Reg. No. : 38.............................

Name : ......Rejay.........................

Sixth Semester B.Tech. Degree Examination, April 2014
(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 **I, II, III** of Part – **B**.

PART – A

1. Explain the effect of sliding friction for force analysis of a sliding pair.

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

3. What do you mean by dynamical equivalent system ? State the important role played by such a system for determining the line of action of inertia force.

4. What is turning moment diagrams ? Draw the turning moment diagram of a four stroke cycle internal combustion engine.

5. What is gyroscopic couple ? Explain the terms spin and precession.

6. Define the terms related to governor :

   1) Sensitiveness

   2) Hunting

   3) Isochronism

7. Show that the primary unbalanced forces of a 90° V-twin cylinder engine can be balanced by a counter mass attached to the crank.

8. With the help of time-displacement diagram explain the terms : Overdamping, critical damping and underdamping.

9. Explain vibration isolation and transmissibility in a forced vibration.

10. Explain Viscous damping and Coulomb damping.   **(10×4=40 Marks)**

PART – B

Module – I

11. In a four bar mechanism shown in figure torques T_3 and T_4 of 30 N-m and 20 N-m are applied to links 3 and 4 respectively. The lengths of links are : AB = 300 mm. BC= 700 mm. CD = 400 mm and AD = 800 mm. For the static equilibrium of the mechanism at a given instant; determine the input torque T_2 required to drive link 2.
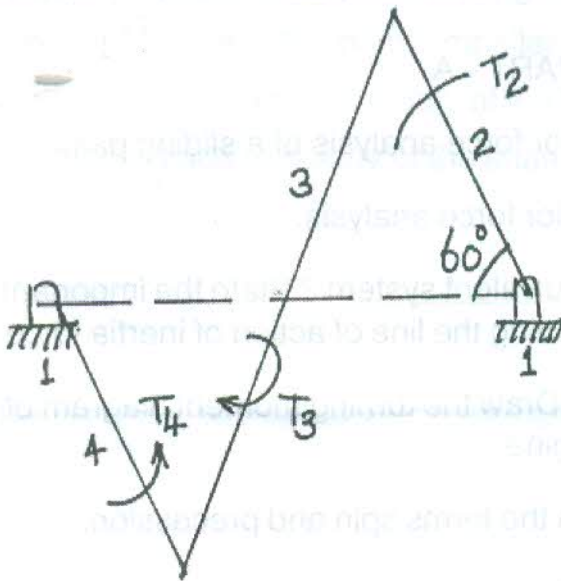
$T_3 = 30\ N\text{-}m.$
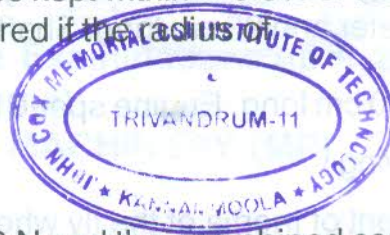
$T_4 = 20\ N\text{-}m.$

(20 Marks)

OR

12. a) The length of crank and ratio of connecting rod length to crank length of a horizontal steam engine are 300 mm and 4.5 respectively. The acceleration of the piston is 36 m/sec^2 when the crank has moved 30° from IDC. The net effective steam pressure on the piston is 0.5 N/mm^2 and friction resistance is 600 N. The diameter of the piston is 300 mm and mass of the reciprocating parts is 180 kg. Determine.

   1) Reaction on the guide bars.

   2) Thrust on the crank shaft bearing.

   3) Torque on crank shaft.

(12 Marks)

b) A horizontal cross compound steam engine develops 300 KW at 90 rpm. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required if the radius of gyration is 2 meters. **(8 Marks)**

Module – II

13. A motor cycle and its rider together weigh 2200 N and their combined centre of gravity is 0.55 m above the road when the motor cycle is upright. Each wheel is of 0.58 m diameter and has a moment of inertia of 1.0 Kg-m². The moment of inertia of rotating parts of the engine is 0.15 Kg-m². The engine rotates at 5 times the speed of the vehicle and in the same sense. Determine the angle of heel necessary when the motorcycle is taking a turnover a track of 35 m radius at a speed of 65 kmph. **(20 Marks)**

OR

14. A single cylinder reciprocating engine has speed 240 r.p.m., stroke 300 mm, mass of reciprocating parts 50 kg, mass of revolving parts at 150 mm radius 37 kg. If two third of the reciprocating parts and all the revolving parts are to be balanced, find : 1. The balance mass required at a radius of 400 mm, and 2. The residual unbalanced force when the crank has rotated 60 ° from top dead centre. **(20 Marks)**

Module – III

15. a) Large guns are designed so that on firing, the barrel recoils aganist a spring. At the end of the recoil, a dashpot is engaged that allows the barrel to return to its initial position in the minimum time without oscillation. Determine the proper spring constant and the dashpot damping co-efficient for a barrel of mass 800 kg, if the initial recoil velocity at the instant of firing is 25 m/sec. and the recoil distance is 1.5 m. **(10 Marks)**

b) Determine the Whirling speed of a shaft 25 mm diameter and 0.8 m long with a mass of 1 kg placed at mid-span, simply supported at ends. The density of the shaft material is 0.05 kg/cm³ and Young's modulus is 2×10^6 bar. **(10 Marks)**

OR

16. A reciprocating internal combustion engine is coupled to centrifugal pump through gearing. The shaft from the flywheel of the engine to the gear wheel is 6 cm diameter and 95 cm long. Shaft from the pinion to pump is 4 cm diameter and 30 cm long. Engine speed is $\frac{1}{4}^{th}$ the pump speed. Other particulars are the following :

Moment of Inertia of the fly wheel = 800 kg-m^2.

Moment of Inertia of the gear wheel = 15 kg-m^2.

Moment of Inertia of the pinion = 4 kg-m^2.

Moment of Inertia of the pump Impeller = 17 kg-m^2.

Determine the natural frequency of the torsional oscillation of the system.

Assume modulus of rigidity of the shaft material is 84×10^4 bar.　　**(20 Marks)**