# BT University

STRUCTURAL DESIGN AND DRAWINGS

B TECH CIVIL ENGINEERING

PROFESSIONAL ENGINEERING CREDITS ASSESSMENT & CONTINUIOUS INTERNAL EVALUATION

## PART I

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 2 MARKS)**

ANSWER ANY 10 QUESTION

1. List the various types of connections used for connecting the structural members?
2. Construct the formula to calculate the efficiency of Bolt and weld Joint.
3. Formulate the equation for calculating the effective throat thickness of weld?
4. List the types of failures occur in riveted joint?
5. Outline the concept of riveting?
6. Define the terms – Pitch of a rivet & nominal diameter of rivet.
7. Differentiate nominal diameter and gross diameter of bolt.
8. List the various types of welded joints
9. Summarize the advantages of HSFG bolts?
10. Define the terms gauge, pitch, edge and end distance of bolt joint
11. Classify the types of bolts used for structural purposes?
12. Recommend the limit states of serviceability applicable to steel structures?
13. Discuss the factors to be considered in mechanical properties of structural steel?
14. Summarize about splitting of plates.
15. Arrange the double riveted lap joint with neat sketch

# PART IA

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 6 MARKS)**

ANSWER ALL QUESTION

1. Two plates 10 mm and 20 mm thick are connected by double cover butt joint made of 8mm cover plate. Record the strength of the joint. If 6 numbers of M20 bolts of grade 4.6 and Fe 415 are used on either sides of the joint in two rows with pitch of 60mm and edge distance of 40mm in both direction

2. Describe about the following

   a) Design philosophies for structural steel

   b) Show the various limit states to be considered in design of steel structures

3. Discuss about the following

   a) Sectional classification and properties of structural steel

   b) Factor of safety for loads and materials

4. Estimate the dimensions of a doubly bolted lap joint for plates 16mm thick to carry its full load. Take permissible axial tension in plate 150N/mm2

5. Estimate the safe load and efficiency of a double cover butt joint. The main plates are 12mm thick connected by 18mm diameter bolts at a pitch of 100mm. Design the cover plate also. What is the percentage reduction in the efficiency of the joint if the plates are lap jointed?

6. A single bolted double cover butt joint is used to connect two plates 8mmthick. Assuming 20mm bolts at 50mm pitch examine and record the efficiency of the joint. The thickness of cover plate is 4mm

7. A tie member 75 mm X 8mm is to transmit a load of 90 kN. What is the length of the fillet weld and calculate the necessary overlap.

# PART II

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 2 MARKS)**

ANSWER ANY 10 QUESTION

1. Define tension member?

2. Write the expression for calculating net area for angle and Tsection in tension.

3. Define slenderness ratio

4. When gusset plates areused?

5. Formulate to calculate net area in (a) chain bolting (b) zigzag bolting. BT-2 Understand

6. Name the types of steel sections used as tension members

7. Classify the modes of failure in Tension member.

8. Write down the expression for design of angle tension member.

9. Distinguish Net sectional and Gross area?

10. Discuss Tension Splice.

11. Discuss Shear Lag in Tension member?

12. Illustrate built-up members?

13. What is the formula for design strength due to yielding of critical section?

14. Extend the equation for calculating the effective net area for a double angle joined back to back.

15. Examine lug angle and its use?

16. Investigate the design strength due to block shear.

17. Plan two specifications for designing of lug angle

18. What if a single angle with one leg is connected to a gusset plate which is subjected to an eccentric load?

19. Select any two typical cross sections of tension member using angle sections with neat sketch.

20. Measure the maximum pitch when the angles are placed back to back?

## PART IIA

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 6 MARKS)**

ANSWER ALL QUESTION

1. Design the tensile strength of a roof truss diagonal 100x75x8 mm connected to the gusset plate by 5mm welds

2. Use 10mm thick gusset plate and 20 mm diameter black bolts to design a tension member to carry factored axial tension of 450KN.

3. Determine the tensile strength of a roof truss member 2 ISA 90x60x6 mm connected to the gusset plate of 8 mm thickness by 4mm weld. The effective length of weld is 200mm.

4. Design a tension member to carry a factored force of 340KN. Use 20mm diameter black bolts and a gusset plate of 8mm thick

5. Design a single angle equal section 100x100x10 mm, connected to a gusset plate at the ends with 20mm diameter bolts with the connection length of 250mm to transfer tension

6. Write the procedure for the design of tension members

7. Explain in detail about the modes of failure in Tension member

8. Find the suitable dimensions so as to design a tension member using 2 unequal angles of size 120mm x 90mm x 8mm with a 10mm thick gusset plate. The short leg is outstanding. The pull on the member of 250kN

9. Explain the concept of shear lag in detail

## PART III

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 2 MARKS)**

ANSWER ANY 10 QUESTION

1. Define compression member and slenderness ratio

2. List the various types of compression members?

3. Distinguish column and strut

4. Define effective length of a column

5. State the uses of providing column base?

6. What are the different way by which a compression member buckles. Construct the diagram of buckling modes of column.

7. Evaluate the effective length of column based on end conditions

8. What do you mean by web buckling?

9. Discuss the purpose of providing battens in compound steel columns?

10. Explain gusset base and strut

11. Classify the modes of failure in compression member.

12. Define buckling load and state the assumptions made in Euler's analysis

13. Illustrate the lateral systems that are used in compound columns.

14. Explain effective sectional area in column design

15. Differentiate between slab base and gusseted base for steel columns

16. Examine the cause for decrease in permissible stresses due toincrease in slenderness ratio

17. Why lacings are used in compression members?

18. Justify the purpose for providing anchors bolt in base plate?

19. Where should the splice plate be located in a column?

20. What do you mean by latticed column

## PART IIIA

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 6 MARKS)**

ANSWER ALL QUESTION

1. A rolled steel beam section HB 350 @ 0.674 kN/m is used as astanchion. If the unsupported length of the stanchion is 4 m, evaluatesafe load carrying capacity of the section

2. Find the suitable design for a built-up column consisting of twochannels connected by batten to carry an axial load of 800 KN; theeffective length of the column is 6 m

3. Explain the step by step procedure for finding the load carrying capacity of a compression member

4. A 4.8m long column with one end fixed and other end hinged is made of ISMB 400 with a flange plate of 300 x 20 mm welded to each flange. Determine the load carrying capacity of the column section, if the grade of steel is Fe415 / E250.

5. i) List out the maximum values of effective slenderness ratio for various members as per IS recommendations.

ii) Analyse the different failure modes of column in detail

6. Find the suitable design for a rolled steel beam section column to carry an axial load 1100 kN. The column is 4 m long and adequately in position but not in direction at both end

7. Illustrate in detail about column splice and mention its purpose

8. A column of ISMB 400 is subjected to an axial force of 750kN. Analyse and design suitable base plate. Assume necessary data required.

9. Describe about laced column and also explain its design and specifications.

## PART IV

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 2 MARKS)**

ANSWER ANY 10 QUESTION

1. Define shape factor and what is meant by slender section?

2. Write the various factors affecting the lateral-torsional buckling strength

3. What is laterally unsupported beam? Give an example.

4. Demonstrate the reasons behind splicing in plate girder

5. Evaluate the economical depth of a plate girder?

6. Write about the Box girders.

7. Construct the failure mode of laterally unsupported beams

8. What do you mean by castellated beam?

9. Explain effective sectional area in column design

10. Write the formula for calculating the thickness of beam bearing plate

11. Discuss about built up beams

12. Distinguish web buckling and web crippling?

13. What are the classifications in Stiffeners?

14. Examine the purpose of providing stiffener in plate girder and what are the different types of stiffeners provided in plate girder?

15. Define laterally restrained beam. Why do compression flanges require lateral support?

16. What do you mean by curtailment of flanges

17. Justify the purpose for providing the bearing stiffener and where it is used?

18. How do you improve the shear resistance in plate girder?

19. What is web crippling?

20. Discuss the elements of the plate girder

## PART IVA

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 6 MARKS)**

ANSWER ALL QUESTION

1. An ISMB 500 section IA used as a beam over a span of 6 m, with simply supported ends. Determine the maximum factored uniformly distributed load that the beam can carry if the ends are restrained against torsion but compression flange is laterally unsupported.

2. Find the suitable design for a simply supported steel joist with a 4.0m effective span carries a UDL of 40kN/mover its span inclusiveof self-weight. The beam is laterally unsupported.

3. Find the suitable design for a simply supported beam of effective span 10m carrying a factored load of 30kN/m. The compression flange of the beam is laterally restrained all along and provided with stiffened end bearing of 100mm wide. The overall depth of thebeam is restricted to 450mm.

4. Estimate the suitable built up beam section for a span of 8m to carry a uniformly distributed load of 15kN/m and a central concentrated load of 100 kN. The beams is laterally supported through out.Show the curtailment of plates also

5. Write short notes on:

(i) Bending strength of a laterally supportedbeam

(ii) Shearing strength of a laterally supported beam

6. A welded plate girder of span 25m is laterally restrained throughout its length. It has to carry a load of 80 kN/m over the whole span besides its weight. Design the girder without intermediate transverse stiffeners

7. Explain the step by step procedure for design of vertical, intermediate and horizontal stiffeners in a plate girder

8. Analyse the expression for the economical depth of the plate girder

# PART V

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 2 MARKS)**

ANSWER ANY 10 QUESTION

1. Explain the co efficient of external wind pressure.
2. What are economical considerations for industrial truss?
3. Write the uses of sag rod in a roof truss
4. Explain about the importance of steel decking.
5. State the necessity of curtailment of flange plates in plate girder.
6. What is the purpose of the purlin in a roof truss?
7. What are the loads to be considered for the design of gantry girder?
8. List the criteria to be adopted for arriving at the spacing of truss?
9. List the various components of a roof truss.
10. Classify the type of truss based on span.
11. Define bracing and Why bracings required in roof trusses?
12. Give general guidelines for fixing spacing of roof trusses
13. Define pitch of trusses
14. Discuss about Principles of plastic analysis
15. Define gantry girders
16. Which section is recommended for gantry girder? Why
17. Define Drift Analysis
18. Explain recommended allowable stresses and deflection for gantry girder?
19. Name the commonly used roof coverings.
20. Define end bearing in roof trusses?

# PART VA

**UNIVERSITY EXAM QUESTION PATTERN – 6 MARK (EACH QUESTION CARRIES 6 MARKS)**

ANSWER ALL QUESTION

1. I.Classify the different types of roof truss with neat sketches

   Ii.Give general guidelines for fixing spacing of roof trusses

2. A roof truss- shed is to be built Jodhpur city area for an industrial use. Determine the basic wind pressure .The use of shed 18 m x 30 m

3. An industrial roof shed of size 20 mx30 m is proposed to be constructed at Mangalore near a hillock of 160 m and slope is 1 in 2.8. The roof shed is to be built at a height of 120 m from the base of the hill. Determine the design wind pressure on the slope. The height of roof shed shall be 12m

4. A communications tower of 80 m height is proposed to be built hill top height 520 m with a gradient of 1in 5. The horizontal approach distance is 2.8 m km from the level ground .The tower is proposed at Abu mount .Determine the design wind pressure.

5. Design a purlin for a roof truss having the following data: Span of the truss = 6.0m ,Spacing of truss = 3m c/c, Inclination of roof = 30o Spacing of Purlin = 2m c/c Wind pressure = 1.5 kN/m2,Roof coverage= A.CSheeting weighing 200 N/m2 , Provide a channel section Purlin.

6. Identify the suitable purlin in an industrial building, the trusses of 16m span and 4m rise are spaced at 8m apart. The building is in medium wind zone in an industrial area of plain land.

7. Discuss briefly the following with neat sketches.

i) bracing system in roof truss

ii) Connection of purlin to rafter

iii) Anchorages of truss with concrete column

END