(Pages : 4)

B – 5526

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, March 2017

(2008 Scheme)

08.602 : DYNAMICS OF MACHINERY (MP)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions : **(10×4=40 Marks)**

1. Define 'inertia force' and 'inertia torque'.

2. Explain the principle of virtual work for force analysis.

3. How the different masses rotating in same planes are balanced ?

4. Is it possible to balance an in-line engines completely ?

5. Why is it important to find the natural frequency of a vibrating system ?

6. What is the difference between a vibration absorber and a vibration isolator ?

7. What is the function of a flywheel ? How does it differ from that of a governor ?

8. Explain the effect of sliding friction for static force analysis of sliding pair.

9. Describe the gyroscopic effect on sea going vessels.

10. What is stability of a governor ? Sketch the controlling force versus radius diagrams for a stable, unstable and isochronous governor.

P.T.O.

PART – B

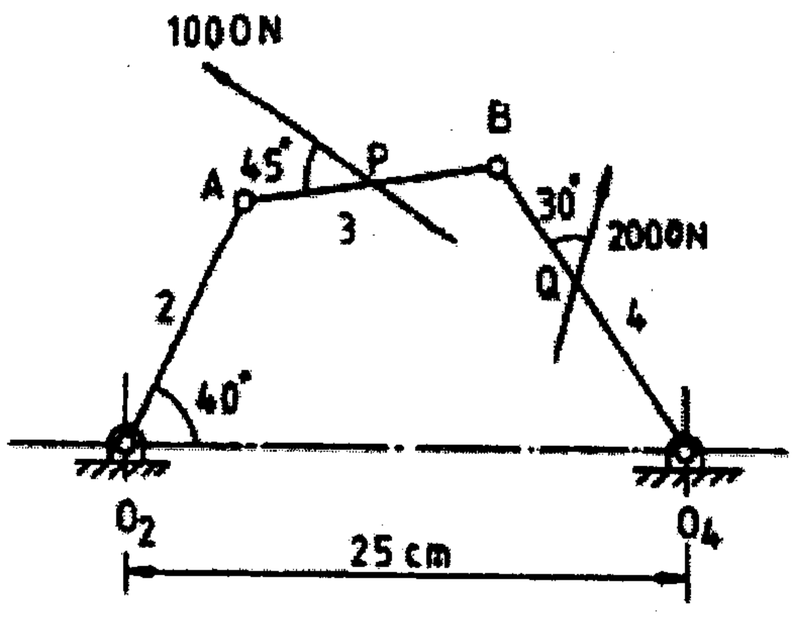
Answer **one full** question from **each** Module :

Module – I

11. Refer to the figure shown below : **20**

a) Determine the force acting perpendicular to link 2 and passing through its midpoint, for static equilibrium, what are the pin forces ?

b) Instead of a force on link 2, if link 2 is driving crank, determine the couple C_2 necessary for static equilibrium. Determine also the pin forces.



O_2 A = 10 cm , AB = 15 cm
O_4 B = 15 cm , O_4Q = 8 cm
AP = 7 cm

OR

12. a) The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2. The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate :

1) Pressure on slide bars,
2) Thrust in the connecting rod,
3) Tangential force on the crank-pin, and
4) Turning moment on the crank shaft. **12**

b) An electric motor drives a punching press to which a flywheel of radius of gyration 0.5 m is fitted. The flywheel runs at 240 rpm. The press is capable of punching 600 holes per hour with each punching operation taking 2 seconds and requiring 15 kNm of work. Determine :

i) The rating of the motor, and

ii) Mass of the flywheel if its speed does not drop below 220 rpm. **8**

Module – II

13. a) A Porter governor has links 150 mm long and are attached to pivots at a radial distance of 30 mm from the vertical axis of the governor. The mass of each ball is 1.75 kg and the mass of the sleeve is 25 kg. The governor sleeve begins to rise at 300 r.p.m. when the links are at 30° to the vertical. Assuming the friction force to be constant, find the minimum and maximum speed of rotation when the inclination of the links is 45° to the vertical. **10**

b) A four wheel trolley car of total mass 2000 kg running on rails of 1 m gauge, rounds a curve of 25 m radius at 40 km/h. The track is banked at 10°. The wheels have an external diameter of 0.6 m and each pair of an axle has a mass of 200 kg. The radius of gyration for each pair is 250 mm. The height of C.G. of the car above the wheel base is 0.95 m. Allowing for centrifugal force and gyroscopic couple action, determine the pressure on each rail. **10**

OR

14. a) Four masses A, B, C and D revolve at equal radii and are equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angles of 90° and 240° respectively with the radius of B. Find the magnitude of the masses A, C and D and the angular position of A so that the system may be completely balanced. **12**

b) The reciprocating mass per cylinder in a 60° V-twin engine is 1.5 kg. The stroke and connecting rod length are 100 mm and 250 mm respectively. If the engine runs at 2500 r.p.m., determine the maximum and minimum values of the primary and secondary forces. Also find out the crank position corresponding these values. **8**

Module – III

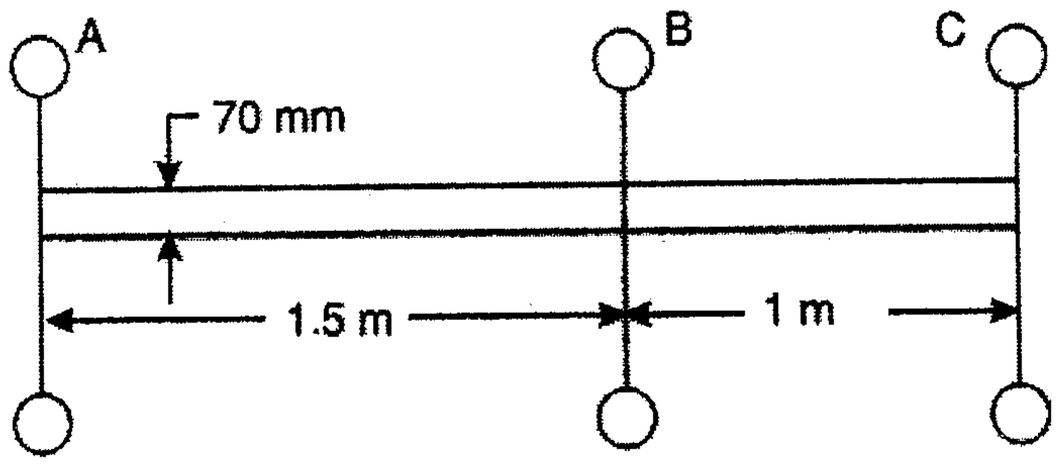
15. a) A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a harmonic force of frequency 4 Hz what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that with damping. **10**

b) The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine :

1) Stiffness of the spring,
2) Logarithmic decrement and
3) Damping factor, i.e. the ratio of the system damping to critical damping. **10**

OR

16. a) A single cylinder oil engine drives directly a centrifugal pump. The rotating mass of the engine, flywheel and the pump with shaft is equivalent to a three rotor system as shown below. The mass moment of inertia of the rotors A, B and C are 0.15, 0.3 and 0.09 kgm^2. Find the natural frequency of the torsional vibration. The modulus of rigidity for the shaft material is 84 kN/mm^2. **12**



b) Explain the term 'whirling speed' or 'critical speed' of a shaft. Prove that the whirling speed for a rotating shaft is the same as the frequency of natural transverse vibration. **8**