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Total No. of Pages : 03

Total No. of Questions : 09

**B.Tech(AE) (2011 Onwards) (Sem.-5)**  
**DESIGN OF AUTOMOTIVE COMPONENTS**

Subject Code : BTAE-504

M.Code : 70487

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A****1. Explain briefly :**

- a) List the Name of theories of failure.
- b) What is synthesis of design? List the various factors of synthesis of design.
- c) Define stress concentration factor and what are the design faults that give rise to stress concentration?
- d) Differentiate the concept of self-energizing and self-locking brakes.
- e) What is the advantage of graduating the leaves of a laminated leaf spring?
- f) What do you understand by endurance limit and proportionality limit? What is their significance in design of components?
- g) List the name of various piston rings with their functions.
- h) Which theory is used for design of clutch and why?
- i) On what basis the material of flywheel is selected?
- j) What is the basic concept behind the design of connecting rod and which formula is used for its design?

### SECTION-B

2. What are the factors to be considered for the selection of material for Crankshaft?
3. What is meant by working stress and how it is calculated from the ultimate stress or yield stress of a material? What will be the factor of safety in each case for different types of loading?
4. A circular steel bar 50 mm diameter and 200 mm long is welded perpendicularly to a steel plate to form a cantilever to be loaded with 5 kN at the free end. Determine the size of the weld, assuming the allowable stress in the weld as 100 MPa.
5. A wall bracket, as shown in Fig. 1 is fixed to a wall by means of four bolts. Find the size of the bolts and the width of bracket. The safe stress in tension for the bolt and bracket may be assumed as 70 MPa.

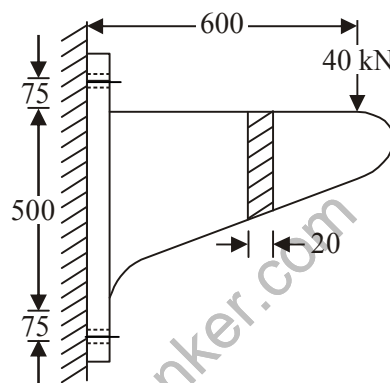


Fig.1.

6. A centrifugal friction clutch has a driving member consisting of a spider carrying four shoes which are kept from contact with the clutch case by means of flat springs until increase of centrifugal force overcomes the resistance of the springs and the power is transmitted by the friction between the shoes and the case. Determine the necessary mass and size of each shoe if 22.5 kW is to be transmitted at 750 r.p.m. with engagement beginning at 75% of the running speed. The inside diameter of the drum is 300 mm and the radial distance of the center of gravity of each shoe from the shaft axis is 125 mm. Assume  $\mu = 0.25$ .

### SECTION-C

7. Determine the size of a piston rod subjected to a total load of having cyclic fluctuations from 15 kN in compression to 25 kN in tension. The endurance limit is 360 MPa and yield strength is 400 MPa. Take impact factor = 1.25, factor of safety = 1.5, surface finish factor = 0.88 and stress concentration factor = 2.25.

8. A cast iron flywheel is to be designed for a single cylinder double acting steam engine which delivers 150 kW at 80 r.p.m. The maximum fluctuation of energy per revolution is 10%. The total fluctuation of the speed is 4 per cent of the mean speed. If the mean diameter of the flywheel rim is 2.4 meters, determine the following :
- Cross-sectional dimensions of the rim, assuming that the hub and spokes provide 5% of the rotational inertia of the wheel. The density of cast iron is  $7200 \text{ kg/m}^3$  and tensile stress 16 MPa. Take width of rim equal to twice of thickness.
  - Dimensions of hub and rectangular sunk key. The shear stress for the material of shaft and key is 40 MPa.
  - Cross-sectional dimensions of the elliptical arms assuming major axis as twice of minor axis and number of arms equal to six.
9. A pair of bevel gears connects two shafts at right angles and transmits 9 kW. Determine the required module and gear diameters for the following specification :

Particulars	Pinion	Gear
Number of teeth	21	60
Material	Semi steel Grey	cast iron
Brinell hardness number	200	160
Allowable static stress	85 MPa	55 MPa
Speed	1200 r.p.m	420 r.p.m
Tooth profile	$14\frac{1}{2}^\circ$ composite	$14\frac{1}{2}^\circ$ composite

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**