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Question Paper Code : 21855

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Mechanical Engineering

ME 2302/ME 52/ME 1301/10122 ME 503 – DYNAMICS OF MACHINERY

(Regulations 2008/2010)

(Common to PTME 2302/10122 ME 503 – Dynamic of Machienry for B.E. (Part – Time) Fourth Semester Mechanical Engineering – Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. The lengths of crank and connecting rod of vertical reciprocating engine are 300mm and 1.5 m respectively. If the crank rotates at 200 rpm, Find the velocity of piston at $\theta = 40°$.

2. Why the weight of flywheel for single cylinder engine is heavier than that of same powered multi cylinder engine?

3. What do you mean by partial balancing of Single cylinder engine?

4. In case of balancing of rotary masses in different planes, how many planes in which balance masses will be kept?

5. Why transient solution is not considered in the response of forced damped vibrating system?

6. If a damper exerts a force of 30 kN at a speed of 2 m/sec. movement, determine the damping coefficient.

7. Define Transmissibility?

8. Classify Vibration.

9. Why too sensitivity Governors are not useful?

10. What is the function of active gyro couple?

PART B — (5 × 16 = 80 marks)

11. (a) A vertical petrol engine 150 mm diameter and 200 mm stroke has a connecting rod 350 mm long. The mass of the piston is 1.6 kg and engine speed is 1800 rpm. On the expansion stroke with crank angle 30° from top dead centre, the gas pressure is 750 kN/m^2. Determine the net thrust on the piston.

Or

(b) The turning moment diagram for multi cylinder engine has been drawn to a vertical scale of 1mm =650Nm and a horizontal scale of 1mm = 4.5°. The areas above and below the mean torque line are –28, + 380, –260, +310, –300, +242, –380, +265 and –229mm^2, the fluctuation of speed is limited to ±1.8% of the mean speed which is 400 rpm. Density of rim material is 700kg/m^3 and width of the rim is 4.5 times its thickness. The hoop stress in the rim material is limited to 6 N/mm^2. Neglecting the effect of the boss and arms, determine diameter and cross section of fly wheel rim.

12. (a) Data of three unbalance masses A, B and C are given below M_a=4kg, M_b=3kg, M_c=2.5kg, R_a=75mm, R_b=85mm, R_c=50mm, $\theta_a = 45°$, $\theta_b = 135°$ and $\theta_c = 240°$ (θ measured from right horizontal axis at the origin). The shaft length is 800 mm between bearings. These three masses are completely balanced by two counter masses located 75mm from each bearing. The axial distances of 3 unbalance masses are $L_a = 150mm$, $L_b = 350mm$ and $L_c = 525mm$ from the right hand side counter mass plane. Determine the masses and angular positions of counter masses, if the radial location of counter masses are R_{b1}=75mm and R_{b2}=40mm.

Or

(b) The following data related to a single cylinder reciprocating engine.

(i) Mass of reciprocating parts=40 kg

(ii) Mass of revolving parts = 30 kg at 180 mm radius

(iii) Speed=150 rpm

(iv) Stroke=350 mm

If 60% of the reciprocating parts and all the revolving parts are to be balanced determine

(1) The balance mass required at radius of 320 mm

(2) The unbalance force when the crank has turned 45° from top dead centre.

13. (a) A rotor has mass of 12 kg and is mounted midway on a 24 mm diameter horizontal shaft supported at the ends by two bearings. The bearings are 1m apart. The shaft rotates at 2400rpm. If the center of mass of the rotor is 0.11mm above from the geometric centre of the rotor due to a certain manufacturing defects, find the amplitude of the study state vibration and the dynamic force transmitted to the bearing. Take $E=200GN/m^2$

Or

(b) The shaft carries two masses. The mass A is 300 kg with radius of gyration of 0.75m and the mass B is 500 kg with radius of gyration of 0.9m. the shaft is a stepped shaft having, 100 mm diameter for 300mm length, 150 mm diameter for 160mm length, 120 mm diameter for 125mm length and 90mm diameter for 400mm length. Determine the frequency of the natural torsional vibration. It is desired to have node at the mid section of shaft of 120mm diameter by .changing the diameter of the section having 90mm diameter, what will be the new diameter. Take $G=84GN/m^2$.

14. (a) A machine with a mass of 500 kg has an amplitude of vibration 0.01m when operating at a speed of 49Hz. If the machine is critically damped and spring stiffness coefficient is 10×10^3 N/m. Find the amount of unbalance.

Or

(b) The static deflection of an electric motor of mass 400 kg supported by a system of four parallel springs and the static deflection is found to be 50mm. If the electric motor has rotating unbalance of 20 kgm.Determine

(i) the amplitude of vibration at 2000 rpm

(ii) the force transmitted to the ground.

15. (a) In a spring loaded governor, the controlling force curve is a straight line. The balls are 400 mm apart, when the controlling force is 1500N and 240 mm when it is 800N. The mass of each ball is 10 kg. Determine the speed at which the governor runs, when the balls are 300mm apart. By how much should the initial tension be increased to make the governor isochronous? Also find the isochronous speed.

Or

(b) The turbine rotor of a ship has mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft. The radius of gyration of rotor is 320mm. Determine the gyroscopic couple and its effect when

(i) the ship turns right at a radius of 250m with a speed of 25km/hr

(ii) the ship pitches with the bow rising at an angular velocity of 0.8 rad/sec

(iii) the ship rolls at an angular velocity of 0.1 rad/sec
