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Question Paper Code: 55701

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2019

Fifth Semester

Mechanical Engineering

15UME501 -DYNAMICS OF MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The unit of inertia torque is CO1- R
(a) N/m (b) Nm (c) J/m (d) N/mm²
2. The ratio of the maximum fluctuation of speed to the mean speed is called CO1- R
(a) Fluctuation of speed (b) Maximum fluctuation of speed
(c) Coefficient of fluctuation of speed (d) None of these
3. The unit of centrifugal force is CO2- R
(a) N (b) Nm (c) N/m (d) kg/m³
4. The partial balancing means CO2- R
(a) Balancing partially the revolving masses
(b) Balancing partially the reciprocating masses
(c) Best balancing of engines
(d) All of the above
5. When a body is subjected to transverse vibrations, the stress induced in a body will be CO3- R
(a) Tensile stress. (b) Compressive stress.
(c) Shear stress. (d) Longitudinal stress.

– 162, The speed is to be kept within $\pm 1\%$ of the mean speed of the engine. Calculate the necessary moment of inertia of the flywheel. Determine the suitable dimensions of a rectangular flywheel rim if the breadth is twice its thickness. The density of the cast iron is 7250 kg/m^3 and its hoop stress is 6 MPa . Assume that the rim contributes 92% of the flywheel effect.

17. (a) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm . The masses at A and D have an eccentricity of 80 mm . The angle between the masses at B and C is 100° and that between the masses at B and A is 190° , both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm . If the shaft is in complete dynamic balance, determine:
1. The magnitude of the masses at A and D;
 2. The distance between planes A and D; and
 3. the angular position of the mass at D.

Or

- (b) A, B, C and D are four masses carried by a rotating shaft at radii $100, 125, 200$ and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are $10 \text{ kg}, 5 \text{ kg}$ and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.
18. (a) A machine of mass 75 kg is mounted on spring and is fitted with a dashpot to damp out vibrations. There are three springs each of stiffness 10 N/mm and it is found that the amplitude of vibration diminishes from 38.4 mm to 6.4 mm in two complete oscillations. Assuming that the damping force varies as the velocity, determine: (i) the resistance of the dash pot at unit velocity (ii) the ratio of the frequency of the damped vibration to the frequency of the undamped vibrations and (iii) the periodic time of the damped vibrations.

Or

- (b) A shaft of length 1.25 m is 75 mm in diameter for the first 275 mm of its length, 125 mm in diameter for the next 500 mm length, 87.5 mm in diameter for the next 375 mm length and 175 mm in diameter for the remaining 100 mm of its length. The shaft

carries two rotors at two ends. The mass moment of inertia of the first rotor is 75 kg m^2 whereas of the second rotor is 50 kgm^2 . Find the frequency of natural torsional vibrations of the system. The modulus of the rigidity of the shaft material may be taken as 80 GN/m^2 .

19. (a) A mass of 10 kg is suspended from one end of a helical spring, the other end being fixed. The stiffness of the spring is 10 N/mm. The viscous damping causes the amplitude to decrease to one-tenth of the initial value in four complete oscillations. If a periodic force of $150\cos 50t$ N is applied at the mass in the vertical direction, find the amplitude of the forced vibrations. What is its value of resonance? CO4 -Ana (16)

Or

- (b) A spring mass system is excited by a force $F \sin \omega t$. On measuring the amplitude of vibration is found to be 12 mm at resonance. However, at a frequency 0.8 times the resonant frequency, the amplitude reduces to 8 mm. Determine the damping ratio of the system. CO4 Ana (16)

20. (a) 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. CO5-App (16)

Or

- (b) Each paddle wheel of a steamer has a mass of 1600 kg and a radius of gyration of 1.2 meters. The steamer turns to port in a circle of 160 meters radius at 24 km/hr. The speed of the paddle is 90 rpm. Find the magnitude and effect of the gyroscopic couple acting on the steamer. CO5-App (16)