T.E. (Mechanical) (Semester – I) Examination, 2010
THEORY OF MACHINES – II (New)
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **3** questions from Section **I** and **3** questions from Section **II**.*

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) Your answers will be **valued** as a whole.*

*6) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

*7) Assume **suitable** data, if **necessary**.*

SECTION – I

Unit – I

1. a) Derive an expression for frictional torque and load carrying capacity of truncated conical pivot bearing, assuming uniform pressure theory. **8**

b) A centrifugal clutch is to transmit 15 kW at 900 rpm. The shoes are four in number. The speed at which the engagement begins, is 3/4th of the running speed. The inside radius of the pulley rim is 150 mm and centre of gravity of the shoe lies at 120 mm from the centre of the spider. The shoes are lined with Feredo for which the coefficient of friction may be taken as 0.25. Determine 1) Mass of each shoe and 2) Size of the shoes, if angle subtended by the shoes at the centre of the spider is 60° and the pressure exerted on the shoe is 0.1 N/mm^2. **10**

OR

2. a) Write a short note on Bevis Gibson torsion type dynamometer. 6

b) A band and block brake having 12 blocks, each of which subtends an angle of 16° at the centre, is applied to a rotating drum of diameter 600 mm. The blocks are 75 mm thick. The drum and flywheel, mounted on same shaft have a mass of 1800 kg and have a combined radius of gyration of 600 mm. The two ends of the band are attached to pins on the opposite sides of the brake fulcrum at a distance of 40 mm and 150 mm from the fulcrum. If a force of 250 N is applied at a distance of 900 mm from the fulcrum, find

i) The maximum braking torque

ii) The angular retardation of the drum

iii) The time taken by the system to be stationery from the rated speed of 300 rpm.

Take coefficient of friction between the blocks and the drum as 0.3. 8

c) A bicycle and rider travelling at 12 km/hr on a level road, have a mass of 105 kg. A brake is applied to rear wheel which is 800 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find the distance covered by the bicycle and number of turns of its wheel before coming to rest. 4

Unit – II

3. a) Give the classification of governor. 6

Explain the working of porter governor.

b) The turbine rotor of a ship has a mass of 30 tons, a radius gyration of 6 mm and rotates at 2400 rpm in a clockwise direction when viewed from aft. The ship pitches through a total angle of 15°, 7.5° above and 7.5° below the horizontal, the motion being simple harmonic and having a period of 12 sec. Determine the maximum gyroscopic couple on the holding down bolts on the turbine and the direction of yaw as the bow rises. 10

OR

4. a) Explain the following terms related to governor. **6**

   1) Sensitivity of governor

   2) Isochronous governor

   3) Hunting of governor.

   b) A rear engine automobile is travelling around the track of 100 m mean radius. Each of the four road wheels has a moment of inertia of 1.6 kg-m^2 and an effective diameter of 600 mm. The rotating parts of the engine have a moment of inertia of 0.85 kg-m^2, the engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The gear ratio, engine to back axle is 3 : 1. The vehicle has a mass of 1400 kg and its center of gravity is 450 mm above the road level. The width of the track of the vehicle is 1.5 m.

   Determine the limiting speed of the vehicle round the curve for all four wheels to maintain contact with the road surface to avoid skidding of vehicle. **10**

Unit – III

5. Draw the profile of a cam operating a roller reciprocating follower and with the following data : **16**

   Minimum radius of cam = 25 mm. Lift = 30 mm

   Roller diameter = 15 mm

   The cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration during the decent period.

   OR

6. a) What is cam jump phenomenon ? 8

Derive the expression for minimum speed of cam to avoid jump.

b) Write short notes on : 8

i) Advanced cam curve

ii) Cam with specified counters.

SECTION – II

Unit – IV

7. a) Two spur gear wheels of pitch circle diameter of 100 mm and 350 mm have involute teeth of 5 mm module, and 20° angle of obliquity. The addenda are equal and it is as large as possible while avoiding the interference. If pinion rotates at 100 rpm, find :

i) the addendum,

ii) the contact ratio,

iii) the sliding velocities

a) at the beginning of point of contact,

b) at the end of point of contact. 12

b) State and prove the law of Gearing. 6

OR

8. a) A Pair of gears have 14 and 16 teeth and the module pitch is 12.5 mm. The addendum is also 12.5 mm. The angle of obliquity is 14½°. Show that the gears have interference.

Determine the portions by which the addendums of gears must be reduced to avoid interference. Also determine the length of path of contact for the reduced addendum. 10

b) Define the following terms used in Gears : 4

i) Pressure angle,

ii) Module,

iii) Addendum,

iv) Arc of contact.

c) Enumerate 4 advantages of involute tooth profile over cycloidal tooth profile. 4

Unit – V

9. a) Two spiral gear wheels of equal diameters are used to drive a machine tool. The angle between the shaft is 75° and the approximate centre distance is 11.5 cm. Speed of A is 1.5 times the speed of B and normal pitch is 1 cm. If the smaller wheel rotates at 100 rpm, find :

i) the number of teeth on each wheel,

ii) the spiral angle for each wheel,

iii) the rubbing velocity between the teeth. 8

b) Derive the expressions for various forces acting on bevel gear with neat sketch. 8

OR

10. a) A three start worm rotating at 1000 rpm, drives a 31 tooth worm gear. Pitch of teeth is 20 mm on a 60 mm pitch diameter. The coefficient of friction is 0.035. Find :

i) the helix angle of the worm

ii) the speed of worm gear

iii) the centre distance,

iv) the efficiency of the drive

v) the lead angle for maximum efficiency and corresponding value of efficiency. **12**

b) Derive the expression for virtual number of teeth of helical gear. **4**

Unit – VI

11. a) Gear wheel A having 14 teeth is rigidly mounted on the driving shaft. It gears with compound wheel B-D. B gears with fixed annular wheel C and D gears with annular wheel E. The compound wheel B-D, revolve freely on a pin. The annular wheel E is rigidly mounted on the driven shaft.

Module of all the gears is same. The driving and driven shafts and the annular wheels are coaxial. Number of teeth on gear C, E and D are 100, 98, 41. Driving shaft rotates at 1200 rpm and transmits 25 kw power.

i) Sketch the arrangement

ii) Find the speed of driven shaft

iii) Find the torque transmitted by the driven shaft. **12**

b) Explain the inertia of geared system. **4**

OR

12. a) Explain with neat sketch : **4**

i) Compound Gear Train

ii) Reverted Gear Train.

b) An electric motor drives a machine through a speed reduction gear of ratio 9 : 1. The motor armature with its shaft and gear wheel has a moment of inertia of 0.65 kgm^2. The rotating parts of the driven machine have a moment of inertia of 50 kgm^2. The driven machine has a resisting torque of 100 Nm. Assume no losses in the reduction gear, find :

i) the power rating (in kw) of the motor at a speed of 150 rpm

ii) the time required for the speed of the machine to increase from zero to 50 rpm, when the torque developed by the motor in starting from rest is 30 N-m. **12**
