

Roll No. ....

**3607**

**B. Tech. 7th Semester (ME)  
Examination – February, 2022**

**DESIGN OF MACHINE ELEMENT-II**

**Paper : PCC-ME-401-G**

**Time : Three Hours ]**

**[ Maximum Marks : 75**

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

*Note : Attempt five questions in all selecting one question from each Unit. Question No. 1 is compulsory. All questions carry equal marks. PSG Design Data Book is allowed.*

1. Explain the following : 2.5 × 6 = 15

(a) Discuss about Beam & wear strength of gear tooth.

~~(b)~~ Explain rolling contact bearing.

3607-1600-(P-4)(Q-9)(22)

P. T. O.

~~(c)~~ Application of bevel gear.

~~(d)~~ Define leaf springs.

~~(e)~~ Explain term Stiffness in Spring.

~~(f)~~ Discuss value engineering considerations in design.

**UNIT – I**

2. Briefly explain the design considerations for casting, forging and machining. 15
3. A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by : ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. 15

**UNIT – II**

4. A shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 metres. It carries two pulleys each weighing 1500 N supported at a distance of 1 metre from the ends respectively. Assuming the safe value of stress, determine the diameter of the shaft. 15

3607-1600-(P-4)(Q-9)(22)

(2)

5. Design a helical spring for a spring loaded safety valve (Ramsbottom safety valve) for the following conditions : 15

Diameter of valve seat = 65 mm; Operating pressure = 0.7 N/mm<sup>2</sup>; Maximum pressure when the valve blows off freely = 0.75 N/mm<sup>2</sup>; Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm<sup>2</sup> = 3.5 mm; Maximum allowable stress = 550 MPa; Modulus of rigidity = 84 kN/mm<sup>2</sup>; Spring index = 6. Draw a neat sketch of the free spring showing the main dimensions.

### UNIT - III

6. A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm<sup>2</sup>. The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the 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: 1. The amount of artificial cooling required, and 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as 1850 J/kg /°C. 15

7. What are rolling contact bearing ? Discuss their advantages over sliding contact bearings. Also briefly explain the various properties of lubricants. 15

### UNIT - IV

8. A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 r.p.m. and the speed of the compressor shaft is desired to be 200 r.p.m. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine : 1. Module and face width of the gears using 20 degrees stub teeth, and 2. Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor. 15

9. A worm and worm gear is to be designed for an input of 1.1 kW with a transmission ratio 27. The speed of the hardened steel worm is 1440 r.p.m. The worm wheel is to be made of phosphor bronze. The tooth form is to be 20° involute. 15