

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

December, 2017

00282

**BICE-013 : STRUCTURAL DESIGN AND
DRAWING – I**

Time : 3 hours

Maximum Marks : 70

Note : Attempt any *five* questions. All questions carry equal marks. Use of IS 456 and IS 800 codes is allowed. Use of scientific calculator is permitted.

1. (a) Describe the situations in which doubly reinforced concrete beams become necessary. What is the role of compression steel in such beams ? 6

- (b) Determine the area of tensile reinforcement in terms of ϕ 20 mm bars of Fe 250 for a singly reinforced rectangular beam having cross-section $b \times D = 300 \times 550$ mm to resist a moment of 150 kN-m. Take concrete of grade M 25, nominal cover of 30 mm and shear reinforcement of ϕ 8 mm. 8

2. Design an RC column of size 460 mm $\times$ 600 mm having effective length of 3.6 m to support an axial service load of 2500 kN. Use M 20 grade concrete and HYSD steel of Fe 415 grade. 14

3. (a) Differentiate between a cantilever and a counterfort type of retaining wall with the help of neat sketches. 7
- (b) Elaborate the difference between Working Stress method and Limit State method of design. How is partial safety factor different from factor of safety ? 7

4. (a) Discuss the merits and demerits of welded joints. 7
- (b) Determine the strength of a single riveted joint of 6 mm thick plates having 20 mm diameter rivets at a pitch of 60 mm. For plate, $f_y = 150$ MPa. Rivets are hand driven shop rivets. 7

5. (a) Write the steps for designing compound compression members with lacing. 7
- (b) Find the net effective area of a tension member formed by an ISA 150 $\times$ 75 $\times$ 10 which is connected by its longer leg to a 12 mm gusset plate by
 - (i) 5 mm weld,
 - (ii) 20 mm dia rivets (single hole). 7

6. Design a simply supported I-section beam of 8 m span carrying a uniformly distributed load of 45 kN per metre. The compression flange may be assumed laterally supported throughout its length. Take $f_y = 250$ MPa.

(Properties of ISMB 550 @ 103.7 kg/m :
 $z_x = 2359.8 \text{ cm}^3$, $z_y = 193.0 \text{ cm}^3$, $t_f = 19.3 \text{ mm}$,
 $t_w = 11.2 \text{ mm}$, $B = 190 \text{ mm}$)

Take support width = 300 mm.

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7. Write short notes on any *four* of the following :

$$4 \times 3 \frac{1}{2} = 14$$

- (a) Classification of Welded Joints
 - (b) Stress – Strain Curve of Mild Steel
 - (c) Efficiency of a Joint
 - (d) Gusseted Base
 - (e) Stability of Retaining Walls
 - (f) Two-Way Slab
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