

Faculty of Engineering & Technology
Fifth Semester B.E. (Mech.)/Third Sem. B.E.P.T.
(Mech.) Examination
MACHINE DESIGN – II
Sections—A & B

Time—Three Hours]

[Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

- (1) All questions carry marks as indicated.
- (2) Answer **TWO** questions from Section A and **TWO** questions from Section B.
- (3) Due credit will be given to neatness and adequate dimensions. rtmnuonline.com
- (4) Assume suitable data wherever necessary.
- (5) Illustrate your answers wherever necessary with the help of neat sketches.
- (6) Use of Design Data Book is permitted.
- (7) Use of non-programmable calculator is permitted.

SECTION—A

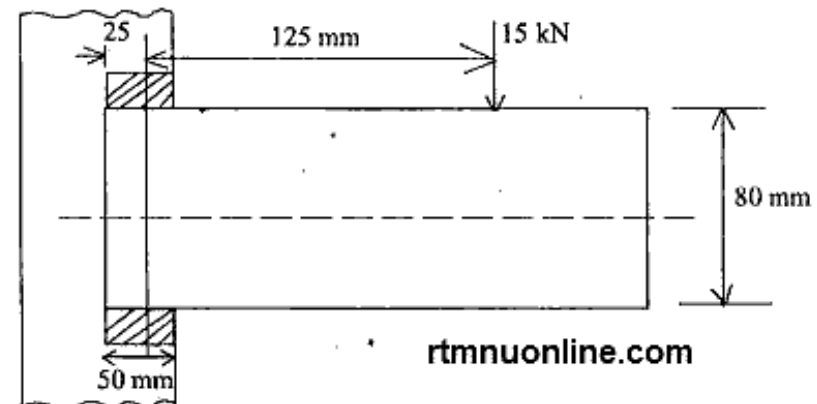
1. (a) Discuss the various factors governing the selection of material for the design of machine component. 5
- (b) Explain in short 'the various phases in machine design process'. 5
- (c) Explain the different modes of failure for an element. 5
- (d) Define the following properties :
 - (i) Machinability rtmnuonline.com
 - (ii) Formability

- (iii) Castability
- (iv) Weldability
- (v) Forgeability.

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2. (a) Design a knuckle joint to connect two shafts having circular cross-section, made of SAE 1040 to sustain a tensile load of 48 kN. 10
- (b) A bracket carrying load of 15 kN is to be welded as shown in fig. Find the size of weld required if the allowable shear stress is not to exceed 80 N/mm^2 . 10



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3. (a) The lead screw of a lathe has single-start ISO metric trapezoidal threads of 52 mm nominal diameter and 8 mm pitch. The screw is required to exert an axial force of 2 kN in order to drive the tool carriage during turning operation. The thrust is carried on a collar of 100 mm outer diameter and 60 mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30 rpm. Calculate :
 - (i) the power required to drive the lead screw; and
 - (ii) the efficiency of the screw. 10

- (b) At the bottom of an elevator shaft a group of 8 identical springs are set in parallel to absorb shock caused by the falling of the cage in case of a failure. The loaded cage weighs 42 kN while a counter weight is of 10 kN. Assuming that the cage has a fall of 1.5 m from rest. Determine the maximum stress in each spring, if each spring is made of 25 mm steel rod. The spring index is 6 and number of active turns in each spring is 20. Take $G = 80 \times 10^3$ MPa. 10

SECTION-B rtmnuonline.com

4. (a) A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 rpm. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4 :
- Assuming a uniform pressure of 0.17 N/mm^2 , determine the inner diameter of the friction surfaces.
 - Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached. 10
- (b) A simple band brake has a 750 mm drum fitted with a steel band 2.5 mm thick lined with a friction material having a coefficient of friction 0.25. The arc of contact is 240° . This brake drum is attached to a 600 mm hoisting drum that sustains a rope load of 8000 N. The operating force has a moment arm of 1500 mm and the band is attached 125 mm from pivot. Assume the direction of rotation for minimum operating force and find the operating force required

for just supporting the load. What width of steel band is required if the tensile stress is limited to 55 N/mm^2 ? rtmnuonline.com 10

5. (a) What are the different types of stresses induced in pressure vessels? Write the equations for it with figure showing resisting areas. 4
- (b) A pressure vessel of cast iron grade 35 is having inside diameter of 200 mm and is subjected to the internal pressure of 3.5 N/mm^2 . By choosing the suitable material for bolts and gasket, determine :
- Wall thickness of vessel
 - Size and no. of bolts required
 - Type of gasket for leak proof joint
 - Top cover plate assuming it to be flat & circular
 - Integral bottom cover plate with dished shape.
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6. A shaft is supported on bearings A and B, 800 mm between centres. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3 : 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. 20