

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 4095**

Roll No.

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**B.Tech.**

(SEM VI) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

**MACHINE DESIGN - II**

Time : 3 Hours

Total Marks : 100

- Note :** (i) Attempt *all* questions.  
 (ii) Assume any missing data suitably.  
 (iii) Use of 'design data book' is *permitted*.

1. Attempt the following :

- (a) Explain the phenomenon of interference in involute gears. How is it avoided ? (5)
- (b) A pair of straight teeth spur gears, having 20° involute full depth teeth is to transmit (15)  
 15 kW at 300 rpm of the pinion. The speed ratio is 3:1. Assume number of teeth on pinion is to be 16 with a face width of 14 times module. Surface endurance limit of gears is 600 MPa. Assuming the steady load conditions and 8-10 hours of service per day, determine the module, face width and pitch diameter of gears. Given

	<b>Gear (CI)</b>	<b>Pinion (steel)</b>
Allowable static stress	60 Mpa	105 Mpa
Modulus of elasticity	100 kN/mm <sup>2</sup>	200 kN/mm <sup>2</sup>

**OR**

A compressor running at 250 rpm is driven by a 15 kW, 1000 rpm motor through a (15)  
 14.5° full depth gears. The centre distance is 375 mm. The motor pinion is to be of C-30 forged steel hardened and tempered, and driven gear is to be of cast steel. Assuming medium shock conditions, determine the module, face width and the number of teeth on each gear.

2. Attempt the following :

- (a) With the help of a sketch, explain how an axial thrust is generated in a helical gear. What is herringbone gear ? (5)
- (b) Design a pair of parallel helical gears made of 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 gear is made of steel with ultimate strength of  $600 \text{ N/mm}^2$  and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. (15)

OR

Design two C.I bevel gears having pitch diameter of 7.5 cm and 10 cm respectively are (15)

to transmit 2 kW at 1100 rpm of the pinion. The teeth profiles are  $14\frac{1}{2}^\circ$  system. Assume

light shock load conditions with 8-10 hours per day service.

3. Attempt the following :

- (a) What are the advantages and disadvantages of rolling contact bearing over sliding contact bearing ? (5)
- (b) Select single row deep groove ball bearing for a radial load of 4 kN and an axial load of 5 kN, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load. (15)

OR

Design a worm gear set to transmit 12 kW from a shaft rotating at 1400 rpm to another shaft at 75 rpm. Assume normal pressure angle as  $20^\circ$  and centre distance between the shafts is 25 cm. (15)

4. Attempt the following :

- (a) Explain the various stresses induced in the connecting rod of an IC engine. (5)
- (b) A 4 stroke diesel engine has the following specifications : (15)
- |                                   |   |                       |
|-----------------------------------|---|-----------------------|
| Brake power                       | = | 5 kW                  |
| Speed                             | = | 1200 rpm              |
| Indicated mean effective pressure | = | $0.35 \text{ N/mm}^2$ |
| Mechanical efficiency             | = | 80 %                  |

Determine the bore and length of the cylinder and thickness of cylinder head.

OR

A four stroke IC engine is developing 50 kW power at 2200 rpm for which a (15)  
connecting rod is required to be designed for the following data :

Piston diameter	= 90 mm
Mass of reciprocating parts	= 1.5 kg
Length of connecting rod between the two centres	= 300 mm
Stroke length	= 125 mm
Approximate compression ratio	= 6.8 : 1
Maximum explosion pressure shortly after dead centre	= 3.5 N/mm <sup>2</sup>

5. Attempt **any four** of the following : (4x5=20)

- (a) Gear manufacturing methods
- (b) Design considerations of piston
- (c) Gear tooth profiles
- (d) Selection of ball bearing
- (e) Selection of type of IC engine
- (f) Valve gear mechanism of IC engine

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