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

PAPER ID : 2536 Roll No. | | | | | | | | | | |

B.Tech.

(SEMESTER-VI) THEORY EXAMINATION, 2012-13

MACHINE DESIGN – II

Time : 3 Hours] *[Total Marks : 100*

Note : (1) Attempt all questions.

(2) Notations used have usual meaning.

(3) Assume any relevant data, if missing.

(4) Use of Design data book is permitted.

1. Attempt any **two** parts of the following : $2 \times 10 = 20$

(a) Explain the following in brief :

(i) Failure of Gear tooth.

(ii) Phenomenon of interference in Involute gears & how it can be avoided.

(iii) Selection of gear materials.

(b) A Bronze Spur pinion (σ_{safe} = 83 MN/m^2) rotating at 600 rev/min drives a cast steel spur gear (σ_{safe} = 103 MN/m^2) at a transmission ratio of 4 to 1. The pinion has 16 standard 20° full depth involute teeth of 8 module. The face width of both gears is 90 mm. How much power can be transmitted from the standpoint of strength ?

(c) A pair of 20° full depth straight teeth spur gears is to be transmit 25 kW. The pinion rotates at 400 rpm and the gear ratio is 4:1. The allowable static stresses for gear and pinion materials 100 MPa and 120 MPa respectively. The pinion has 16 teeth and the face width is 12 times the module. Design for static strength.

2. Attempt any **two** parts of the following : **2 × 10 = 20**

(a) A pair of helical gears used to transmit 7.5 kW at 1440 rpm of pinion has 20° involute stub teeth. Helix angle is 30°. Gear ratio is 4:1. Centre distance is 200 mm. Material for both pinion and gear is steel having safe static stress of 100 MPa and hardness of 200 BHN. Design the gears. Check the design for Dynamic and wear strength considerations.

C = Dynamic load constant $= 119 \times 10^3$ N/m.

Use minimum no of teeth on pinion.

(b) Explain how the efficiency of Worm gear drive is calculated. Discuss the importance of heat dissipation in worm and worm gear.

(c) For a Worm and worm wheel the centre distance is given as 225 mm. Worm is made of hardened steel and rotates at 1250 rpm. Worm transmits power to a phosphor bronze gear (σ_b = 55 MPa) with a transmission ratio of 15. The teeth on gear are 20° full depth involute (y = 0.125). Determine all the design parameters and recommend the safe power that the drive can transmit.

3. Attempt any **two** parts of the following : **2 × 10 = 20**

(a) A deep groove ball bearing having bore diameter of 60 mm and rotating at 1440 rpm is subjected to a radial force of 2500 N and an axial force of 1200 N. The radial and axial thrust factors are 0.56 and 2.0 respectively. The load factor is 1.2. If the expected rating life is 25000 hrs, calculate the required basic dynamic capacity of the bearing and select the bearing.

(b) Select a deep groove ball bearing for shaft of 40 mm diameter running at speed of 1000 rpm. The required bearing life is 5000 hrs at a reliability of 99 %. The radial load is 2.5 kN and axial load is 1.2 kN. The maximum operating temperature is 40° C and inner race rotates.

(c) Write a short note on following :

(i) Lubricants used in Sliding contact bearing.

(ii) Materials used for sliding contact bearings.

(iii) Selection of bearing.

4. Attempt any **two** parts of the following : **2 × 10 = 20**

(a) A tentative design of a Journal bearing result in a diameter of 75 mm and a length of 125 mm for supporting a load of 20 kN. The shaft runs at 1000 r.p.m. The bearing surface temperature is not to exceed 75° C in a room temperature of 35° C. The oil used has an absolute viscosity of 0.01 kg/m-s at the operating temperature 115° C. Determine the amount of artificial cooling required in watts. Assume d/c = 1000.

(b) A journal bearing is proposed for a steam engine. The load on the journal is 3 kN, diameter 50 mm, length 75 mm, speed 1600 r.p.m, diametral clearance 0.001 mm, ambient temperature 15.5° C. Oil SAE 10 is used and the film temperature is 60° C. Determine the heat generated and heat dissipated. Take absolute viscosity of SAE 10 at 60° C = 0.014 kg/m-s.

(c) Explain the terms : Static bearing capacity, Dynamic bearing capacity, Equivalent Load, Life of bearing.

Also differentiate Sliding contact bearings and Rolling Contact bearings.

5. Attempt any **one** part of the following : **1 × 20 = 20**

(a) Design a Cast Iron Piston for a single acting four stroke engine for following data:

Cylinder bore	=	90 mm
Stroke	=	120 mm
Maximum gas pressure	=	5 N/mm^2
Mean effective pressure	=	0.75 N/mm^2
Mechanical efficiency	=	80%
Fuel consumption	=	0.2 Kg per Brake power per hour
Higher Calorific value of fuel	=	43×10^3 kJ/Kg
Speed	=	2000 RPM

Any other data required for the design may be assumed.

(b) Design a connecting rod for a Petrol Engine from the following data :

Diameter of piston = 110 mm

Mass of reciprocating parts, m = 2 kg

Length of connecting rod, 1 = 325 mm

Stroke = 150 mm

Compression ratio = 4:1

Speed = 1500 rpm with possible over speed of 2500 rpm

Maximum explosion pressure = 2.5 MPA
