

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

Term-End Examination

December, 2016

00292

BIME-025 : DESIGN OF MACHINE ELEMENTS

Time : 2 hours

Maximum Marks : 70

Note : Answer *five* questions in all, Question no. 1 is *compulsory*. All questions carry equal marks. Design data book is allowed. Use of scientific calculator is permitted.

1. Select the correct answer from the given four alternative answers : $7 \times 2 = 14$
- (a) The ultimate strength of steel in tension in comparison to shear is in the ratio of
- (i) 1 : 1
 - (ii) 2 : 1
 - (iii) 3 : 2
 - (iv) 2 : 3
- (b) Guest's theory of failure is applicable for the following type of materials :
- (i) Brittle
 - (ii) Ductile
 - (iii) Elastic
 - (iv) Plastic

- (c) Tensile strength of a mild steel specimen can roughly be predicted from the following hardness test :
- (i) Brinell
 - (ii) Rockwell
 - (iii) Vicker
 - (iv) Shore's Scleroscope
- (d) The notch angle of the Izod impact test specimen is
- (i) 10°
 - (ii) 20°
 - (iii) 30°
 - (iv) 45°
- (e) Cold working
- (i) increases the fatigue strength
 - (ii) decreases the fatigue strength
 - (iii) has no influence on the fatigue strength
 - (iv) None of the above
- (f) The function of a washer is to
- (i) provide cushioning effect
 - (ii) provide bearing area
 - (iii) absorb shocks and vibrations
 - (iv) provide smooth surface in place of rough surface

- (g) Spring index is the
- (i) ratio of coil diameter to wire diameter
 - (ii) load required to produce unit deflection
 - (iii) indication of quality of spring
 - (iv) capability of the spring to store energy

2. The piston rod of a steam engine is 50 mm in diameter and 600 mm long. The diameter of the piston is 400 mm and the maximum steam pressure is 0.9 N/mm^2 . Find the compression of the piston rod, if $E = 210 \text{ kN/m}^2$ for the piston rod material. 14
3. Design a knuckle joint to connect two steel bars under a tensile load of 25 kN. Allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing. 14
4. Explain what do you understand by Ergonomics. Elaborate on the importance of ergonomics in respect of design process. 14
5. A helical spring is made from a wire of 6 mm diameter and has outer diameter (coil) of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity is 84 kN/mm^2 , find the axial load which the spring can carry and the deflection per active turn. 14

6. (a) What are fits and tolerances ? How are they designated ? 7
- (b) What is meant by 'hole basis system' and 'shaft basis system' ? Which one is preferred and why ? 7
7. (a) Illustrate how the stress concentration in a component can be reduced. 7
- (b) Explain how the factor of safety is determined under steady and varying load. 7
8. Write short notes on the following : $4 \times 3 \frac{1}{2} = 14$
- (a) Endurance Limits
- (b) Keys and Cotters
- (c) Rankine-Gordon's Formula
- (d) Buckling in Helical Springs
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