Seat
No.

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T.E. (Mech. & Automobile) (Semester – I) Examination, 2014
THEORY OF MACHINES – II
(2008 Course)

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) Figures to the **right** indicate **full** marks.*
*4) Assume **suitable** data **if necessary**.*

SECTION – I

1. a) Derive an expression for frictional torque in conical pivot bearing using uniform wear theory. **6**

   b) What is friction circle ? **2**

   c) A single plate clutch transmits 25 KW at 900 rpm. The maximum pr. intensity is 85 kN/m². The outer dia. of plate is 360 mm with both sides effective. Find the inner dia. of plate if $\mu = 0.25$. **8**

OR

2. a) Write short note on internal expanding shoe brake. Discuss in brief about leading and trailing shoe. **8**

   b) Discuss the difference between power absorbing and transmission type dynamometers. **4**

   c) A torsion dynamometer is fitted on turbine shaft to measure the angle of twist. The shaft twist 1.6° for a length of 8 m at 600 rpm. The dia. of shaft is 250 mm. Find power transmitted by the turbine if G = 80 GPa. **4**

3. Draw a cam profile with roller follower of 7.5 mm diameter. Follower is supposed to lift for 28 mm and the motion of follower should be uniform acceleration and decceleration during rise and return. Follower axis is offset by 12 mm towards right. The minimum radius of cam is 25 mm and it is rotating at 200 rpm. During first 60° of cam rotation the follower should achieve the max displacement from the zero displacement position. The follower should remain lifted for next 45° of cam rotation and should come back to its original position during next 90° of cam rotation. Find maximum velocity and uniform acceleration of follower during rise and return. **18**

OR

4. a) A cam consists of circular disc of 75 mm dia. with eccentricity of 25 mm. The follower has flat horizontal surface in contact with cam and line of action of follower is vertical passing through shaft axis. The mass of follower is 2.3 kg and pressed downwards by a spring having stiffness 3.5 N/m. In the lowest position the spring force is 45 N.

   i) Derive the expression for acceleration of follower in terms of angle of rotation from the beginning of lift.

   ii) Determine the camshaft speed where the follower begins to lift from the cam surface. **12**

   b) Prove that the speed of cam should be lessthan the limiting speed to avoid cam jump. **6**

5. a) Explain in detail the various performance curves drawn in different types of governors. Discuss the significance of each. **7**

   b) A porter governor has four arms of 250 mm long. The upper arms are attached to axis while lower are attached to sleeve at distance of 30 mm from axis. The mass of each ball is 5 kg and that of sleeve is 50 kg. The extreme radii of rotation are 150 mm and 200 mm resp. Determine the range of speed of governor. **9**

                         OR

6. a) What is difference between flywheel and governor ? **4**

   b) A disc of 300 mm dia. and 5 kg is mounted on one end of arm 600 mm long. The other end of arm is free to rotate in bearing. If the disc rotates about the arm with 300 rpm in clockwise direction, looking from front, with what speed will it precess about the vertical axis ? **4**

   c) Explain the gyroscopic action with the help of neat sketches in the case of

   i) Aeroplane   ii) Naval ship **8**

                   SECTION – II

7. a) State and prove the Law of gearing. **6**

   b) Two mating gears (larger gear and pinion) have 50 and 13 involute teeth of module 10 mm and 20° pressure angle. he addendum is one module. Does interference occurs ? If it occurs, to what value should the pressure angle be changed to eliminate interference. **12**

                         OR

8. a) Derive an expression for the length of path of contact for two involute profile gears in mesh. **6**

   b) Two Mating involute spur gear of 20° pressure angle have a gear ratio of 2. The number of teeth on the pinion is 20 and its speed is 250 rpm. The module pitch of the teeth is 12 mm. If the addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum possible length each, find

   i) The addendum for pinion

   ii) The addendum for gear wheel

   iii) The length of arc of contact

   iv) The maximum velocity of sliding during approach. **12**

   Assume pinion to be driver.

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9. a) Draw a neat sketch of terminology of helical gears and define helix angle, circular pitch. **6**

   b) The approximate centre distance between two meshing spiral gears is 375 mm and gear ratio is 2. The angle between shaft is 50° and the normal circular pitch is 19 mm. If the driving and driven wheels are having same spiral angle and friction angle 6° determine :
   i) Number of teeth on each wheel
   ii) The exact centre distance
   iii) Efficiency of the drive. **10**

   OR

10. a) Explain the terminology used in bevel gears with neat sketch. **6**

   b) The angle between two meshing spiral gears is 90° and centre distance is 150 mm. The normal circular pitch of the gear is 10 mm and the gear ratio is 2.5. The frictional angle is 6° and the efficiency of the drive is maximum, determine :
   i) Spiral angle of teeth
   ii) Circular pitches of the gear
   iii) Number of teeth on each wheel
   iv) The exact centre distance
   v) Efficiency of the drive. **10**

11. a) Explain with neat sketch reverted gear train. Also give its applications. **6**

   b) In a reverted epicylic gear train, the arm F carries two wheel A and D and a compound wheel B-C. The wheel A meshes with wheel B and wheel D meshes with wheel C. The number of teeth on wheel A, D and C are 80, 48 and 72 respectively. Find the speed and direction of wheel D when wheel A is fixed and arm F makes 200 rpm clockwise. **10**

   OR

12. a) Explain differential gear box with neat sketch. **6**

   b) An epicyclic train is composed of a fixed annular wheel A having 150 teeth. Meshing with A is a wheel B which drives wheel D through an idle wheel C, D being concentric with A. Wheels B and C are carried on an arm which revolves clockwise at 100 rpm. about the axis of A or D. If the wheel B and D are having 25 and 40 teeth respectively, find the number of teeth of C and the speed and sense of rotation of C ? **10**

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