BT-4/J08

Dynamics of Machines

Paper : ME-210-E

Time : 3 Hours] [Maximum Marks : 100

Note : Attempt **FIVE** questions, at least **ONE** question from each unit.

UNIT—I

1. Following data relates to a horizontal reciprocating engine :

Weight of reciprocating parts	= 1·250 kN
Weight of connecting rod	= 1·00 kN
Length of stroke	= 220 mm
Length of connecting rod	= 440 mm
Distance of C.G. from big end centre	= 180 mm
Engine speed	= 750 r.p.m.

Find the resultant inertia torque on the crank-shaft when the crank makes an angle of 30 degrees with inner dead centre. 20

2. The turning moment diagram for a multicylinder engine is to a scale of 1 cm to 3 kN-m vertically and 1 cm to 30 degree horizontally. The intercepted areas between output torque curve and mean resistance line, taken in order from the left hand are : −0·52, +1·24, −0·92, ++1·4, −0·85, +0·72, −1·07 sq. cm. When the engine is running at 800 rpm and weight of flywheel is 5 kN. Total fluctuation of speed does not exceed 2 percent of mean speed. What is the value of radius of gyration ? 20

UNIT—II

3. (a) Draw an internal expanding shoe brake and explain its working principle, also deduce expressions for Torque and moments. 10

   (b) With neat sketch, explain the working of Wilson-Hartnell governor and determine an expression for its equilibrium speed. 10

4. A shaft carries four weights P, Q, R and S weighing 120 N, 200 N, 300 N and 160 N respectively spaced 450 mm apart. Measuring anti-clockwise from P, Q makes 240 degree, R makes 135 degree and S makes 270 degree. The radii are 400, 300, 150 and 450 mm and shaft runs at 180 rpm. Find the magnitude and direction relative to P of the unbalanced force and couple about a plane midway between P and Q. 20

UNIT—III

5. (a) Determine the minimum number of teeth on pinion in involute Rack in order to avoid interference. 10

   (b) A pair of spur gears with 21 and 30 teeth are of involute profile and pressure angle 20°. Find maximum addenda on pinion and gear to avoid interference if module is 6 mm. Also find the maximum velocity of sliding on either side of pitch point if pinion runs at 300 rpm. 10

6. (a) Describe a differential gear and prove that two rear wheels will rotate at different speeds when rounding a curve path. 10

   (b) What do you mean by interference in involute profile gears ? What are the methods to avoid it ? Explain with heat sketch. 10

UNIT—IV

7. (a) Derive an expression for the couple that comes in picture when a wheel rotates with uniform angular velocity and has a given precessional motion. 10

   (b) A locomotive moving at a speed of 100 km/hour turns round a curve of 500 meters radius to the right. The pair of driving wheels are 2 m in diameter and along with axle weigh 2 tonnes. The radius of gyration of the wheels together with axle is 0·6 m. Find the gyroscopic effect on the pair of driving wheels. 10

8. (a) Explain, with neat sketches the Block diagrams and their importance in control devices. 10

   (b) Establish an expression for the transfer function of spring controlled governor. 10