

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

PAPER ID : 4075

Roll No.

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B.Tech**(SEM V) ODD SEMESTER THEORY EXAMINATION 2009-10
MACHINE DESIGN - I***Time : 3 Hours]**[Total Marks : 100*

Note : *Answer all questions. Assume suitable value for missing data. Design data-book may be allowed.*

- 1** Answer part (a) and any two more from the remaining questions :
- (a) Arrange the number from 1-to-10 in the basic series R10 of preferred number. **6**
- (b) State the criteria for the selection of materials for creep loading. **7**
- (c) Briefly discuss the BIS criteria for specification of carbon steels and alloy steels. **7**
- (d) With the help of flow chart indicate the various steps that may be involved in design leading to production. **7**
- 2** Answer any **four** parts : **5×4**
- (a) Explain the criteria of failure for brittle materials subjected to static loading.

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aktuonline.com (b) Explain Goodman's criteria and state its application to different types of loading.

(c) What do you mean by stress concentration ? Differentiate between form stress factor and stress concentration factor.

(d) The stresses at a point in the body are :

$$\sigma_X = 91 \text{ MN/m}^2, \quad \sigma_Y = 21 \text{ MN/m}^2,$$

$$\tau_{XY} = 84 \text{ MN/m}^2,$$

yield stress $\sigma_Y = 280 \text{ MN/m}^2$. Determine the factor of safety using distortion energy theory.

(e) Determine the maximum stress produced in a stepped shaft, stepped down from 40 mm to 30 mm with a fillet radius of 6 mm. It is subjected to a couple of 100 Nm.

Take : form stress factor $k_t = 1.23$

(f) The principal stresses at a point consist of

$$\sigma_1 = 200 \text{ MPa} \text{ (tensile) and}$$

$$\sigma_2 = 100 \text{ MPa} \text{ (compressive) and } \sigma_3 = 0.$$

Determine the maximum shear stress and factor of safety if the material has σ_y (yield stress) = 500 MPa.



3 Answer any two parts :

- (a) State and explain parallel fillet welded joint and derive the corresponding expression of strength. 10
- (b) Mention the use of square, flat and rectangular keys. Also explain what is advantage claimed by making key tapered ? 10
- (c) Design a protected type rigid coupling to transmit 60 kW at 750 rpm. The allowable shear stress for shaft material is 56 MPa. The material for the coupling is cast iron with allowable stress of 14 N/mm². 10

4 Answer any two parts :

- (a) A closed coiled helical compression spring has a mean coil diameter of 60 mm and the diameter of the wire is 10 mm. Number of active and inactive coil turns is 11 and 2 respectively. Free length of the spring is 210 mm. Decide the maximum load that can be applied on the spring if the minimum load is one third of the maximum load. Take F.O.S. = 1.5, stress at endurance = 1360 MPa and at yield = 700 MPa, $K_m = 1.1025$ (spring constant at mean load), $K_v = 1.15$ (at variable load) 10
- (b) Explain the design procedure for design of a leaf spring of an automobile. Also state the advantage of full length leaves over graduated leaves. 10



- (c) In a hand vice the screw has a double start square threads of 26 mm diameter. If the lever is 0.25 meter and maximum force that can be applied at the end of the level is 300 N, determine the force with which the job is held in the jaws of vice. Take $\mu = 0.14$.

5 Answer any four of the following :

5×4

- (a) Design by evolution
- (b) Brain storming
- (c) Need Based Development
- (d) Consumption life cycle of a product.
- (e) Barrier to creative thinking in new product development.
- (f) Difference between old and new design.