B.Tech III Year I Semester (R13) Supplementary Examinations June 2017

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) State the laws of static friction.

(b) Write the expression for efficiency for the: (i) Body going up the plane with inclined force. (ii) For the body going down the plane with inclined force.

(c) What is hammer blow? Write the equation for hammer blow.

(d) State the reason why the reciprocating masses are partially balanced.

(e) The engine and propeller of airplane having moment of inertial of 127.421 kgm^2 and running at 3000 rpm. Find the gyroscopic couple for the engine taking a circle turn of radius 100 m towards left hand side.

(f) Define: (i) Stability. (ii) Hunting of governor.

(g) State the difference between inertial and centrifugal governor.

(h) State any two differences between flywheel and governor.

(i) Draw the neat diagram showing basic elements of vibrating system.

(j) What is critical speed? Is the natural frequency of vibration itself the critical speed?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Derive the equation for flat collar pivot with usual notations.

OR

3 A cone clutch transmits 20 kW at 1600 rpm. The following data apply: Cone angle = 30^o, Maximum intensity of pressure = 0.8 x 10^5 N/m^2. The mean radius is twice the width of friction surface. Coefficient of friction is 0.3. Determine: (i) Dimensions of the contact surface. (ii) Axial load or force keeping the clutch engaged when transmitting power. (iii) Width of the friction surface.

UNIT – II

4 The mass of a turbine rotor of a ship is 3500 kg. It has a radius of gyration of 45 cm and a speed of 3000 rpm clockwise, when looking from stern. Estimate the gyroscopic couple and its effects upon the ship under the following conditions.
(i) When ship is steering to the left in a curve of 100 m radius at a speed of 36 km/hr.
(ii) When a ship is pitching in SHM, the bow is falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between two extreme positions of pitching is 12 degrees.

OR

5 A three cylinder single acting engine has its crank set equally at 120^o and runs at 600 rpm. The torque crank angle diagram for each cylinder is triangle for the power, with maximum torque 80 N-m at 60^o after the dead center of the corresponding crank. The torque on the return stroke is sensibly zero. Determine: (i) Power developed. (ii) The coefficient of fluctuation of speed if the flywheel used has a mass of 10 kg and has radius of gyration of 8 cm. (iii) Coefficient of fluctuation of energy. (iv) The maximum angular acceleration of the flywheel.

Contd. in page 2

UNIT – III

6 Illustrate the following qualities of the governor:
(a) Sensitiveness.
(b) Stability.
(c) Effort and power.

OR

7 In a Porter governor all the arms are 300 mm long. Upper and lower arms are pivoted on the axis of rotation. Central mass is 15 kg. Mass of each ball is 5 kg. Force of friction is 30 N and the extreme radii of rotation are 200 mm and 250 mm. Determine the range of speed: (i) Without considering friction. (ii) Considering friction.

UNIT – IV

8 A shaft has three eccentricities of mass 1 kg each. The central plane of the eccentricities is 50 mm apart. The distances of the centers from the axis of revolution are 20, 30 and 20 mm and their angular positions are 120^o apart. Find the amount of out-of-balance force and couple at 600 rpm. If the shaft is balanced by adding two masses at radius of 70 mm at a distance of 100 mm from the central plane of the middle eccentric, find the amount of masses and their angular positions.

OR

9 The following data refers to two cylinder locomotive with cranks at 90^o. Reciprocating mass per cylinder is 300 kg. Crank radius = 0.3 m, driving wheel diameter = 1.8 m, distance between cylinders centre lines = 0.7 m, Distance between driving wheel centre planes = 1.6 m. Determine: (i) The friction of the reciprocating masses to be balanced if the hammer blow is not to exceed 46 kN at 96.5 km/hr. (ii) The variation of the tractive effort. (iii) The maximum swaying couple.

UNIT – V

10 Derive the equation for the damping factor for damped vibrations with usual notations.

OR

11 The flywheel of an engine dynamo weighs 150 N and has radius of gyration of 0.25 m. The shaft at the flywheel end has an effective length of 0.2 m and is 50 mm in diameter. The armature weighs 80 N and has a radius of gyration of 0.2 m. The dynamo shaft has a diameter of 40 mm and an effective length of 0.15 m. Neglecting the inertia of the shaft and the coupling, calculate the frequency of the torsional vibration and the position of node.

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