Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (AE) (2011 Onwards) (Sem.–4)

MECHANICS OF MACHINES

Subject Code : BTAE-402

Paper ID : [A1162]

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) What is the difference between kinematics and kinetics?

b) How many minimum number of links are required to have a mechanism and why?

c) Slack side of the open belt drive is always on upper side, why?

d) Distinguish between hunting and stability of the governor.

e) What do you mean by a dynamically equivalent system?

f) State the law of belting.

g) What do you understand by pressure angle in Cam? What will happen if pressure angle exceed beyond a certain value?

h) What do you mean by dynamic balancing of a system?

i) Define the coefficient of fluctuation of speed.

j) What is hammer blow and swaying couple? What are their effects?

SECTION-B

2. The turning moment diagram for a multi-cylinder engine has drawn to a vertical scale of 1mm = 650 N.m and horizontal scale of 1=4.5° the area above and below the mean torque line are -28, +380, -260, +310, -300, +242, -380, +265 and -229 mm^2. The fluctuation of speed is limited to ± 1.8% of the mean speed which is 400 rpm. The density of the rim material is 7000 kg/m^2 and (width of the rim is 4.5 times its thickness. The centrifugal stress in the rim material is limited to 6 N/mm^2. Neglecting the effect of boss and arms, determine the diameter and cross-sectional area of the flywheel rim.

3. a) Determine degree of freedom of linkage shown in figure-I.

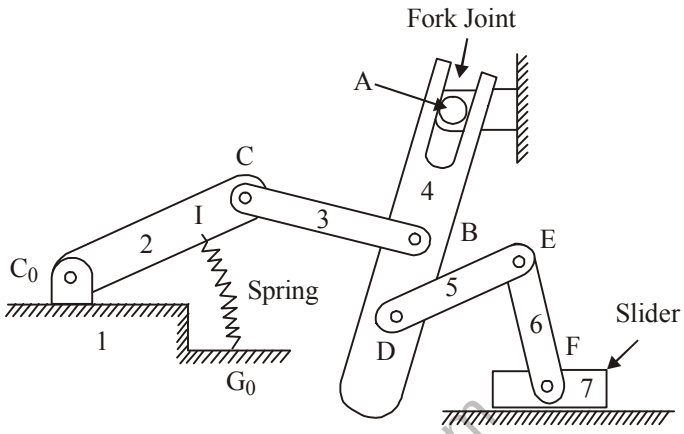

Figure - 1

b) Prove that the chain formed by three binary links is a redundant chain and with four binary links is a kinematic chain.

4. An open belt run over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 m apart and transmits 4 kW from the smaller pulley that rotates at 300 r.p.m. Coefficient of friction between belt and pulley is 0.3 and the safe working tension is 10N per mm width of belt. Determine :

a) Minimum width of the belt.

b) Initial tension in belt.

c) Length of the belt.

5. The crank and the connecting rod of the vertical single cylinder gas engine running at 1800 r.p.m are 60 mm and 240 mm respectively. The diameter of the piston is 80 mm and the maps of the reciprocating part is 1.2 kg. At a point during the power stroke when the piston has moved 20 mm from the top dead centre position, the pressure on the piston is 800 kN/m^2. Determine the :

a) Net force on the piston.

b) Thrust in the connecting rod.

c) Engine speed at which the above values are zero.

6. The arms of the Porter governor are pivoted on the governor axis and are each 250 mm long. Mass of each ball is 0.5 kg and the mass of sleeve is 2 kg. The arms are inclined at an angle of 30° to the governor axis in the lower most position of the sleeve. Lift is equal to 50 mm. Determine the force of friction if the speed at the moment the sleeve start lifting from lower most position is the same as the speed at the moment it falls from uppermost position.

SECTION-C

7. A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and coefficient of friction is 0.3 find the total spring load pressing the plate together to transmit 25 kW at 1575 rpm. If there are 6 springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear.

8. A cam shaft of high speed pump consist of a parallel shaft 25 mm diameter and 480 mm long. It carries three eccentricities, each of diameter 60 mm and uniform thickness of 18 mm. The assembly is symmetrical as shown in fig. Bearings are at A and B. The angle between the eccentricities is 120° and the eccentricities of each are 12.5 mm. The material density is 7000 kg/m^3, and the speed of rotation is 1430 rpm.

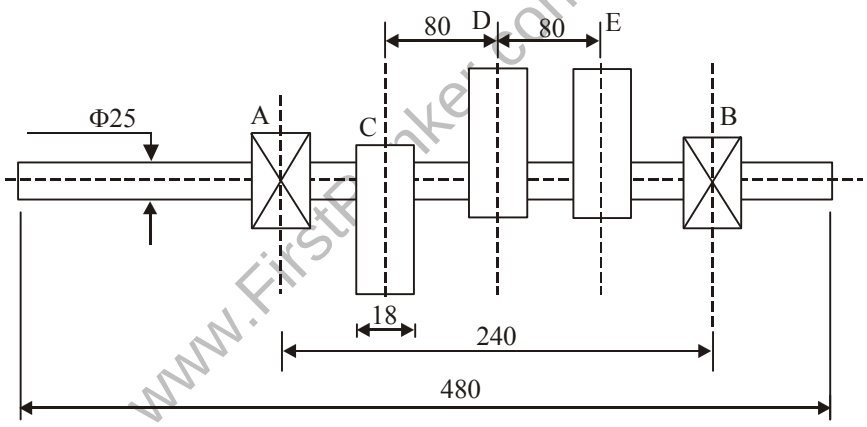

Figure - 2

9. Use the following data in drawing the profile of cam in which a knife edge follower is raised with uniform acceleration and retardation and is lowered with simple harmonic motion :

   Least radius of cam is 60 mm; Lift of follower is 45 mm; Angle of ascent is 60°; Angle of dwell between accent and descent is 40°; Angle of descent is 75°. If the cam rotates 180 rpm CW, determine the maximum velocity and acceleration during ascent and descent