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ME–603

B. TECH.

SIXTH SEMESTER EXAMINATION, 2003-2004

MACHINE DESIGN–II

Time : 3 Hours *Total Marks : 100*

Note : Answer the following questions. Use of Design Data Book is permitted.

1. *(a)* "I-section is adopted as the cross-section of high speed engine connecting rods." Discuss. **(5)**

(b) Data given below refer to a single cylinder 4-stroke I.C. engine.

Find the suitable dimensions of cross-section of the connecting rod under gas load and check the design under inertia load due to the self-weight of the connecting rod OR find the suitable dimensions of crank web of a centre crank for the engine. **(15)**

Cylinder diameter	=	110 mm
Stroke	=	160 mm
Power	=	10 kW at 800 rpm
Max. explosion pressure	=	2·2 MPa (22 kgf/cm^2) at TDC
Length of connecting rod	=	360 mm
At max. torque position gas pressure	=	1·2 MPa (12 kgf/cm^2) at $\theta = 40°$
Mass of reciprocating parts	=	2 kg
Density of connecting rod material	=	7·2 kg per 1000 cm^3.

Draw neat sketch, wherever necessary.

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2. *(a)* Give an account of failure of gears. (5)

(b) A pair of gears is to be designed to transmit 4 kW at 600 rpm of the pinion to a gear rotating at 150 rpm. 20° FD involute teeth are to be used. The centre distance should be as small as possible. Only from strength considerations (Lewis equation), determine the module, face width and number of teeth on gears, assuming spur gear drive or helical gear drive. (15)

3. *(a)* Show that in a right-angled bevel gear drive, selecting the pinion alone determines the gear ratio of the drive. (5)

(b) Two cast-iron bevel gears connect shafts at 90° and transmit a tangential force of 1350 N. The teeth are 20° FD and are carefully cut. Take pitch line velocity about 3 m/s and the face width as 50 mm. Calculate the dynamic load F_d. (15)

OR

(b) Design a high efficiency worm gear speed reducer to transmit continuously the rated power output of 15 kW motor turning at 1750 rpm. The steel worm with BHN 250 is to be integral with the motor shaft and velocity ratio is 10. The phosphor bronze gear should not have less than 40 teeth. Determine pitch, face and diameters of gears.

4. *(a)* Define the terms: Static bearing capacity; Dynamic bearing capacity; Equivalent load; Cubic mean load; and Life of bearing in MR. (5)

(b) Select a suitable rolling element bearing for the following application :— (15)

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Shaft dia. = 50 mm

Speed = 600 rpm

Required bearing life = 12000 hours with reliability 95%

Radial load = 2 kN

Axial load = 0·5 kN

Operating temperature = 50 °C

Inner race revolves.

(a) Define the terms : Critical bearing modulus; Minimum film thickness; Sommerfeld number; Operating oil temperature; Oil bath bearings as applied to journal bearings. **(5)**

OR

Clearly differentiate between thin film lubrication and thick film lubrication. Give examples.

(b) Design a journal bearing to support a load of 4 kN at 500 rpm, using a hardened steel journal and a bronze backed babbit bearing. Take room temperature as 20 °C and operating oil temperature as 70 °C. **(15)**

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