

**ANNA UNIVERSITY - 2006**  
**B.E/B.TECH IV SEMESTER DEGREE EXAMINATION**  
**DYNAMIC OF MACHINES**  
**(MECHANICAL ENGINEERING)**

TIME-3HOUR  
MARK-100

**ANSWER ALL QUESTIONS**

**PART A (10 \* 2 = 20)**

1. Define Inertia force.
2. What is the function of the flywheel?
3. What is the firing order of six cylinder engine? Is this engine fully balanced?
4. Define hammer blow with respect to locomotives.
5. State energy method of finding the equation of motion of a system.
6. State different types of damping a vibration system.
7. Define Magnification factor.
8. Define critical damping and state its application.
9. How governors are classified?
10. Define power of a governor.

**PART B (5 \* 16 = 80)**

11. A gun barrel of mass 600 kg has a recoil spring of stiffness 294 kN/meter. If the barrel recoils 1.3 m on firing determine (i) the initial recoil velocity of the barrel (ii) the critical damping co-efficient of the dash pot which is engaged at the end of the recoil stroke (iii) the equation of motion of the gun barrel if the time of recoil is of time period.

12. (a) The crank and connecting rod of a steam engine are 0.3 m and 1.5 m in length. The crank rotates at 180 rpm. clock wise. Determine the velocity and acceleration of the piston when the crank is at 40 degrees from the inner dead centre position. Also determine the position of the crank for zero acceleration of the piston.

Or

(b) A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 rpm. The co-efficient of fluctuation of energy is 0.1 and fluctuation of speed is 2% of the mean speed. If the diameter of the flywheel rim is 2 meter and the hub and spokes provide 5% of the rotational inertia of the flywheel, find the mass and cross sectional area of the flywheel rim. Assume density of flywheel as 7200 kg/m<sup>3</sup>.

13. (a) Four masses are attached to a shaft at planes A, B, C and D at equal radii. The distance of the planes B, C and D from A are 40 cm, 50 cm and 120 cm respectively. The masses at A, B and C are 60 kg, 45 kg and 70 kg respectively. If the system is in complete balance, determine the mass at D and position of masses B, C and D with respect to A.

Or

(b) A four cylinder vertical engine has cranks 300 cm long. The planes of rotation of the first, third and fourth cranks are 750 mm, 1050 mm and 1650 mm respectively from that of the second crank and their reciprocating masses are 150 kg, 400 kg and 250 kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete primary balance.

14. (a) (i) A torsional pendulum when immersed in oil indicates its natural frequency of 200 Hz. But when it was

put to vibration in vacuum having no damping, its natural frequency has observed as 250 Hz. Find the value of damping factor of the oil.

(ii) A mass of 1 kg is attached to a spring having a stiffness of 3920 N/m. The mass slides on a horizontal surface, the co-efficient of friction between mass and surface being 0.1. Determine the frequency of vibration of the system and amplitude after one cycle if the initial amplitude is 0.25 cm.

Or

(b) A machine of mass 1000 kg is supported on springs which deflect 8 mm under static load. With negligible damping the machine vibrates with an amplitude of 5 mm when subjected to a vertical harmonic force at 80 percent of the resonant frequency. When a damper is fitted it is found that the resonant amplitude is 2 mm. Find (i) Amplitude of the damping force and (ii) damping co-efficient.

15. (a) In a spring controlled governor the curve of a controlling force is a straight line. When the balls are 400 mm apart the controlling force is 1200 N and when 200 mm apart the controlling force is 450 N. At what speed will the governor run when the balls are 250 mm apart. What initial tension on the spring would be required for isochronism and what would then be the speed. The mass of each ball is 9 kg.

Or

(b) Find the angle of inclination with respect to vertical of a two wheeler negotiating a turn. Combined mass of the vehicle with its rider is 250 kg.

Moment of inertia of the engine flywheel — 0.3 kg m<sup>2</sup>

Moment of inertia of each road wheel — 1 kg m<sup>2</sup>

Speed of the flywheel is 5 times the speed of the road wheel and in the same direction. Height of centre of gravity of the rider with vehicle is 0.6 m. Speed of the two wheeler is 90 KMPH. Wheel radius is 300 mm. Radius of turn is 50 meters.

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