

(Following Roll No. to be filled by candidate)

Roll No.

**B. TECH.
SIXTH SEMESTER EXAMINATION 2014-15
EME-602
MACHINE DESIGN – II**

Time: 3 Hours**Max. Marks: 100****Note:**

- Attempt all questions.
- Use of design data book is permitted.
- Assume any missing data suitably.

1. Attempt **any two parts** of the following: [2 x 10]

- Design a pair of spur gear made of cast steel and cast iron respectively. The diameter of pinion is 140 mm and it transmits 30 kW at 1250 r. p. m. The gear ratio is 3:1 and teeth are 20 degree full depth involute. The allowable static stress for cast steel and cast iron are 110 and 55 respectively. Given : Dynamic factor = 228 N/mm, $E_p = 200 \text{ kN/mm}^2$ and $E_g = 100 \text{ kN/mm}^2$.
 - A pair of straight teeth spur gears with 20 degree full depth involute system is to transmit 20 kW when the pinion rotates at 300 r. p. m. The velocity ratio is 1:3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. The velocity ratio can be taken as $3/(3+v)$, where v is expressed in m/s. Find module, face width, pitch circle diameters of both the pinion and gear from the standpoint of strength.
- c. Answer the following in brief:
- Explain the classification of gears with suitable diagrams.
 - Derive the expression for the beam strength of gear teeth.

2. Attempt **any two parts** of the following: [2 x 10]

- Write down the advantages and disadvantages of helical gear over spur gear. A 100 mm helical pinion drives a 300 mm gear. The pinion shaft has 60 N-m of torque applied, and the pressure angle and helix angle are 20 degree and 30 degree respectively. Determine the tangential force, radial force and the axial force on the gear.
 - A worm shaft is supplied with 2 kW at 740 r. p. m. The number of starts for threads on the worm is 4 with a 60 mm pitch circle diameter. The worm wheel has 30 teeth with a 5 mm module. The normal pressure angle is 20 degree. Calculate the efficiency of the worm gear set and power lost in friction.
- e. Answer the following:
- Derive an expression for formative number of teeth on helical gears.

ii. Write about the forces acting on worm gear drive.

3. Attempt **any two parts** of the following: [2 x 10]

- A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm^2 . The speed of the journal is 900 r. p. m. and the ratio of journal diameter to diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 Kg/m-s . The room temperature is 35°C . Find the required amount of artificial cooling. Also calculate the mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C . The specific heat of the oil is $1850 \text{ J/Kg}^\circ \text{C}$.
 - Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r. p. m., for a rating life of 5 years at 10 hours per day. Assume uniform and steady load.
- c. Explain the following:
- Design procedure for journal bearing.
 - Construction and advantages of thrust ball bearings.

4. Attempt **any two parts** of the following: [2 x 10]

- What is the function of cylinder in I. C. engines? How will you find the thickness of cylinder wall, bore and length of cylinder, studs for cylinder flange and thickness of cylinder head.
 - Design a connecting rod for four stroke petrol engine with the following data : piston diameter = 0.10 m, stroke = 0.14 m, length of connecting rod = 0.315 m, weight of reciprocating parts = 18.2 N, speed = 2500 r. p. m., maximum explosion pressure = 2.45 MPa, weight of reciprocating parts = 18.2 N. Consider the material of connecting rod as mild steel. For mild steel, the compressive yield strength is 320 MPa and constant $a=1/7500$. Allowable bending stress for big end cap is 80 MPa and allowable tensile stress for its bolt material is 60 MPa.
- c. Explain the following in brief:
- Various forces acting on connecting rod.
 - Criterion for the selection of a cross section of connecting rod.

5. Answer **any four parts** of the following in brief: [4 x 5]

- Gear tooth profiles based on law of gearing.
- Efficiency of worm gear drive.
- Causes of gear tooth failure.
- Comparison of journal bearing and rolling bearing.
- Significance of bearing modulus.
- Design steps for piston.