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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, April 2017
(2013 Scheme)
13.602 : DYNAMICS OF MACHINERY (MP)

Time: 3 Hours Max. Marks : 100

PART – A

Answer **all** questions; **each** carries **2** marks.

1. Define dynamically equivalent system.
2. A flywheel with a mass of 3 kN has a radius of gyration of 1.6 m. Find the energy stored in the flywheel when its speed increases from 315 rpm to 340 rpm.
3. Explain the gyroscopic effect when the ship rolls.
4. Define the terms : Hunting and Sensitiveness of the governor.
5. Calculate the power of porter governor having all equal arms intersect on the axis whose height and effort are 26 cm and 39.24 N respectively.
6. State D'Alembert's principle.
7. Choose the Engine/s which is /are completely balanced :
   a) V-engine
   b) In-line-4 cylinder-4S engine
   c) In line two-cylinder engine
   d) 6 Cylinder 4-stroke engine.
8. Define resonance. State the effect of turbine operation below and above the resonance value.

P.T.O.

9. Find the natural frequency of damped vibration whose mass and equilibrium equation at a certain instant is given as 3.5 kg and $3.5\ \ddot{x} + 2.45\ \dot{x} + 500\ x = 0$. Where x is the displacement from equilibrium position.

10. For a certain un-damped vibrating system, at resonance condition, calculate the transmissibility, if the 50 kN exciting force is applied to the system having single mass and massless spring.

PART – B

Answer **any one** question from **each** Module; **each** carries **20** marks.

Module – I

11. Following data relate to the connecting rod of the reciprocating engine :
Mass = 50 kg; distance between bearing centers = 900 mm; diameter of big end bearing = 100 mm; diameter of small end bearing = 80 mm; time of oscillation when connecting rod is suspended from big end = 1.7 s and small end is 1.85 s. Determine the radius of gyration of the rod about an axis through center of mass perpendicular to the plane of oscillation.

12. In a four-link mechanism shown in Fig. 1 below, torque T_3 and T_4 have magnitudes of 30 Nm and 20 Nm respectively. The link lengths are AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm. For the static equilibrium of the mechanism, determine the required input torque T_2.

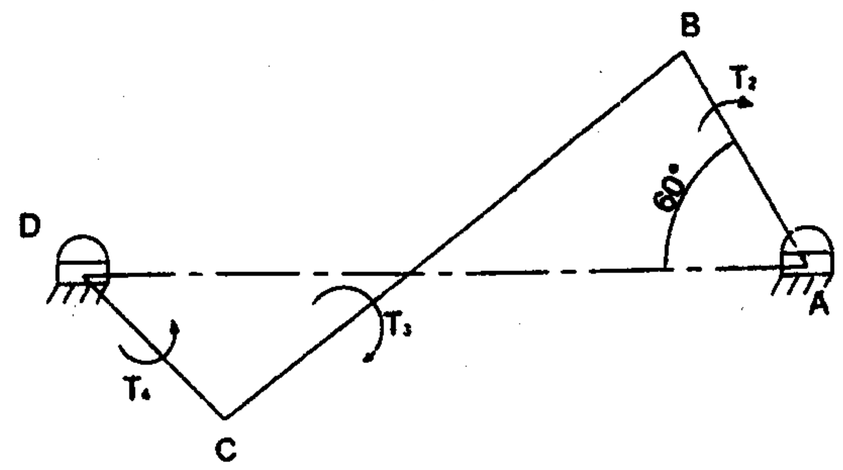

Fig. 1

Module – II

13. The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft. The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when the:
    i) Ship turns right at a radius of 250 m with a speed of 25 km/hr.
    ii) Ship pitches with the bow rising at an angular velocity of 0.8 rad/s.
    iii) Ship rolls at an angular velocity of 0.1 rad/s.

14. Each arm of a porter governor is 200 mm long and is hinged at a distance of 40 mm from the axis of rotation. The mass of each ball is 1.5 kg and the sleeve is 25 kg. When the links are at 30° to the vertical, the sleeve begins to rise at 260 rpm. Assuming that the friction force is constant, find the maximum and the minimum speeds of rotation when the inclination of the arms to the verticle is 45°.

Module – III

15. Explain with sketches the unbalanced forces and couples in case of the following in-line engines :
    i) 2- cylinder 4-S engine ii) 4-cylinder 4-S engine.

16. The turning moment diagrams of a 4-S engine is assumed to be re presented by four triangles the areas of which from the line of zero pressure are; suction stroke = 440 mm^2; compression stroke = 1600 mm^2; expansion stroke = 7200 mm^2; exhaust stroke = 660 mm^2. Each mm^2 of area represent 3 Nm of energy if the resisting torque is uniform, determine the mass of the rim of a flywheel to keep the speed between 218 and 222 rpm when the mean radius of the rim is to be 1.25m.

Module – IV

17. A machine part having a mass of 2.5 kg vibrates in a viscous medium. A harmonic exciting force of 30 N acts on the part and causes a resonant amplitude of 14 mm with a period of 0.22 seconds. Find the damping co-efficient. If the frequency of the exciting force is changed to 4 Hz, determine the increase in amplitude of forced vibrations upon removal of the damper.

18. Show that the ratio of two successive amplitudes of oscillations is constant in a damped vibrating system.