

FACULTY OF ENGINEERING

B.E. 3/4 (M/P/AE) I – Semester (New) (Suppl) 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. What is correction couple in finding the inertia of connecting rod.
2. What is gyroscopic effect on pitching and rolling of ships?
3. Differentiate functions of flywheel and governor.
4. What are the effects of partial balancing in locomotives?
5. What are whirling speeds of shafts?
6. Explain vibration isolation materials.
7. If a spring of spring constant 'K' is exactly made half, what will be the stiffness of each half?
8. Give an expression for finding natural frequency by Dunkerley's method.
9. Distinguish longitudinal and transverse vibrations.
10. Draw the controlling force diagram for spring controlled governor when it is stable, unstable and isochronous.

PART – B (50 Marks)

11. The effective steam pressure on the piston of a vertical steam engine is 200 kN/m^2 when the crank is 400° from the IDC on the down stroke. The crank length is 300 mm and the connecting rod length is 1200 mm. The diameter of the cylinder is 800 mm. What will be the torque on the crank shaft if the engine speed is 300 rpm and the mass of reciprocating parts 250 kg.
12. A porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.
13. The flywheel of a steam engine has a radius of gyration of 1 m and mass 2500 kg. The starting torque of the steam engine is 1500 N-m and may be assumed constant. Determine : i) The angular acceleration of the flywheel and ii) The kinetic energy of the flywheel after 10 seconds from the start.

- 2 -

14. The axes of a three-cylinder air compressor are at 120° to one another and their connecting rods are coupled to a single crank. The length of each connecting rod is 240 mm and the stroke is 160 mm. The reciprocating parts have a mass of 2.4 kg per cylinder. Determine the primary and secondary forces if the engine runs at 2000 r.p.m.
15. A shaft diameter is 180 mm is supported in two bearings 2.5m apart. It carries three discs of mass 250 kg, 500 kg and 200 kg at 0.6 m, 1.5m and 2 m from the left hand. Assuming the mass of the shaft 190 kg/m, determine the critical speed of the shaft. Young's modulus of the material is 211 GN/m^2 .
16. The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its mean equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after 5 oscillations. Determine : i) stiffness of the spring ii) logarithmic decrement iii) damping factor.
- 17.a) Explain Holzer's method for finding natural frequency of multi-rotor system.
- b) Discuss the effect of gyroscopic couple on naval ship during steering.
