

6E7011**6E7011****B.Tech. (Sem. VI) (Main) Examination, April-May 2018****Mechanical Engineering** rtuonline.com**6ME1A Design of Machine Elements-II**

Time : 3 Hours]

[Maximum Marks : 80

[Min. Passing Marks : 26

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. Design Data Book 2. Nil

UNIT - I

- 1 (a) Explain the following terms in connection with design of machine members subjected to variable loads :
- Endurance limit
 - Size factor and Surface finish factor
 - Notch sensitivity
 - Stress Concentration Factor

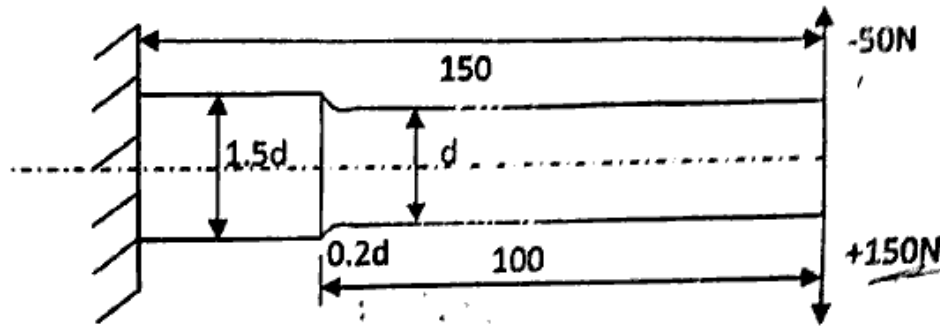
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- (b) A steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440 N-m to - 220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has ultimate strength of 550 MN/m² and yield strength of 410 MN/m². Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62.

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OR

- 1 (a) Write Gerber, Goodman and Soderberg's equation with S-N diagram. 10
- (b) A cantilever beam made of cold drawn carbon steel 40C8 ($\sigma_u = 600$ N/mm² and $\sigma_y = 380$ N/mm²) is shown in fig. The force P acting at the free end varies from -50 N to $+150$ N. The expected reliability is 90%. And the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter 'd' of the beam at the fillet cross-section.



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UNIT - II

- 2 (a) Discuss the design of piston for an internal combustion engine. 10
- (b) The cylinder of a four stroke diesel engine has following specifications
 Brake power = 7.5 kW
 Speed = 1400 rpm
 Indicated mean effective pressure = 0.35 MPa
 Mechanical efficiency = 80%
 Maximum gas pressure = 3.5 MPa
 The cylinder liner and head are made of gray cast iron FG 260 ($\sigma_{ut} = 260$ N/mm² and $\mu = 0.25$). The studs are made of plain carbon steel 40C8 ($\sigma_{yt} = 380$ N/mm²). The factor of safety for all parts is 6.
 Calculate :
 (i) Bore and length of cylinder liner
 (ii) Thickness of the cylinder liner
 (iii) Thickness of cylinder head
 (iv) Size, number of studs

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OR

- 2 (a) Discuss about Design procedure and crankshaft. 6
- (b) Design a connecting rod for a diesel engine with the following data :
- Cylinder bore = 125 mm
 Length of connecting rod = 300 mm
 Maximum gas pressure = 3.5 Mpa
 Mass of reciprocating parts = 1.6 kg
 Engine speed = 2200 rpm
 Length of stroke = 125 mm
 Assume suitable data and state the assumptions you make. 10

UNIT - III

- 3 (a) It is required to design a helical torsion spring for a window shade. The spring made of oil-hardened steel wire of Grade-4. The yield strength of material taken as 50% of ultimate tensile stress with factor of safety is 2 and mean diameter is kept as 18 mm. The maximum bending moment acting on the spring is 250 N-mm and modulus of elasticity is 207000 N/mm². The stiffness of the spring should be 3 N-mm. 8
- (b) A helical compression spring subjected to a force which varies from 2.5 kN to 3.5 kN, the spring index and deflection takes as 5 and 5 mm. The spring made of cold-draw steel with ultimate stress and modulus of rigidity are 1050 N/mm² and 81370 N/mm². Design the spring if the permissible stress taken as 50% of ultimate stress. 8

OR

- 3 (a) Describe the design procedure for belt drive system. 8
- (b) A pulley made of grey cast iron fg 150, transmits 10 kw of power at 720 rpm. The diameter of the pulley is 500 mm. The pulley has four arms of elliptical cross-section, in which the major axis is twice of the minor axis. Determine the arm, if the factor of safety is 5. 8

UNIT - IV rtuonline.com

4 (a) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. 8

(b) A pair of straight bevel gears, mounted on shafts which are intersecting at right angles, consisting of a 21 teeth pinion meshing with a 28 teeth gear. The pressure angle is 20° . The pinion shaft connected to an electric motor developing 5 kW rated power at 1440 rpm. The service factor taken is 1.5. Both gears are made of case hardened steel ($S_{ut} = 750 \text{ N/mm}^2$) and heat treated to a surface hardness of 380 BHN. The limits of errors are $10 \mu\text{m}$. The module and face width are 4 mm and 20 mm. Determine the factor of safety against bending as well as against pitting failure. 8

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OR

4 (a) Write the expressions for static strength, limiting wear load and dynamic load for helical gears and explain the various terms used therein. 8

(b) Discuss about wear strength of gear for spur gear. 8

UNIT - V

5 (a) What do you mean by bearing ? Why ball and roller bearing are called 'antifriction' bearing ? 8

(b) Explain the design procedure of ball bearing with following :
Design a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. 8

OR

5 (a) Who do you mean by 'Lubrication' ? Explain all methods of lubrication in bearing. 8

(b) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. Find out the bearing number. 8

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