



Code No. : 6100/S

**FACULTY OF ENGINEERING**  
**B.E. 3/4 (M/P/AE) I Semester (Suppl.) Examination, July 2014**  
**DYNAMICS OF MACHINES**

Time: 3 Hours]

[Max. Marks: 75

**Note :** Answer **all** questions from Part – **A** and **any five** questions from Part – **B**.

PART – A

**(25 Marks)**

1. Explain how stability is achieved during manoeuvres in aeroplanes and ships.
2. Explain the effect of friction on the sensitivity of the governor.
3. Distinguish between the working of a flywheel and the governor.
4. Explain the term coefficient of fluctuation of energy.
5. What is partial balancing of reciprocating parts ? What are its adverse effects ?
6. Give the application of direct and reverse crank method.
7. What is whirling phenomenon in shafts ?
8. What are different types of damping ?
9. Define a torsionally equivalent shaft.
10. Explain the principle of Rayleigh's method for natural frequency of a multi rotor system.

PART – B

**(50 Marks)**

11. The ship has a rotor of mass 3 tonnes rotating at 2500 rpm and its radius of gyration is 30 cm. If the direction of rotation of the rotor is clockwise looking from stern, calculate the gyroscopic couple that is set on the ship by the rotor, when
  - i) the ship takes a left hand turn with a radius of 400 m at a speed of 50 kmph.
  - ii) pitching of the bow at an angular velocity of 2 rad/sec.
12. A porter governor has all the four arms 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 4 cm from the axis of rotation. The load on the sleeve is 600 N and each ball weights 100 N. If friction of the mechanism is equivalent to a force of 50 N. Calculate (a) the equilibrium speed when the radius of rotation is 190 mm and (b) also the speed during sleeve ascend.



13. A punching machine having a stroke of 10 cm, punches a 1.25 cm hole once in every 10 seconds in a 1 cm thick steel plate. During the punching operation, it does 600 Nm of work per square cm. of sheared area. The maximum linear speed of the flywheel rim is not to exceed 30 m/s. Design a suitable flywheel of this speed is not to fall below 27.5 m/s.
14. A rigid rotor has all its unbalance in one plane and can be considered to consist of three masses  $m_1 = 5$  kg,  $m_2 = 3$  kg at an angle of  $165^\circ$  C.C.W. from  $m_1$ ; and  $m_3 = 8$  kg at an angle of  $85^\circ$  C.W. from  $m_1$ . The radii  $a_1 = 20$  cm,  $a_2 = 8$  cm;  $a_3 = 14$  cm; determine the balancing mass required at a radius of 10 cm. Specify its location with respect to  $m_1$ .
15. A 22 mm wide and 45 mm deep steel bar is freely supported at two points that are 800 mm apart and carries a load of 180 kg midway between them. Determine the natural frequency of transverse vibration, neglecting the weight of the bar. Also find the frequency of vibration, if an additional load of 180 kg is distributed uniformly along the length of the shaft.
16. A shaft of dia 10 cm is supported on two bearings, which are 160 cm apart. It carries 3 pulleys weighing 600 N, 500 N and 700 N all within the span only. The pulley weighing 500 N is located at the midspan. The pulley weighing 600 N is 25 cm from one bearing while the pulley weighing 700 N is 37 cm from the other bearing. Determine the critical speed of the shaft.  $E = 1.96 \times 10^{11}$  N/m<sup>2</sup>.
17. Write a short note on the following :
  - a) Comparison of performance of porter and proell governor
  - b) Effect of balancing of reciprocating parts
  - c) Methods of vibration isolation.