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

PAPER ID : 2177 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012-13

DESIGN OF MACHINE ELEMENTS

Time : 3 Hours *Total Marks : 100*

Note : *(1) Attempt **all** questions.*

(2) Assume suitable value for missing data, if any.

(3) Use of design data book is allowed.

1. Answer any **four** parts of the following :— **(5×4=20)**

(a) Write a short notes on Geometrical modeling and list the components of CAD.

(b) With the help of sketch depict the evolution of machine design.

(c) Explain 'endurance limit', S-N curve and fatigue strength.

(d) Explain maximum shear stress theory of failure.

(e) Determine the dia. of a ductile steel bar subjected to an axial tensile load of 40 kN and torsional moment of 16×10^5 N-mm. Take : factor of safety = 1·5, E = 2×10^5 MPa and yield stress σ_o = 210 MPa.

(f) A machine component is subjected to a flexural stress which fluctuates between + 300 MN/m² and – 150 MN/m². Determine the value of minimum ultimate strength according to Gerber relation. Take : Yield strength = 0·55, Ultimate strength, Endurance strength = 0·5, ultimate strength and factor of safety = 2.

2. Answer any **two** parts :— **(10×2=20)**

(a) A pair of gears is to be designed for compact size. Power to be transmitted 20 kW at 1450 rpm of pinion and gear ratio. Tooth profile 20° stub. Material for pinion C.S. and for gear C.I. Determine the module and necessary face width by using Lewis Equation.

(b) Explain how and why Lewis Equation is modified in case of helical gear.

(c) A pair of bevel gear is required to transmit 18 kW at 600 rpm. The output shaft is making an angle of 90° with input shaft and rotates at 300 rpm. Pinion has 30 teeth. The teeth are 20° full depth. Safe static stress for the material is 105 MPa. Check the design for wear strength.

3. Answer any **two** parts :— **(10×2=20)**

(a) A 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick, made of steel with a yield strength of 340 MPa is to be used. Determine the required strength of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and factor of safety of 2.

(b) Design a rigid muff coupling. Use C.I. for the muff. The power transmitted is 25 kW at 300 rpm. ultimate stress = 200 MPa, factor of safety = 6. Use 30C8 steel for the shaft. Consider Yield stress = 330 MPa.

(c) The lead screw of a lathe has trapezoidal threads. To drive the tool carriage the screw has to exert an axial force of 20 kN. The thrust is carried by the collar. The length of

the lead screw is 1·5 m. Coefficients of friction at the collar and nut are 0·1 and 0·15 respectively. Suggest suitable size of screw and height of the nut if the permissible bearing pressure is 4 MPa.

4. Answer any **one** of the followings :— **(20×1=20)**

(a) Flywheel for punching machine to punch a hole of 22 mm dia. in 18 mm thick plate is to be designed. Punching machine has 40 strokes/mt punching one hole per stroke. The hole is punched during $1/10^{th}$ revolution of crank shaft. The crank shaft is connected to flywheel by gear ratio 1 : 10. The mean dia. of flywheel is 1 m. The minimum speed of the flywheel is limited to 90% of the maximum speed. The ultimate shearing stress for cold punching is 400 MPa. If the mechanical efficiency of the machine is 80%, estimate the capacity of the motor and design the flywheel.

(b) Design a C.I. piston for a single acting four stroke engine for the following specifications :

Cylinder bore = 100 mm, Stroke = 120 mm, Maximum gas pressure = 5 N/mm^2, Break mean effective pressure = 0·65 N/mm^2, Fuel consumption = 0·227 kg/kW/hr, Speed = 2200 rev./min.

5. Answer any **two** parts :— **(10×2=20)**

(a) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm dia. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress.

(b) A locomotive semi-elliptical laminated spring has an over all length of 1 m and sustains a load of 70 kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a centre band of 100 mm width. All the leaves are to be stressed to 400 MPa when fully loaded. The ratio of the total spring depth to that of width is 2. E = 210 kN/ mm^2. Determine the thickness and width of the leaves.

(c) A compression spring of spring constant K is cut into two springs having equal number of turns and the two springs are then used in parallel. What is the resulting spring constant of the combination ? How does the load carrying capacity of the resulting combination compare with that of the original spring ?