

**DIPLOMA – VIEP – MECHANICAL
ENGINEERING (DMEVI)**

Term-End Examination

00912

December, 2017

BIME-025 : DESIGN OF MACHINE ELEMENTS

Time : 2 hours

Maximum Marks : 70

Note : Answer any **five** questions. Question no. 1 is **compulsory**. All questions carry equal marks. Design data book is allowed. Use of scientific calculator is permitted. Assume missing data, if any, suitably.

1. Select the correct answer from the given four alternative answers : $7 \times 2 = 14$
- (a) With the percentage increase of carbon in steel,
- (i) strength of steel decreases
 - (ii) hardness of steel decreases
 - (iii) brittleness of steel decreases
 - (iv) ductility of steel decreases
- (b) Factor of safety is the ratio of
- (i) yield stress/working stress
 - (ii) tensile stress/working stress
 - (iii) compressive stress/working stress
 - (iv) bearing stress/working stress

- (c) Taper usually provided on cotter is
 - (i) 1 in 5
 - (ii) 1 in 40
 - (iii) 1 in 24
 - (iv) 1 in 10
- (d) Rivets are generally specified by
 - (i) Thickness of plates to be riveted
 - (ii) Length of rivet
 - (iii) Diameter of head
 - (iv) Nominal diameter
- (e) Strength of material in fatigue loading as compared to static loading is
 - (i) Same
 - (ii) Higher
 - (iii) Lower
 - (iv) Depends on other factors
- (f) Resilience of a material is important, when it is subjected to
 - (i) Fatigue
 - (ii) Thermal stresses
 - (iii) Wear and tear
 - (iv) Shock loading
- (g) Rankine's theory of failure is applicable for the following type of materials :
 - (i) Brittle
 - (ii) Ductile
 - (iii) Elastic
 - (iv) Plastic

2. Design a cotter joint to connect two steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension, 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. 14
3. Compare the ratio of strength of a solid steel column to that of a hollow column of internal diameter equal to $3/4^{\text{th}}$ of its diameter. Both the columns have the same cross-sectional area, length and end conditions. 14
4. Determine the diameter of a piston rod for a cylinder of 125 cm diameter subjected to a pressure of 0.2 N/mm^2 . The rod is made of alloy steel and is secured to the piston by a tapered rod. The modulus of elasticity is 210 kN/mm^2 , factor of safety is 8 and length of the rod is 3 metres. 14
5. Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 cm. The spring is to be enclosed in a casing of 25 cm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2 . Also calculate the maximum shear stress induced. 14
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. 14
7. Discuss the function of coupling. Describe with the help of neat sketches, various types of shaft couplings, mentioning the uses of each type. 14

8. Write short notes on the following : $4 \times 3 \frac{1}{2} = 14$

- (a) Stresses in Crane Hook
 - (b) Multi-Leaf Spring
 - (c) Equivalent Length for Various End Conditions of Column
 - (d) Fits and their Classification according to Indian Standard
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