



B.E DEGREE EXAMINATIONS: MAY 2015

(Regulations 2009)

Fifth Semester

MECHANICAL ENGINEERING

MEC113:Dynamics of Machinery

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The ratio of the maximum fluctuation of speed to the mean speed is called
 - a) Fluctuation of speed
 - b) Maximum fluctuation of speed
 - c) Coefficient of fluctuation of speed
 - d) None of these
2. Inertia force is also called as
 - a) reversed effective force
 - b) reversed shaking force
 - c) reversed radial force
 - d) Reversed tangential force
3. The swaying couple is due to the
 - a) Primary unbalanced force
 - b) Secondary unbalanced force
 - c) Two cylinders of locomotive
 - d) Partial balancing
4. Unbalanced force is also called as
 - a) Tangential force
 - b) shaking force
 - c) circular force
 - d) radial force
5. Resonance occurs when the frequency of external system is
 - a) Higher than natural frequency
 - b) lower than natural frequency
 - c) Equal to natural frequency
 - d) None of these
6. Rotating shafts tend to vibrate violently at whirling speeds because
 - a) The shafts are rotating at very high speeds
 - b) Bearing centre line coincides with shaft axis
 - c) The system is unbalanced
 - d) Resonance is caused due to the heavy weight of the rotor
7. A body is said to be under forced vibrations, when
 - a) no external force acts on a body, after giving it an initial displacement
 - b) a body vibrates under the influence of external force

(OR)

- b) The connecting rod of an IC engine is 225 mm long and has a mass 1.6 kg. The mass of the piston and gudgeon pin is 2.4 kg and stroke is 150 mm. The cylinder bore is 112.5 mm. the centre of gravity of the connecting rod is 150 mm from the small end. Its radius of gyration about the centre of gravity for oscillations in the plane of swing of the connecting rod is 87.5 mm. Determine the magnitude and direction of the resultant force on the crank pin when the crank is at 40° and the piston is moving away from inner dead centre under an effective gas pressure of 1.8 MN/m². The engine speed is 1200 r.p.m.

22. a) A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.

(OR)

- b) A shaft carries four masses A,B,C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° , and C to D 120° . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.

23. a) A vertical shaft of 5 mm diameter is 200 mm long and is supported in long bearing at its ends. A disc of mass 50 kg is attached to the centre of the shaft. Neglecting any increase in stiffness due to the attachment of the disc to the shaft, find the critical speed of rotation and the maximum bending stress when the shaft is rotating at 75% of the critical speed. The centre of the disc is 0.25 mm from the geometric axis of the shaft. $E=200\text{GN/m}^2$

(OR)

- b) A vibrating system consists of a mass of 50 kg, a spring of stiffness 30 kN/m and a damper. The damping provided is only 20% of the critical value. Determine (i)

the damping factor (ii) the critical damping coefficient (iii) the natural frequency of damped vibration (iv) the logarithmic decrement (v) the ratio of two consecutive amplitudes.

24. a) A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a harmonic force of frequency 4 Hz, what will be the percentage increase in the amplitude of vibration when damper is removed as compared with damping?

(OR)

- b) The mass of an electric motor is 120 kg and it runs at 1500 r.p.m. The armature mass is 35 kg and its C.G. lies 0.5 mm from the axis of rotation. The motor is mounted on five springs of negligible damping so that the force transmitted is one-eleventh of the impressed force. Assume that the mass of the motor is equally distributed among the five springs. Determine: (i). Stiffness of each spring; (ii). Dynamic force transmitted to the base at the operating speed; and (iii). Natural frequency of the system.

25. a) The mass of each ball of a Proell governor is 7.5 kg and the load in the sleeve is 80 kg. Each of the arms is 300 mm long. The upper arms are pivoted on the axis of rotation, whereas the lower arms are pivoted to links of 40 mm from the axis of rotation. The extensions of the lower arms to which the balls are attached are 100 mm long and are parallel to the governor axis at the minimum radius. Determine the equilibrium speeds corresponding to extreme radii of 180 mm and 240 mm.

(OR)

- b) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: (i) when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. (ii) when the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.
