

Government College of Engineering, Aurangabad
(An Autonomous Institute of Government of Maharashtra)

Third Year Mechanical Engineering (Rev)
End Semester Examination 2016 – 17. Semester I

ME 343: Theory of Machine

Time: Four Hours

17 NOV 2016

Max. Marks: 60

"Verify the course code and check whether you have got the correct question paper"

N.B.: - All questions are compulsory.

1. Figures to the right indicate full marks.
2. Assume suitable data if necessary and state it clearly.
3. Use of Non-programmable Calculator is allowed.

Question no 1 - Solve any one (a or b)

A The three cranks of a three cylinder locomotive are all on the same axle and are set at 120° . The pitch of the cylinders is 1 metre and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance masses are 0.8 m from the inside crank. If 40% of the reciprocating parts are to be balanced, find : 1. The magnitude and the position of the balancing masses required at a radius of 0.6 m ; and 2. the hammer blow per wheel when the axle makes 6 r.p.s. (12 marks)

OR

B. 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. . (12 marks)

Question no 2 - Solve any one (a or b)

A i) The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60 m. Its speed is 2000 r.p.m. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Determine the following: 1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the ship during pitching, and 3. The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the left. . (6 marks)

ii) Explain the term sensitiveness, stability & hunting of governor in detail. (6 marks)

OR

B i) A Porter governor has all four arms 250 mm long. The upper arms are attached on the axis of rotation and the lower arms are attached to the sleeve at a distance of 30 mm from the axis. The mass of each ball is 5 kg and the sleeve has a mass of 50 kg. The extreme radii of rotation are 150 mm and 200 mm. Determine the range of speed of the governor. (6 marks)

ii) Discuss the effect of gyroscopic couple on an aero plane. (6 marks)

Question no 3- Solve any one (a or b)

A i) Explain & Derive expression for brake power prony brake dynamometer. (6 marks)

ii) A band brake acts on the $\frac{3}{4}$ th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the (a) anticlockwise direction, and (b) clockwise direction. (6 marks)

OR

B) i) A torsion dynamometer is fitted to a propeller shaft of a marine engine. It is found that the shaft twists 2° in a length of 20 metres at 120 r.p.m. If the shaft is hollow with 400 mm external diameter and 300 mm internal diameter, find the power of the engine. Take modulus of rigidity for the shaft material as 80 GPa. (6 marks)

ii) Explain internal expanding brake (6 marks)

Question no 4

The following data refer to a steam engine: Diameter of piston = 240 mm; stroke = 600 mm ; length of connecting rod = 1.5 m ; mass of reciprocating parts = 300 kg; mass of connecting rod = 250 kg; speed = 125 r.p.m ; centre of gravity of connecting rod from crank pin = 500 mm ; radius of gyration of the connecting rod about an axis through the centre of gravity = 650 mm. Determine the magnitude and direction of the torque exerted on the crankshaft when the crank has turned through 30° from inner dead centre. (12 marks)

Question no 5 Solve any one (a or b)

A i) Derive the expression for natural frequency of free longitudinal vibration by equilibrium method (6 marks)

ii) Derive the expression for free transverse vibration. (6 marks)

OR

i) Derive the expression for natural frequency of free longitudinal vibration by Energy method (6 marks)

ii) Explain types of vibration and their effects in detail. (6 marks)