Code No. 2184 / O

FACULTY OF ENGINEERING

B.E. 3/4 (M/P) I – Semester (Old) Examination, May 2013

Subject : Dynamics of Machines

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A and answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. The rotor of a ship is rotating in clock-wise direction viewed from rear and taking a right turn. What is the effect of gyroscopic couple on the ship?

2. How do you calculate the net force on a piston and turning moment on the crank shaft of reciprocating engine?

3. Differentiate between the governor and flywheel.

4. Explain the advantage of spring loaded governors over dead-weight governors.

5. What is meant by hammer blow and why it occurs in 2 cylinder locomotive engines?

6. Define : natural frequency. Explain the critical speed of a shaft.

7. How does the viscosity influences the working of a viscous damper?

8. Give the expression for the torsionally equivalent shaft.

9. Explain the significance of magnification factor in forced vibrations.

10. Explain how a geared system is considered to calculate the natural frequencies.

PART – B (50 Marks)

11. Each road wheel of a motor cycle has a moment of inertia of 1.5 kg-m^2. The rotating parts of the engine of the motor cycle have a mass moment of inertia of 0.25 kg-m^2. The speed of the engine is 5 times the speed of the wheels and is in the same sense. The mass of the motor cycle with its rider is 250 kg. and its centre of gravity is 0.6m above the ground level. Find the angle of heel if the cycle is traveling at 50 km/h and is taking a turn of 30 m radius. The wheel diameter is 0.6 m.

12. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35mm from the axis of rotation. The load on the sleeve is 54 kg and the mass of each ball is 7 kg. Determine the equilibrium speed when the radius of the balls is 225mm. What will be the range of the speed for this position, if the frictional resistances to the motion of the sleeve are equivalent to a force of 30 N.

13. A punching press is required to punch 40 mm diameter holes in a plate of 15 mm thickness at the rate of 30 holes per minute. It requires 6 N-m of energy per mm^2 of sheared area. If the punching takes 1/10 of a second and the rpm of the fly wheel varies from 160 to 140, determine the mass of the flywheel having a radius of gyration of 1 metre.

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14. A, B, C, and D are four masses carried by a rotating shaft at radii 100 mm, 150 mm, 150 mm and 200 mm respectively. The planes in which the masses rotate are spaced at 500 mm apart and the magnitude of the masses B, C and D are 9 kg, 5kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

15. A shaft 1.5m long is supported in flexible bearings at the ends and carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 0.4 m from the centre towards right. The shaft is hollow of external diameter 75 mm and inner diameter 37.5 mm. The density of the shaft material is 800 kg/m^3. The young's modulus for the shaft material is 200 GN/m^2. Find the frequency of transverse vibrations.

16. A body of mass of 50 kg is supported by an elastic structure of stiffness 10 kN/m. The motion of the body is controlled by a dashpot such that the amplitude of vibration decrease to one-tenth of its original value after two complete vibrations.
    Determine : a) the damping force at 1 m/s b) the damping ratio and
    c) natural frequency of vibration.

17. The two rotors A and B are attached to the end of a shaft 500 mm long. The mass of the rotor A is 300 kg and its radius of gy ration is 300mm. The corresponding values of the rotor B are 500 kg and 450 mm. respectively. The shaft is 70 mm in diameter for the first 250 mm, 120 mm for the next 70 mm and 100 mm diameter for the remaining length. The modulus of rigidity for the shaft material is 80 GN/m^2. Find the frequency of the torsional vibrations.

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