

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI(NEW) – EXAMINATION – SUMMER 2019
Subject Code:2160607
Date:21/05/2019
Subject Name:Elementary Structural Design
Time:10:30 AM TO 01:30 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of IS:456, IS:800 and steel table is permitted.
5. Assume M20 grade concrete and Fe415 steel for RCC element and f_y of 250 MPa and f_u of 410 MPa for the structural steel if not given.

MARKS

- | | | |
|------------|--|-----------|
| Q.1 | (a) Discuss the suitability of steel as reinforcement material. | 03 |
| | (b) Why are drilled holes preferred over punched holes? When Punched holes are allowed? | 04 |
| | (c) Explain different methods of designing R.C.C structures. | 07 |
| Q.2 | (a) Draw detailed stress and strain diagrams for singly under-reinforced section & Over reinforced section. | 03 |
| | (b) What are the values of factor of safety for concrete and steel? Why do we use less factor of safety for steel as compared to concrete? | 04 |
| | (c) A R.C beam of rectangular section 230 mm wide and 600 mm deep is reinforced on tension side by 4 bars of 20 mm diameter. The characteristic strength of concrete and steel used are 25 N/mm ² and 500 N/mm ² . Take nominal cover 20 mm. Calculate
a) Ultimate moment of resistance of the section b) Determine the maximum uniformly distributed load a simply supported beam of this section can carry over a span of 6m. | 07 |
| | OR | |
| | (c) A reinforced concrete slab 150 mm thick is reinforced with 10 mm bars @ 180 mm c/c. the reinforcement is located at an effective depth of 125 mm from top. Calculate the moment of resistance of the section. Use M-20 concrete and Fe 415 steel. | 07 |
| Q.3 | (a) Explain the difference between one way and two way slab. | 03 |
| | (b) Find the ultimate load carrying capacity and allowable load for a short column of size 500 mm * 500 mm. the column is reinforced with 4-25 mm diameter bars. Use M20 concrete and HYSD grade Fe 415 steel. Assume $e_{min} < 0.05D$. | 04 |
| | (c) A Simply supported beam 300 mm * 600 mm (effective) is reinforced with 5 bars of 25 mm diameter. It carries a uniformly distributed load of 80 kN/m (Including self-weight) over an effective span of 6m. Out of 5 main bars, two bars can be bent up safely near the supports. Design the shear reinforcement for the beam. Use M20 grade of concrete and Fe 415 steel. | 07 |
| | OR | |
| Q.3 | (a) What is the function of providing distribution steel in slab? | 03 |
| | (b) Write design steps for isolated rectangular column footing. | 04 |
| | (c) Determine the ultimate moment of resistance of the tee beam having the following properties: -
1. Width of flange = 900 mm
2. Thickness of Flange = 150 mm | 07 |

3. Width of rib = 200 mm
4. Effective depth = 600 mm
5. Area of tension reinforcement = 3966 mm²

Use M-20 Grade of Concrete and Fe-415 HYSD bars.

- Q.4**
- (a) Describe failure modes of steel beam. **03**
 - (b) Write short notes on block shear failure in plates and angles. **04**
 - (c) Select a suitable angle section to carry a factored tensile force of 290 kN assuming a single row of M20 bolts and assuming design strength $f_y = 250 \text{ N/mm}^2$ **07**

OR

- Q.4**
- (a) How can the effects of shear lag be considered in the design calculation? **03**
 - (b) Discuss cross section classification. **04**
 - (c) Two plates of thickness 12 mm and 10 mm are to be jointed by a groove or butt weld as shown in fig.1 The joint is subjected to a factored tensile force of 300 kN. Assuming an effective length of 150mm, Check the safety of joint for single groove weld joint and double V groove weld joint. Assume Fe410 grade steel plate and welds are shop welded. **07**

- Q.5**
- (a) Write design steps of lacing column. **03**
 - (b) Draw a neat sketch of gusseted steel footing. **04**
 - (c) Design simply supported beam of span 3.5 m subjected to a factored bending moment of 300 kNm and factored shear of 140 kN. The beam is laterally unsupported. Steel grade of Fe 410. **07**

OR

- Q.5**
- (a) Write design steps of battening column. **03**
 - (b) Compare welded joint vs bolted joints. **04**
 - (c) A beam of ISMB550 has simple support span of 9m and is laterally supported at center only. Calculate the maximum all inclusive factored udl it can support. **07**

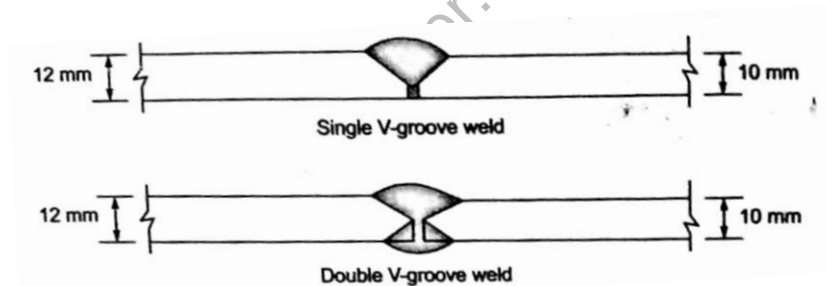


Figure -1
