

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

Term-End Examination

00636

June, 2015

BIME-025 : DESIGN OF MACHINE ELEMENTS

Time : 2 hours

Maximum Marks : 70

*Note : Question no. 1 is **compulsory**. Attempt any **four** questions from Q. No. 2 to 8. Design data book is allowed. All questions carry equal marks.*

1. Select the most appropriate alternative : $7 \times 2 = 14$

(a) In a unilateral system of tolerance, the tolerance is allowed on

- (i) one side of the actual size
- (ii) one side of the nominal size
- (iii) both sides of the actual size
- (iv) both sides of the nominal size

(b) The ratio of the ultimate stress to the design stress is known as

- (i) elastic limit
- (ii) strain
- (iii) factor of safety
- (iv) bulk modulus

- (c) The neutral axis of a beam is subjected to
- (i) zero stress
 - (ii) maximum tensile stress
 - (iii) maximum compressive stress
 - (iv) maximum shear stress
- (d) The length of the cylinder in I.C. Engine is usually taken as
- (i) equal to the length of piston
 - (ii) equal to the length of stroke
 - (iii) equal to the cylinder bore
 - (iv) 1.5 times the length of stroke
- (e) A spring used to absorb shocks and vibration is
- (i) closely-coiled helical spring
 - (ii) open-coiled helical spring
 - (iii) conical spring
 - (iv) leaf spring
- (f) Which of the following screw threads is adopted for power transmission in either direction ?
- (i) Acme threads
 - (ii) Square threads
 - (iii) Buttress threads
 - (iv) Multiple threads
- (g) A connecting rod is designed as a
- (i) long-column
 - (ii) short-column
 - (iii) strut
 - (iv) None of these

2. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of the bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a concentration factor of 1.65 for fatigue load. Use Goodman straight line as the basis for design. 14
3. A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10,000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. 14
4. 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
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 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm². Also calculate the maximum shear stress induced. 14

6. State the assumptions used in Euler's column theory. Compare the ratio of strength of a solid column to that of a hollow column of internal diameter equal to $3/4^{\text{th}}$ of its external diameter. Both the columns have the same cross-sectional areas, lengths and end conditions. 14
 7. Discuss the function of coupling. Describe with the help of neat sketches, the types of various shaft couplings, mentioning the uses of each type. 14
 8. What is the function of a connecting rod of an internal combustion engine? Explain the various stresses induced in the connecting rod. 14
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