Paper Code & Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | | |

Odd Semester Examination-2016

B.Tech. (Semester-V)

MACHINE DESIGN-I

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

Note : Attempt **All** questions. All questions carry **equal** marks. Assume missing data suitably.

1. Attempt **any four** : [5×4=20]

(a) Explain the basic needs for the development of a product.

(b) Explain the criteria for the selection of product.

(c) Explain BIS system for designation of steel.

(d) What do you mean by case study? Explain any example of case study.

(e) The principal stresses induced at a point in a machine component made of steel 50C4(S_{yt} =460 N/mm^2) are as follows:

$\sigma_1 = 200 N/mm^2$, $\sigma_2 = 150 N/mm^2$, $\sigma_3 = 0$.

Calculate the factor of safety by (i) maximuhear stress theory (ii) distortion energy theory.

(f) Where do you use maximum shear stresseory of failure? Explain.

2. Attempt **any four:** [5×20]

(a) Explain the modified Goodman diagram the torsional shear stresses.

(b) State the applications where self-lockg is essential.

(c) What is purpose of spigot and recess in rigidnge coupling? Explain.

(d) What is objective of nipping of leaf sng? Describe the stresses in leaf spring under ning.

(e) What is the cause of residual stresses in ded joint? How are they relieved?

(f) Prove that the plane, where maximum shearess is induced, is inclined at 45° to lag dimensis in

case of parallel fillet weld of equal lags. Also find the expression for maximum shear stress.

3. Attempt **any two** : [10×2=20]

(a) Derive an expression for the distortion energy theory of elastic failure.

(b) Explain the design for finite and infinite life. Draw and explain the Soderberg and Gerber line.

(c) The force acting on a bolt consists of two components-an axial pull of 12KN and a transverse shear force of 6KN. The bolt is made of steel FeE (S_{yt} = 310 N/mm^2) and factor of safety is 2.5. Determine the diameter of bolt using maximum shear stress theory of failure.

4. Attempt **any two** : [10×2=20]

(a) A circular shaft, 75mm in diameter is welded to the support by means of a circumferential fillet weld. It is subjected to a torsional moment of 3000 N-m. Determine the size of weld, if maximum shear stress in the weld is not to exceed 70 N/mm^2.

(b) A rotating shaft, 40mm in diameter is made of steel FeE (S_{yt} = 580 N/mm²). It is subjected to a steady torsional moment of 250 Nm and bending moment of 1250Nm. Calculate factor of safety based on, (i) maximum principal stress theory (ii) maximum shear stress theory.

(c) The cross section of a flat key for a 40mm diameter shaft is 22×14 mm. The power transmitted by the shaft to the hub is 25kw at 300 rpm. The key is made of steel ($S_{yc} = S_{yt} = 300$ N.mm²) and factor of safety is 2.8. Determine the length of key. Assume ($S_{sy} = 0.577 S_{yt}$).

5. Attempt **any two:** [10×2=20]

(a) Explain the design procedure of helical spring.

(b) A helical compression spring of a mechanism is subjected to an initial pre-load of 50N and maximum force during load cycle is 300N. The wire diameter is 5mm, while spring index is 5. The spring is made of oil hardened and tempered steel wire of grade-SW (S_{ut}=1440N/mm²). Determine factor of safety against fluctuating load.

(c) A 25 m diameter shaft is made of forged steel 30C4 (S_{ut} = 600N/mm²). There is a step in shaft and theoretical stress concentration factor at the step is 2.1. The notch sensitivity factor is 0.84. Determine the endurance limit of shaft if it is subjected to a reversed bending moment.

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