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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2016

13.602 : DYNAMICS OF MACHINERY (MP)

(2013 Scheme)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. What are the conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque ?

2. Explain the superposition theorem as applicable to a system of forces acting on a mechanism.

3. What is effort and power of the governor ?

4. What are isochronous governors ?

5. Mention the conditions for static balancing and dynamic balancing.

6. What do you understand by partial balancing of locomotive ?

7. Why flywheel is needed in punching press ?

8. What are vibrometers and accelerometers ?

9. Define the term transmissibility.

10. What is the critical speed of the shaft ? **(10×2=20 Marks)**

P.T.O.

PART – B

(Answer **any one** question from **each** Module. **Each** question carries **20** marks.)

Module – I

11. Determine the required input torque on the crank of a slider crank mechanism for the static equilibrium when the applied piston load is 1500 N. The lengths of the crank and connecting rod are 40 mm and 100 mm respectively and the crank has turned through 45° from the inner dead centre.

12. The lengths of crank and connecting rod of a horizontal engine are 200 mm and 1 m respectively. The crank is rotating at 400 rpm. When the crank has turned through 30° from the inner dead center, the difference of pressure between cover and piston rod is 0.4 N/mm^2. If the mass of the reciprocating parts is 100 kg and cylinder bore is 0.4 m. then calculate :

    i) Inertia force
    ii) Force on piston
    iii) Piston effort
    iv) Thrust on the sides of the cylinder walls
    v) Thrust in the connecting rod and
    vi) Crank effort.

Module – II

13. Calculate the range of speed of a Porter governor which has equal arms of each 200 mm long and pivoted on the axis of rotation. The mass of each ball is 4 kg and the central mass of the sleeve is 20 kg. The radius of rotation of the ball is 100 mm when the governor begins to lift and 130 mm when the governor is at maximum speed.

14. A Turbine rotor of a ship has a mass of 8 tonnes and a speed of 1700 rpm. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from stern. Find the gyroscopic effects in the following conditions.

    i) The ship sails at a speed of 25 km/hr and steers to the left in a curve of 70 m radius.

ii) The ship pitches 8° above and 8° below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 sec.

iii) The ship rolls and at a certain instant, it has an angular velocity of 0.04 rad/s clockwise when viewed from stern.

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.

Module – III

15. A two cylinder uncoupled locomotive has inside cylinders 0.6 m apart. The radius of each crank is 300 mm and is at right angles. The revolving mass per cylinder is 250 kg and the reciprocating mass per cylinder is 300 kg. The whole of the revolving and two-thirds of the reciprocating masses are to be balanced and the balancing masses are placed in the planes of the driving wheels, at a radius of 0.8 mm. The driving wheels are 2 m in diameter and 1.5 in apart. If the speed of the engine is 80 Km/hr. Find the hammer blow, maximum variation in tractive effort and maximum swaying couple.

16. The effective turning moment exerted by two stroke engine at crank shaft is represented by $T\ (N-m) = 8000 + 1000 + \sin 2\theta - 2000 \cos 2\theta$ where θ = inclination of the crank to the inner dead centre. The cycle repeats for every 180° of crank rotation. The mass of the flywheel is 500 kg and its radius of gyration is 75 cm. The engine speed is 300 rpm. Assuming external resistance as constant, determine :

i) The power developed

ii) The total percentage fluctuations in speed and

iii) The maximum angular retardation of the flywheel.

Module – IV

17. A machine, supported on springs has a mass of 80 kg. The mass of the reciprocating parts is 2.2 kg which moves through a vertical stroke of 100 mm with simple harmonic motion. Neglecting damping,

    i) Determine the stiffness of the spring so that the force transmitted to the foundation is 1/20th of the impressed force. The machine crankshaft rotates at 800 rpm.

    ii) If under the actual working conditions, the damping reduces in magnitude of successive vibration by 30%. Find the force transmitted to the foundation at 800 rpm and force transmitted to the foundation at resonance.

18. A steel shaft ABCD 1.5 in long has flywheel at its end A and B. The mass of flywheel A is 500 kg and has a radius of gyration 0.6. The mass of flywheel D is 700 kg and has a radius of gyration 0.9 m. The connecting shaft has a diameter of 60 mm for the portion AB which is 0.4 m long and has a diameter of 70 mm for BC which is 0.5 m long and has a diameter of 'd' for the portion CD which is 0.6 m long.

    Determine :

    i) The diameter of the proportion CD so that the node of the torsional vibration of the system will be at the centre of length BC.

    ii) Natural frequency of the torsional vibrations.

    The modulus of rigidity for the shaft material is 80 GN/m^2.
