

equation the velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 KW, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4 : 1. The pinion as well as the gear is made of plain carbon steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ). The factor of safety can be taken as 1.5. design the gears, specify their dimensions and suggest suitable surface hardness for the gears.

9. A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is  $20^\circ$ , while the helix angle is  $25^\circ$ . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears.

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B. Tech. 6th Semester (ME)

Examination – May, 2019

MECHANICAL MACHINE DESIGN - II

Paper : ME-304-F

Time : Four Hours ]

[ Maximum Marks : 100

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 Section. Question No. 1 is *compulsory*. All questions carry equal marks. Use only following design data Book by – Mahadevan.

1. Write short notes on the following :

- (i) Miner equation
- (ii) Surging of springs
- (iii) Gear Lubrication

### SECTION – A

2. Discuss the fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's criterion.
3. A cantilever beam made of cold drawn steel 20C8 ( $S_{ut} = 540 \text{ N/mm}^2$ ) is subjected to a completely reversed load of 1000 N as shown in Fig. 5.36. The notch sensitivity factor  $q$  at the fillet can be taken as 0.85 and the expected reliability is 90% determine the diameter  $d$  of the beam for a life of 10000 cycles.

### SECTION – B

4. A solid shaft of diameter  $d$  is used in power transmission due to modification of the existing transmission system, It is required to replace the solid shaft by a hollow shaft of the same material and equally strong in torsion. Further, the weight of the hollow shaft per metre length should be half of the solid shaft. Determine the outer diameter of the hollow shaft in terms of  $d$ .
5. A helical compression spring of cam-mechanism is subjected to an initial preload of 50 N. The maximum

operating force during the load cycle is 150 N. The wire diameter is 3 mm while the mean coil diameter is 18 mm the spring is made of oil-hardened and tempered valve spring wire of grade - VW ( $S_{ut} = 1430 \text{ N/mm}^2$ ). Determine the factor of safety used in the design on the basis of fluctuating stresses.

### SECTION – C

6. A single-row deep groove ball bearing is subjected to a pure radial force of 3 kN from a shaft that rotates at 600 rpm. The expected life  $L_{10h}$  of the bearing is 30000 h. The minimum acceptable diameter of the shaft is 40 mm. Select a suitable ball bearing for this application.
7. A ball bearing subjected to a radial load of 5 kN, is expected to have a life of 8000 h at 1450 rpm with a reliability of 99%. Calculate the dynamic load capacity of the bearing, so that it can be selected from the manufacturer's catalogue based on a reliability of 90%.

### SECTION – D

8. It is required to design a pair of spur gears with  $20^\circ$  full-depth involutes teeth based on the Lewis