

**394655(37)**

**B. E. (Sixth Semester) Examination, April-May 2020**

**(New Scheme)**

**MACHINE DESIGN**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Attempt all questions. Part (a) is compulsory from each question. Attempt question for 14 marks from remaining parts. Design data book can be used.***

**Unit-I**

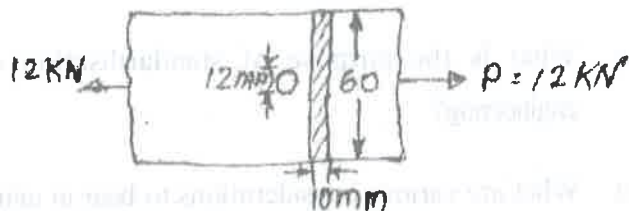
1. (a) What is the purpose of standardisation in engineering? 2
- (b) What are various considerations to bear in mind while preparing a design? 7

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- (c) How ferrous materials are designated according to Indian standard? 7
- (d) Define : 7
- (i) Ultimate strength
  - (ii) Endurance limit
  - (iii) Modulus of Elasticity

### Unit-II

2. (a) Name the various types of loads. 2
- (b) Write a short note on theories of failure. 7
- (c) The rectangular plate  $60 \times 10$  mm with a hole 12 mm dia and subjected to a tensile force of 12 kN as shown in figure. Find out the maximum stress induced in the plate taking stress concentration into account. 7



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- (d) Write a note on working stress and factor of safety. 7

### Unit-III

3. (a) What are the different types of keys? 2
- (b) Design and make a neat dimension sketch of a muff coupling which is used to connect two steel shaft transmitting 40 kN at 350 RPM. The material for the shaft and key is plane carbon steel for which allowable shear stress and crushing stress may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assuming 15 MPa. 14
- (c) 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 stress may be used. The load applied is static. Tensile stress = compressive stress = 50 MPa; Shear stress = 35 MPa and F Crushing stress = 90 MPa. 14

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**Unit-IV**

4. (a) What are the major uses of spring? 2
- (b) Design a helical compression spring for maximum load of 1000 N for a deflection of 25 mm using the value of spring index 5. Assume the necessary data. 7
- (c) A belt is required to transmit 12 HP from a pulley 120 cm diameter running at 200 RPM. The angle embraced is  $165^\circ$  and the coefficient of friction as 0.3. If the safe working stress for the leather is  $14 \text{ kg/cm}^2$ , the weight of 1 cu cm of leather = 1 gm and the thickness of belt = 10 mm, what width of belt will be required taking in account the centrifugal force. 7
- (d) A V-belt drive is to transmit 25 HP at 1500 rpm from a 25 cm pitch diameter sheave to a 90 cm diameter pulley. The centre distance between the two shafts is 100 cm. The groove angle is  $40^\circ$  and the coefficient of friction for the belt and sheave is 0.2 and the coefficient of friction between the

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belt and flat pulley is 0.2. The cross section of the belt is 4 cm wide at the top, 2 cm wide at the bottom and 2.5 cm deep. Each belt weighs 1 gm/cu and the allowable tension/belt is 100 kg. How many belts are required? 7

**Unit-V**

5. (a) What are different types of threads? 2
- (b) A pair of spur gears transmits 20 kW at 300 rpm of the pinion. The velocity ratio is 1 : 3. The allowable static pressure for the pinion and the gear materials are  $120 \text{ N/mm}^2$  and  $100 \text{ N/mm}^2$  respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine (i) module, (ii) face width and (iii) pitch circle dia. of both pinion and gear. 7
- (c) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 20 kN. The nut of the screw is fitted in the hub of a gear wheel having 80 teeth which meshes with a pinion of 20 teeth. The

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mechanical efficiency of the pinion and gear drive is 95%. The axial thrust on the screw is taken up by a collar bearing 250 mm outside diameter and 100 mm inside diameter. Find the minimum diameter of pinion shaft and height of nut when the coefficient of friction for the vertical screw and nut is 0.15 and that for the collar bearing is 0.2. The permissible shear stress in the shaft material is  $60 \text{ N/mm}^2$  and allowable bearing pressure is  $1.5 \text{ N/mm}^2$ .

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(d) Explain spur gear nomenclature with neat sketch. 7