

DESIGN OF MACHINE ELEMENTS (SEMESTER - 4)

CS/B.Tech (AUE-N)/SEM-4/AUE-405/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS/B.Tech (AUE-N)/SEM-4/AUE-405/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
DESIGN OF MACHINE ELEMENTS (SEMESTER - 4)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

- This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
- In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
 - For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
- Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
- Read the instructions given inside carefully before answering.
- You should not forget to write the corresponding question numbers while answering.
- Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
- You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
- Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

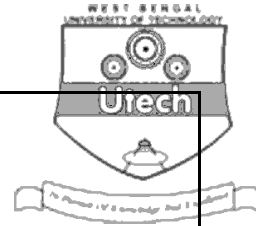
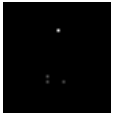
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Marks Obtained

Group – A								Group – B				Group – C				Total Marks	Examiner's Signature
Question Number																	
Marks Obtained																	

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Head-Examiner / Co-Ordinator / Scrutineer

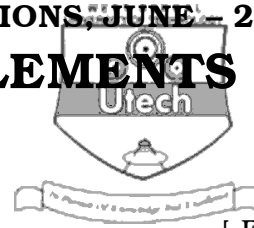
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DESIGN OF MACHINE ELEMENTS

SEMESTER - 4



Time : 3 Hours]

[Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

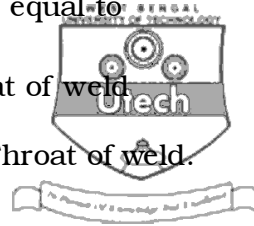
1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) According to Indian Standard specifications, a plain carbon steel designated by 40C8 means that
- a) carbon content is 0.04 per cent and manganese is 0.08 per cent
 - b) carbon content is 0.4 per cent and manganese is 0.8 per cent
 - c) carbon content is 0.35 to 0.45 per cent and manganese is 0.60 to 0.90 per cent
 - d) carbon content is 0.60 to 0.80 per cent and manganese is 0.8 to 1.2 per cent.
- ☐
- ii) Shock resistance of steel is increased by adding
- a) nickel
 - b) chromium
 - c) nickel and chromium
 - d) sulphur, lead and phosphorus.
- ☐
- iii) Two shafts A and B are made of same material. The diameter of shaft B is twice that of shaft A. The ratio of power which can be transmitted by shaft A to shaft B is
- a) 0.5
 - b) 0.25
 - c) 0.125
 - d) 0.0625.
- ☐

iv) In transverse fillet welded joint, the size of weld is equal to

- a) $0.5 \propto$ Throat of weld b) Throat of weld
c) $1.414 \propto$ Throat of weld d) $2 \propto$ Throat of weld.



v) In a flat belt drive, if the slip between the driver and belt is 1% that between follower and belt is 3% and driver and following pulley diameters are equal, then the velocity ratio of the drive will be

- a) 0.99 b) 0.98
c) 0.97 d) 0.96.

vi) According to Indian Standard specifications, 100 H 6/g 5 means that the

- a) actual size is 100 mm
b) basic size is 100 mm
c) difference between the actual size and basic size is 100 mm
d) none of these.

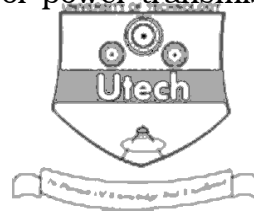
vii) Stress concentration factor is defined as the ratio of

- a) maximum stress to the endurance limit
b) nominal stress to the endurance limit
c) maximum stress to the nominal stress
d) nominal stress to the maximum stress.

viii) A cotter joint is used to transmit

- a) axial tensile load only
b) axial compressive load only
c) combined axial and twisting loads
d) axial tensile or compressive loads.

- ix) Which of the following screw thread is adopted for power transmission in either direction ?



- a) Acme threads
- b) Square threads
- c) Buttress threads
- d) Multiple threads.

- x) To ensure self locking in a screw jack, it is essential that the helix angle is

- a) larger than friction angle
- b) smaller than friction angle
- c) equal to friction angle
- d) such as to give maximum efficiency in lifting.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

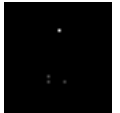
2. a) What is meant by 'hole basis system' ?
- b) A hole is dimensioned as $25^{+0.03}_{-0.02}$ mm and the shaft is dimensioned as $25^{+0.02}_{+0.00}$ mm.

Determine the hole tolerance and allowance of the fit. What type of fit will be established ?

2 + 3

3. a) Show that the efficiency of self locking screws is less than 50 per cent.
- b) Discuss the various types of power threads with relative advantages and disadvantages.

2 + 3



6

4. A solid shaft is transmitting 1 MW at 240 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa. 5
5. Define Rankine's theory and Guest's theory of failure under static load. $2\frac{1}{2} \times 2$
6. Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. 5



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

7. Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress = 90 MPa. 15
8. A crane hook has a rectangular section at A-A as shown in Fig. 1. Find the maximum stresses at point P and Q. 15

Dia.

All dimensions are in mm.

Fig. 1

9. A line shaft supporting two pulleys *A* and *B* is shown in Fig. 2. Power is supplied to the shaft by means of a vertical belt on pulley *A*, which is then transmitted to pulley *B* carrying a horizontal belt. The ratio of belt tensions on tight and loose sides is 3 : 1 and the maximum tension in either belt is limited to 2.7 kN. The shaft is made of plain carbon steel 40C8 ($\sigma_{ut} = 650$ MPa and $\tau_{yt} = 380$ MPa). The pulleys are keyed to the shaft. Determine the shaft diameter according to A.S.M.E. code if $k_b = 1.5$ and $k_t = 1.0$.

15

Dia.

Lengths and forces indicated are in mm. and N respectively.

Fig. 2

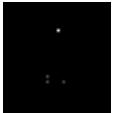
10. The diameters of the driver and follower pulleys of a open flat belt drive are 900 mm and 1200 mm respectively and centre distance is 3 m. The output of the follower shaft is 110 kW. Assuming.

Belt speed = 21 m/s, Co-efficient of friction = 0.30, Slip = 1.5% at each pulley, Belt thickness = 20 mm.

Determine :

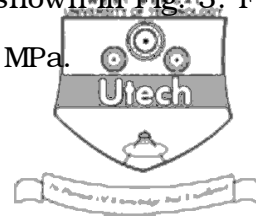
- The length of belt
- The rev/min of each shaft
- Difference in belt tensions
- Width of belt, if σ_t of belt material is 3.0 N/mm^2 .

15



8

11. A bracket carrying a load of 15 kN is to be welded as shown in Fig. 3. Find the size of weld required if the allowable shear is not to exceed 80 MPa. 15



Dia.

All dimensions are in mm.

Fig. 3

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END