

(Please write your Exam Roll No.)

Exam Roll No.

END-TERM EXAMINATION

FIFTH SEMESTER [B.TECH.]— DECEMBER-2007

Paper Code: ETME303 (Batch: 2004-2005)**Subject: Machine Design-I****Paper Id-201280****Time: 3 Hours****Maximum Marks : 75****Note: Attempt one question from each unit. Q.No.1 is compulsory.**

Q.1 Choose the correct answer. -

(1x11)

- (a) Ball bearings are usually made of
 (i) Low carbon steel (ii) High speed steel
 (iii) chrome steel (iv) High carbon steel
- (b) The centre to centre distance between two consecutive rivets in a row is called.
 (i) margin (ii) pitch
 (iii) back pitch (iv) diagonal pitch
- (c) For determining endurance limit a specimen is subject to
 (i) dynamic load (ii) static load
 (iii) bending load (iv) completely reversed load
- (d) Stress concentration factor is a function of
 (i) geometry of the component
 (ii) material of the component
 (iii) geometry and material of the component
 (iv) none of the above
- (e) Endurance limit of a material
 (i) depends on surface finish
 (ii) does not depend on surface finish
- (f) If the diameter of a solid shaft is doubled, its torque transmitting capacity will be
 (i) two times (ii) four times
 (iii) eight times (iv) sixteen times
- (g) The strength of a riveted joint is equal to
 (i) the pull required to shear off the rivet
 (ii) the pull required to crush the rivet
 (iii) the pull required to tear off the plate
 (iv) the minimum of the above three values
 (v) maximum of the above three values
- (h) Cotter joint is used to connect two coaxial rods which are subjected to
 (i) bending (ii) twisting
 (iii) axial loading (iv) all of the above
- (i) Residual compressive stress introduced by shot peening in a machine member subjected to cyclic loading
 (i) improves the load carrying capacity
 (ii) degrades marginally the load carrying capacity
 (iii) degrades drastically the load carrying capacity
 (iv) is insensitive to load carrying capacity
- (j) Fullering is used in
 (i) welded joint (ii) riveted joint
 (iii) threaded joint (iv) spigot and socket joint
- (k) Lewis equation is used in the design of
 (i) springs (ii) spur gears
 (iii) pressure vessels (iv) screwed fastenings

Define the following: -

(1x6)

- 101 (l) Factor of safety
 1025 (m) Pressure angle
 63 (n) Tolerance
 42 (o) Allowance
 195 (p) Notch sensitivity
 (q) Toughness

- Fill in the blanks: -
- (r) The helix angle of square-threaded screw of 70 mm mean diameter and 10 mm pitch is _____.
 - (s) The rocker arms in internal combustion engines are of _____ type of levers.
 - (t) The radial distance from the pitch circle to the bottom of a gear tooth is known as _____.
 - (u) The type of fit obtained from the combination of H6 hole and J5 shaft is a _____ fit.
 - (v) At a point in a stressed body the principal stresses are 30 MPa tensile, 20 MPa compressive and 0 MPa. The maximum shear stress at that point is _____ MPa.
 - (w) If a helical coil spring of stiffness K is cut into two identical half coil springs, the stiffness of each of these spring will be _____.
 - (x) The diameter of rivet hole is usually _____ than the nominal diameter of the rivet.
 - (y) A thin cylinder of diameter d and thickness t is subjected to an internal pressure p . The circumferential or hoop stress developed is _____.

UNIT-I

- Q.2 (a) What is meant by 'stress concentration'? How does take into consideration a case of a component subjected to dynamic loading? Illustrate how the stress concentration in a component can be reduced. (6.5)
- (b) What are common engineering materials suitable for forging? State and illustrate important rules for forged component design. Name some components which are forged. Why are they not cast? (6)
- Q.3 (a) What is mean by 'Endurance Strength' of a material? How do the size and surface finish affect the endurance strength? Differentiate clearly between 'Endurance Strength' and 'Endurance Limit'. (6)
- (b) Select the most commonly used materials for the following applications along with brief justification. (6.5)
- (i) Rails (Railway lines)
 - (ii) Lathe bed
 - (iii) Injecting needle
 - (iv) Overhead crane chains used for lifting of loads
 - (v) Piston of modern automobile
 - (vi) Bolt and nut

UNIT-II

- Q.4 (a) Design a collar joint to connect two mild steel rods of equal diameter transmitting an axial force of 25 kN which is subjected to slow reversals of direction. Tensile stress in the material is limited to 50 MPa. The shear stress has the value $\frac{4}{5}$ of the permissible tensile stress. The crushing stress is limited to 60 MPa. (7)
- (b) Two pieces of MS flat plates 200 mm x 12 mm are to be joined together by means of a lap riveted joint, using only four rivets. The plates are subjected to tension along their axes. Determine the size of the rivets and their arrangement to give strongest joint. Take permissible stress as $\sigma_t = 80 \text{ N/mm}^2$, $\tau = 60 \text{ N/mm}^2$ and $\sigma_c = 120 \text{ N/mm}^2$. What is the efficiency of this joint. (5.5)
- Q.5 (a) A low carbon steel plate of 0.7 m width welded to a structure of same material by means of two parallel fillet welds of 0.112 m length (each) is subjected to an eccentric load of 4 kN the line of action of which has a distance of 1.5 m from the c.g. of the weld group. Find the required thickness of the plate when the allowable stress of the weld metal is 60 MN/m^2 and that of the plate is 40 MN/m^2 . (6)
- (b) A Cylinder head is fastened to the cylinder of compressor using 8 number of M 16 bolts. Bolt material is C20 for which $\sigma_y = 420 \text{ MPa}$ and $\sigma_{en} = 200 \text{ MPa}$. The maximum pressure is 3.5 MPa cylinder diameter is 80 mm. A soft gasket ($k = 1$)