30° and 135° from the inner dead centre.

8. An offset translating roller follower is driven by a cycloidal motion cam rotating at 600 r.p.m. The maximum follower rise is 3 cm during 150° of cam rotation. If the amount of offset is 0.5 cm, the pressure angle 14° for the offset follower at a cam angle of 60°, find the prime circle radius. Also determine the maximum velocity and acceleration.

9. In a Hartnell governor, the radius of ball is 60 mm at the minimum speed of 300 r.p.m. The length of the ball arm is 140 mm and the sleeve arm is 90 mm. The mass of each ball is 5 kg and the sleeve is 8 kg. The stiffness of spring is 32715 N/m. Determine :

   a) Speed when the sleeve is lifted by 50 mm

   b) Initial compression of the spring

   c) Governor effort

   d) Power

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.