Hall Ticket No. | | | | | | | | | | | Question Paper Code: ACE012

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - I

B.TechVI Semester End Examinations (Regular), April – 2020

Regulations: IARE-R16

DESIGN OF STEEL STRUCTURES AND DRAWING

(Civil Engineering)

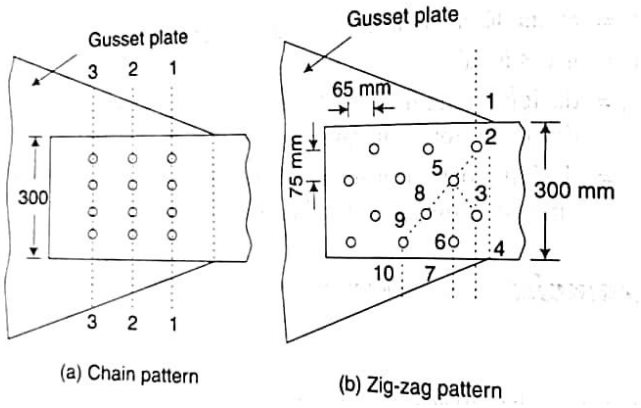
Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT-I

1. (a) Explain why serviceability limit state is considered as important as failure limit states. **[7M]**
   (b) Design a single cover butt joint with grade of steel Fe410 and grade of bolt 4.6 diameter 20mm to resist a factored load of 70 KN thickness of main plate is 10mm and butt plate is 8mm. **[7M]**

2. (a) What are the different loads and load combinations are to be considered to design member or a structure? **[7M]**
   (b) A 300 ISF 8mm of grade Fe410 is used as a tension member in a lattice girder. It is connected to a 12mm thick gusset plate by 18mm diameter bolts of grade 4.6 calculate the effective net area of the member if **[7M]**
      (a) Chain Bolting is done as shown in figure
      (b) ZigzagBolting is done as shown in figure



UNIT-II

3. (a) What are the steps involved in design of laced columns as per IS 800:2007 **[7M]**

   (b) Determine the design axial load capacity of the column ISHB 300 @576.8 N/m if the length of column is 3m and it's both ends restrained in direction and position. **[7M]**

4. (a) What are the various steps involved in design battened columns as per IS 800:2007 **[7 M]**

   (b) Design a stanchion 3.5m long in a building subjected to a factored load of 550KN both the ends of the stanchion are effectively restrained in direction and position. Use grade of steel Fe410. **[7 M]**

UNIT-III

5. (a) What are the stages involved in designing a laterally unsupported beams. **[7M]**

   (b) Determine the design bending strength of ISLB 350 @486N/m considering the beam to be laterally supported.

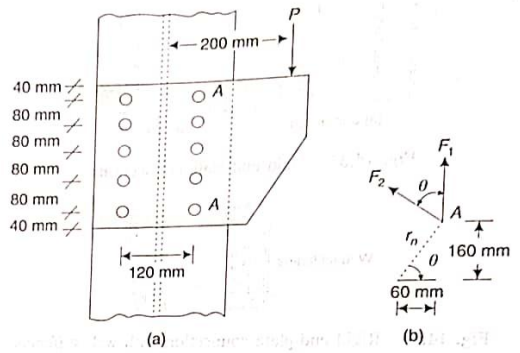
6. (a) Explain in detail about shear buckling **[7M]**
   (a) Simple post critical method
   (b) Tension field method

   (b) Design a laterally unsupported beam for the following data **[7M]**
   Effective span 4m
   Maximum bending moment 550KNm
   Maximum shear force 200KN
   Steel of grade Fe410.

UNIT-IV

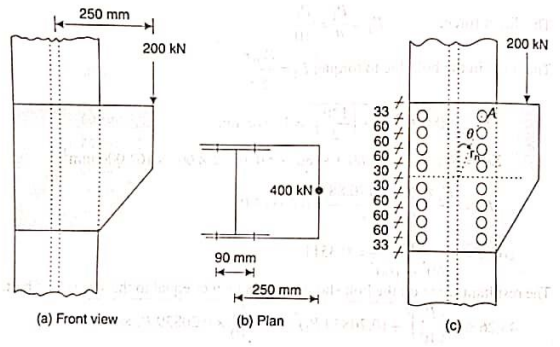
7 (a) Draw the typical sketch to show the following beam column connection: **[7M]**
(a) stiffened seated connection (b) unstiffened seated connection

(b) Determine the safeload P that can be carried by the joint shown in figure the bolts use are 20mm diameter of grade 4.6 the thickness of the flange of I section is 9.1mm and that of bracket plate 10mm. **[7M]**



8 (a) Explain the design procedure for Unstiffened seat connection. **[7M]**

(b) Design a bolted bracket connection to support an end reaction of 400KN because of the factored loads supported by the beam. The eccentricity of the end reaction is as shown in figure the steel used is of grade Fe410 use bolts of grade 4.6. The thickness of bracket plate may be taken as 10mm the column section is ISHB 150@300.19N/m. **[7M]**



UNIT–V

9 (a) What is tension field action in plate girders? **[7M]**

(b) Design a welded plate girder of 20m span using tension field action for the following factored forces **[7M]**

Maximum moment M_z= 5000KNm

Maximum shear force =900KN

The girder is laterally restrained. Use steel of grade Fe410 and assume yield stress of steel be 250Mpairrespective of thickness of plates. Connections need not be designed.

10 (a) What are the design concepts of a plate girder? **[7M]**

(b) Design the most critical section of a welded plate girder of constant depth to carry a superimposed load of 100KN/m, in addition to its self-weight over a span of 20m with two equal over hangs of 3m on each side thus making total length of girder 26m design the following **[7M]**

(a) Cross section

(b) Curtailment

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COURSE OBJECTIVES:

The course should enable the students to:

I	Discuss the concepts of structural steel design conforming to the IS 800 design code
II	Identify various types of structural steel and its properties also define concepts of Limit State Design.
III	Analyze structures using plastic method of analysis and evaluate collapse load and plastic moment capacity.
IV	Design compression members, beams, connections and girders.

COURSE OUTCOMES(COs):

CO	Description
CO 1	Know the materials, making of iron and steel, types of structural steel, mechanical properties of steel, concepts of plasticity yield strength, loads and combinations loading wind loads on roof trusses, behaviour of steel, local buckling. Concept of limit state design – different limit states as per IS 800:2007. Design strengths deflection limits, serviceability, bolted connections, welded connections, efficiency of joint, prying action types of welded joints, design of tension members, design strength of members.
CO 2	Know the design of compression members, buckling class, slenderness ratio, strength design, laced battened columns, column splice, column base, slab base.
CO 3	Know the design of beams, plastic moment, and bending and shear strength laterally supported beams. Design, built up sections, large plates web buckling, crippling and deflection of beams, design of purlin.
CO 4	Know the design of eccentric connections with brackets, beam end connections, web angle, unstiffened and stiffened seated connections (bolted and welded types) and design of truss joints.
CO 5	Know the design of welded plate girders, optimum depth, design of main section, design of end bearing stiffness and intermediate stiffness. Connection between web and flange and design of flange splice and web splices.

COURSELEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

ACE012.01	Know the materials, making of iron and steel.
ACE012.02	Know the types of structural steel, mechanical properties of steel.
ACE012.03	Know the concepts of plasticity yield strength.
ACE012.04	Understand loads and combinations loading wind loads on roof trusses.
ACE012.05	Understand behavior of steel, local buckling.
ACE012.06	Concept of limit state design – different limit states as per IS 800:2007.
ACE012.07	Concept of design strengths deflection limits, serviceability.
ACE012.08	Evaluate the bolted connections.
ACE012.09	Evaluate welded connections, efficiency of joint.
ACE012.10	Analyze the prying action types of welded joints.

ACE012.11	Understand the design of tension members and design strength of members.
ACE012.12	Understand the design of compression members, buckling class, slenderness ratio.
ACE012.13	Understand the strength design, laced battened columns.
ACE012.14	Understand the design of column splice, column base, and slab base.
ACE012.15	Understand the design of beams, plastic moment.
ACE012.16	Analyze the bending and shear strength laterally supported beams.
ACE012.17	Understand the design, built up sections, large plates web buckling.
ACE012.18	Analyze the crippling and deflection of beams, design of purlin.
ACE012.19	Understand the design of eccentric connections with brackets.
ACE012.20	Analyze the beam end connections, web angle, unstiffened and stiffened seated connections, and design of truss joints.
ACE012.21	Understand the design of welded plate girders, optimum depth, and design of main section.
ACE012.22	Understand the design of end bearing stiffness and intermediate stiffness.
ACE012.23	Analyze the Connection between web and flange and design of flange splice and web splices.

Mapping of Semester End Examination to Course Outcomes

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	ACE012.01	Know the materials, making of iron and steel.	CO 1	Understand
	b	ACE012.02	Know the types of structural steel, mechanical properties of steel.	CO 1	Remember
2	a	ACE012.03	Know the concepts of plasticity yield strength	CO 1	Understand
	b	ACE012.04	Understand loads and combinations loading wind loads on roof trusses.	CO 1	Understand
3	a	ACE012.06	Concept of limit state design – different limit states as per IS 800:2007.	CO 2	Understand
	b	ACE012.07	Concept of design strengths deflection limits, serviceability	CO 2	Remember
4	a	ACE012.08	Evaluate the bolted connections	CO 2	Understand
	b	ACE012.09	Evaluate welded connections, efficiency of joint	CO 2	Understand
5	a	ACE012.11	Understand the design of tension members and design strength of members.	CO 3	Remember
	b	ACE012.12	Understand the design of compression members, buckling class, slenderness ratio.	CO 3	Understand
6	a	ACE012.13	Understand the strength design, laced battened columns	CO 3	Remember
	b	ACE012.15	Understand the design of beams, plastic moment	CO 3	Understand
7	a	ACE012.16	Analyze the bending and shear strength laterally supported beams.	CO 4	Remember
	b	ACE012.17	Understand the design, built up sections, large plates web buckling	CO 4	Understand
	a	ACE012.18	Analyze the crippling and deflection of beams, design of purlin.	CO 4	Remember

8	b	ACE012.19	Understand the design of eccentric connections with brackets.	CO 4	Understand
9	a	ACE012.20	Analyze the beam end connections, web angle, unstiffened and stiffened seated connections, and design of truss joints	CO 5	Understand
	b	ACE012.21	Understand the design of welded plate girders, optimum depth, and design of main section.	CO 5	Remember
10	a	ACE012.22	Understand the design of end bearing stiffness and intermediate stiffness	CO 5	Understand
	b	ACE012.23	Analyze the Connection between web and flange and design of flange splice and web splices	CO 5	Remember

Signature of Co-Ordinator **HOD, CE**