Printed Pages: 02
Paper Id: 1 4 0 6 0 9

Sub Code: NME603
Roll No.

B.TECH.
(SEM-VI) THEORY EXAMINATION 2017-18
DYNAMICS OF MACHINES

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. Choose any missing data suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. What do you mean by piston effort?
b. Describe coefficient of fluctuation of energy.
c. Explain all planes and axes related to the gyroscopic effect.
d. Write equation of natural frequency of longitudinal vibration; also explain related terms.
e. What do you mean by partial balancing?
f. What are coupled and uncoupled locomotives?
g. Classify the governors.
h. Define terms related to governors: (i) Sensitiveness, (ii) Stability
i. Explain differential brake.
j. What do you mean by transmission type dynamometer?

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a) Describe forces on different parts of a slider crank mechanism.
b) The following data are given for a vibratory system with viscous damping: Mass = 2.5 kg; spring constant = 3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system.
c) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: 1. The magnitude of the masses at A and D; 2. The distance between planes A and D; and 3. the angular position of the mass at D.
d) Explain the terms and derive expressions for 'effort' and 'power' of a Porter governor.
e) Derive expression for the ratio of the maximum and minimum tensions of band and block brake.

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

a) Derive expression for dimensions of flywheel.
b) A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating parts have a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the crank shaft.

4. Attempt any *one* part of the following: **10 x 1 = 10**

a) Explain the gyroscopic effect on aero plane.

b) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: 1. when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 2. When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

5. Attempt any *one* part of the following: 10 x 1 = 10

a) Explain the terms in detail (i) Variation in tractive effort; (ii) Swaying Couple and (iii) Hammer blow and safe speed of locomotive.

b) The following data refer to two cylinder locomotive with cranks at 90°: Reciprocating mass per cylinder = 300 kg; Crank radius = 0.3 m; Driving wheel diameter = 1.8 m; Distance between cylinder centre lines = 0.65 m; Distance between the driving wheel central planes = 1.55 m. Determine: 1. the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/h. ; 2. the variation in tractive effort ; and 3. the maximum swaying couple.

6. Attempt any *one* part of the following: 10 x 1 = 10

a) In a Porter governor, the upper and lower arms are each 250 mm long and are pivoted on the axis of rotation. The mass of each rotating ball is 3 kg and the mass of the sleeve is 20 kg. The sleeve is in its lowest position when the arms are inclined at 30° to the governor axis. The lift of the sleeve is 36 mm. Find the force of friction at the sleeve, if the speed at the moment it rises from the lowest position is equal to the speed at the moment it falls from the highest position. Also, find the range of speed of the governor.

b) In a spring loaded governor of the Hartnell type, the mass of each ball is 1kg, length of vertical arm of the bell crank lever is 100 mm and that of the horizontal arm is 50 mm. The distance of fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor. The extreme radii of rotation of the balls are 75 mm and 112.5mm. The maximum equilibrium speed is 5 per cent greater than the minimum equilibrium speed which is 360 r.p.m. Find, neglecting obliquity of arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100 mm.

7. Attempt any *one* part of the following: 10 x 1 = 10

a) Explain and discuss following in detail with examples:
(i)Absorption type Brake Dynamometer; (ii) Transmission type Brake Dynamometer.

b) In a winch, the rope supports a load W and is wound round a barrel 450 mm diameter. A differential band brake acts on a drum 800 mm diameter which is keyed to the same shaft as the barrel. The two ends of the bands are attached to pins on opposite sides of the fulcrum of the brake lever and at distances of 25 mm and 100 mm from the fulcrum. The angle of lap of the brake band is 250° and the coefficient of friction is 0.25. What is the maximum load W which can be supported by the brake when a force of 750 N is applied to the lever at a distance of 3000 mm from the fulcrum?