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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, June 2015
(2008 Scheme)
08-602 : DYNAMICS OF MACHINERY (MP)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **all** questions from Part – **A**.*
*2) Answer **one** question **each** from Module **1, 2, 3** of Part – **B**.*

PART – A

1. What is friction circle ? What do you mean by friction axis of a link ?
2. Explain the principle of superposition for the force analysis of a mechanism.
3. Define the terms inertia force and inertia couple. How is their magnitude and direction found ?
4. What is the function of a flywheel ? Explain the terms "fluctuation of energy" and "fluctuation of speed" as applied to fly wheels.
5. What is the gyroscopic effect on stability of two wheeler when it takes a turn ?
6. Explain the following terms related to governor :
   1) Stability
   2) Effort
   3) Controlling force.
7. How reciprocating masses are partially balanced ? Explain the reason.
8. Show that the ratio of any two successive amplitudes of a damped force vibration is constant.
9. Explain the term "dynamic magnifier" in forced vibration.
10. What is meant by torsionally equivalent length of a shaft as referred to a stepped shaft ?

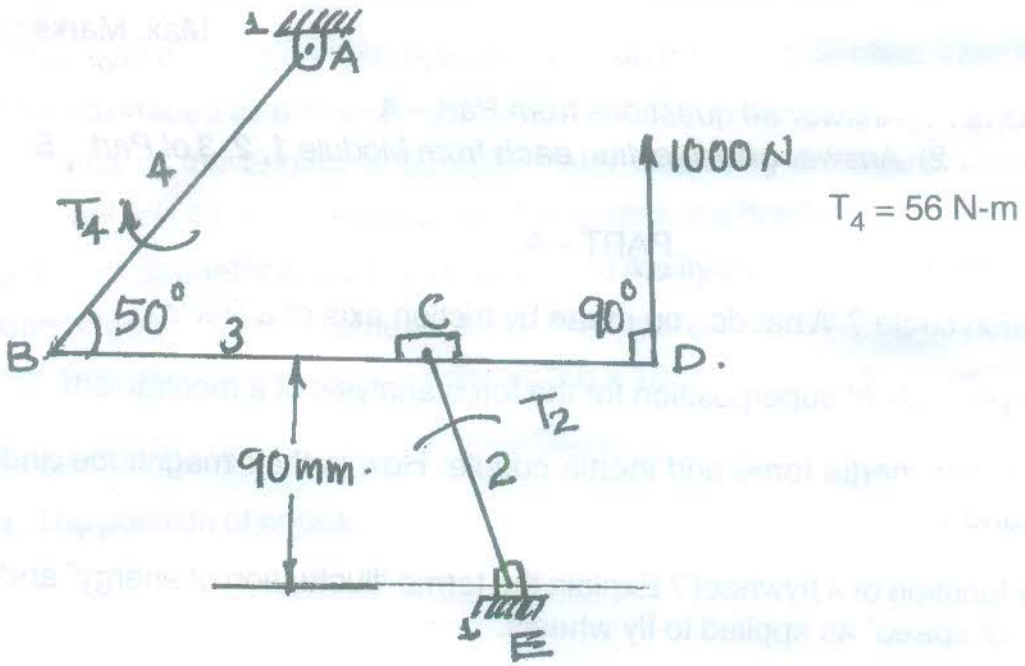
(10×4=40 Marks)

P.T.O.

PART – B

Module – 1

11. In the mechanism shown in figure link 4 is subjected to a torque of 56 N-m and a force of 1000 N is applied at the free end of the link BD. For this configuration, determine the torque required to drive link 2. The various dimensions are : AB = 140 mm. BC = 170 mm. BD = 300 mm and CE = 110 mm, ∠ABD = 50°. **20**



OR

12. a) The connecting rod of a gasoline engine is 300 mm long between its centres. It has a mass of 15 kg and mass moment of inertia of 7000 kg-mm^2. Its centre of gravity is at 200 mm from its small end centre. Determine the dynamically equivalent two mass system of the connecting nod if one of the mass is located at the small end centre. **8**

b) The torque exerted on the crank shaft of a two stroke engine is given by $T = 7000 + 1000 \sin 2\theta - 2000 \cos 2\theta$. Where θ is crank angle from inner dead centre. Assuming resisting torque to be constant determine :

i) Power developed when engine speed is 300 rpm.

ii) The maximum fluctuation in speed in percentage. The mass of fly wheel is 500 kg with radius of gyration 750 mm. **12**

Module – 2

13. A Hartnell governor having a central sleeve and two right angled bell crank levers operates between 300 rpm and 320 rpm for a sleeve lift of 20 mm. The sleeve arms and ball arms are 90 mm and 130 mm respectively. The levers are pivoted at 110 mm from the governor axis and mass of each ball is 3 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine.
    1) Loads on the springs at the lowest and highest equilibrium speed.
    2) Stiffness of the spring. **20**

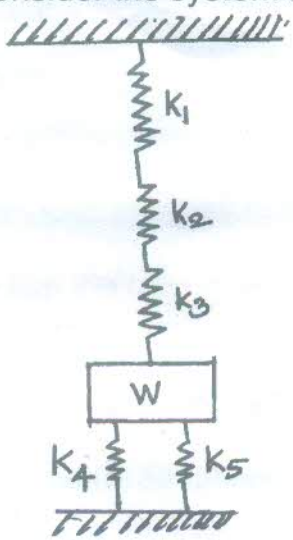
OR

14. a) A ship is propelled by a turbine rotor of mass 600 kg and has a speed of 2800 rpm. The rotor has a radius of gyration 0.8 m and rotates in clockwise direction. When viewed from stern. The ship pitches 18° from the horizontal position upwards with time period of 25 sec. of simple Harmonic motion. Find the gyroscopic couple and its effects. Also determine the maximum angular acceleration during pitching. **10**

    b) The piston of 60° V-twin cylinder engine has a stroke of 90 mm. The two connecting rods operate on a common crank and each is 160 mm long. If the mass of piston is 1.25 kg per cylinder and the crank speed is 2500 rpm. Find maximum and minimum value of primary and secondary forces.
    Mass per cylinder is 1 kg and the engine runs at 3000 rpm. Determine the out-of balance primary and secondary forces and couples on this engine.
    Taking a plane midway between the cylinder 3 and 4 as the reference plane. **10**

Module – 3

15. a) Consider the system shown in figure :



$K_1 = 20$ N/cm.
$K_2 = 15$ N/cm.
$K_3 = 30$ N/cm.
$K_4 = K_5 = 50$ N/cm.

Find weight W if the system has a natural frequency of 10 Hz. **8**

b) A body of 5 kg is supported on a spring of stiffness 200 N/m and has dash pot connected to it which produces a resistance of 0.002 N at a velocity of | cm | sec. In what ratio will the amplitude of vibration be reduced after 5 cycles. 12

OR

16. A four cylinder engine with flywheel is coupled to a propeller. This assembly is approximated as a three rotor torsional vibration system in which the moment of Inertia of the engine is 80 kg-m^2 and that of flywheel and propeller are 35 kg-m^2 and 40 kg-m^2 respectively. The engine and flywheel rotors are connected by 40 mm diameter and 2 m long shaft and the flywheel and propeller rotors are connected by 30 mm diameter and 2 m long shaft. Neglecting the inertia of the shift and taking modulus of rigidity as 0.8×10^5 N/mm^2. Determine :

i) Natural frequency of the torsional vibration.

ii) The position of nodes. 20