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

PAPER ID : 4088 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2010-11

DESIGN OF MACHINE ELEMENTS

Time : 3 Hours *Total Marks : 100*

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

(2) Assume any missing data suitably.

(3) Use of design data book is permitted.

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

(a) What are different modes of failure of a machine element ?

(b) Differentiate between induced and design stress. How are they related ?

(c) Explain why the design of a part subjected to bending moment is done on the basis of safe tensile stress.

(d) What do you understand by preferred numbers ? Explain.

(e) Illustrate how stress concentration in a component can be reduced.

(f) Explain Soderberg's diagram. What information do you derive from this diagram ?

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

(a) Explain the importance of Lewis form factor in designing the spur gear. Also define module, circular pitch, face width and pressure angle for a spur gear.

(b) A pair of spur gear with 20° full depth involute teeth has pinion with 20 teeth and gear with 60 teeth. The pinion speed is 2100 rpm and it transmits 25 kW. The permissible static bending stress for the material of both the gears is 140 MPa. Design the gear.

(c) A pair of straight teeth bevel gears is used for transmitting 7.5 kW at 900 rpm of pinion. Pinion has 20 teeth and module at the outer radius of 5 mm. Find the face width and check it for wear and dynamic load. Gear ratio is 3:1 and safe static stress for the material is 110 MPa.

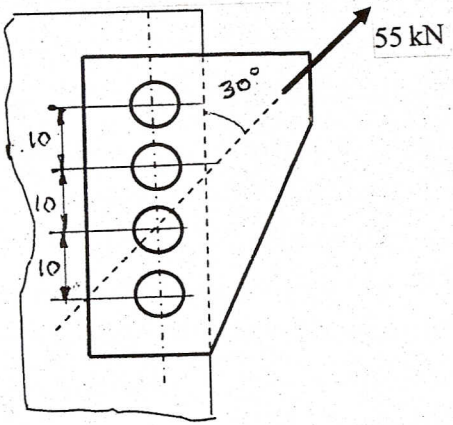
3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Design a rigid muff coupling. The material of coupling is 200 FG C.I. having ultimate strength of 200 MPa and a factor of safety of 6. The power transmitted is 30 kW at 400 rpm. The shaft and keys are made up of 30C8 steel and factor safety is 4.

(b) A 160 mm long journal bearing supports a radial load of 8 kN on a 45 mm diameter shaft. The shaft speed is 160 rpm, oil used is SAE 60 at 25° inlet temperature. If clearance ratio is 600, find the rise in temperature, maximum film pressure and minimum film thickness.

(c) Find the size of rivets necessary to resist a pull of 55 kN in the rod for connection shown in figure. The allowable shear

stress in the rivets should not exceed 100 MPa. Distance between rows of rivets is 10 cm.



4. Attempt any **one** part of the following : **(20×1=20)**

(a) The cylinder of a slow speed steam engine is 22 cm diameter and the steam pressure 1 N/mm^2. The piston rod length is 800 mm and the connecting rod is 1.2 m long. The engine stroke is 520 mm. Determine the dimensions of the cross section of the connecting rod assuming the depth to be twice as thickness and a suitable diameter for the piston rod.

(b) A four stroke diesel engine has the following specifications :

Brake Power	: 5 kW
Speed	: 1200 rpm
Indicated MEP	: 0.35 N/mm^2
Mechanical efficiency	: 80%

Determine (i) bore and length of the cylinder, (ii) thickness of the cylinder head, and (iii) size of stud for the cylinder head.

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

(a) Design a helical compression spring for a maximum load of 1200 N for a maximum deflection of 30 mm. The spring index is 5, the maximum permissible shear stress for spring material is 420 MPa and modulus of rigidity is 84000 MPa.

(b) A truck spring has 12 numbers of leaves, two of which are full length leaves. The spring supports are 1.2 m apart and the central band is 100 mm wide. The central load is to be 6 kN with a permissible stress of 280 MPa. Determine the thickness and width of the spring leaves. Take the ratio of total depth to width of a spring as 3. Also determine the deflection of the spring.

(c) Leaf springs are termed as a beam of uniform strength, why ? How does the pre-stressing affect the stress induced in the leaves of leaf spring with extra full length leaves ?