



FACULTY OF ENGINEERING

B.E. 3/4 (M/P) I Semester (Suppl.) Examination, July 2010

DYNAMICS OF MACHINES

Time : 3 Hours]

[Max. Marks : 75

*Note : 1) Answer all questions from Part – A
2) Answer any five questions from Part – B.*

PART – A

25

1. Mention the three elements of gyroscopic motion and how they are combined in balancing the bicycle.
2. What is controlling force ? What is the use of controlling force diagram ?
3. Define stability and isochronism in governors.
4. What is the use of direct and reverse crank method ?
5. Differentiate between static and dynamic balancing.
6. What is critical speed of a shaft ? Why they are to be determined ?
7. What is magnification factor and phase difference at resonance ?
8. What is the difference between vibration isolator and vibration absorber ?
9. State the use of Rayleigh's method for vibration of single Degree of freedom.
10. What is torsionally equivalent shaft ?

PART – B

50

11. The rolling moment on a ship at a given instant is 1200 tonne meters, C.W., when viewed from rear. The rotor of the stabilizing gyroscope weighs 120 tonnes and spins at 1000 rpm. C.W. When viewed from above. If the radius of the wheels about the spin axis is 2m, determine the angular velocity and sense of precession to maintain the ship in an upright position.
12. A Porter governor has all four arms 30 cm. long. The upper arms are hinged on the axis of rotation, whereas the lower arms at an offset of 40 mm from the spindle axis. Each fly-ball has a mass of 5 kg. and sleeve of 60 kg. Determine the equilibrium speed at radii 16.5 cm.
13. Turning moment curve for one revolution of a multi-cylinder engine above and below the lone of mean resisting torque are given by $-0.32, +4.06, -2.71, +3.29, -3.16, +2.32, -3.74, +2.71$ and -2.45 sq.cm. The vertical and horizontal scales are $1 \text{ cm} = 5880 \text{ Nm}$ and $1 \text{ cm} = 24^\circ$, respectively. The fluctuation of speed is limited to $\pm 1.5\%$ of mean speed, which is 250 rpm. The hoop stress in rim material is limited to 5.5 MPa. Neglecting the effect of boss and arms, determine the mass of the flywheel. Density of rim material is 7200 kg/m^3 .
14. The firing order in a six cylinder four stroke in line engine is 1-4-2-6-3-5. The piston stroke is 100 mm and the length of each connecting rod is 200 mm. The pitch distances between the cylinder center lines are 100 mm, 100mm, 150 mm, 100 mm and 100 mm respectively. The reciprocating mass per cylinder is 1kg and the engine runs at 2500 rpm. Determine the out of balance primary and secondary forces and couples on this engine, taking a plane midway between cylinders 3 and 4 as the reference plane.



15. A shaft of dia. 10 cm is supported by two bearings, which are 160 cm apart. It carries 3 pulleys of weight 600 N, 500 N, and 700 N, all within the span only. The Pulley weighing 500 N is located at the mid span. This pulley weighing 600 N is 25 cm from one bearing while the pulley weighing 700 N is 37cm from the other bearing. Determine the critical speed of the shaft.
 $E = 1.96 \times 10^{11} \text{ N/m}^2$.

16. Determine the natural frequency of torsional vibrations of a shaft with two circular discs of uniform thickness at the ends. The masses of the discs are $M_1 = 500 \text{ kg}$; $M_2 = 1000 \text{ kg}$. and the outer diameters are $D_1 = 125 \text{ cms}$; $D_2 = 190 \text{ cm}$. The length of the shaft is 300 cms. and its diameter $d = 10 \text{ cms}$. Modulus of rigidity of shaft material $G = 0.83 \times 10^{11} \text{ N/m}^2$. Find the natural frequency of the shaft if along half the length of the shaft, the diameter is increased from 10 cm. to 20 cm.

17. Write short note on the following :

- a) Holtzer's method.
- b) Effects of partial balancing in locomotives.
- c) Vibration isolation & Transmissibility .