Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE401

Course Name: - DESIGN OF STEEL STRUCTURES

Max. Marks: 100 Duration: 3 Hours

(Use of IS800, IS875, IS883 are permitted)

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Explain the failures of bolted joints. (5)

b) Design a lap joint between the two plates of width 150 mm, if the thickness of one plate is 12 mm and the other is 10 mm. The joint has to transfer a working load of 100 kN. The plates are of Fe 410 grade. Use bearing type bolts. (10)

2 a) Write any six features of structural steel (3)

b) An ISMC 250 @ 298kg/m is used as a tie member to transmit a factored load of 800kN. The channel section is connected to a gusset plate of 10mm thickness. Design a fillet weld if the lap length is limited to 300mm. Provide slot welds if required. (12)

3 a) With the help of suitable diagram, explain the concept of shear lag. (3)

b) Design a suitable double angle section to carry a factored tensile load of 450 kN. The length of the member is 2.9m.Use M20 bolts of 4.6 grade. The grade of steel is Fe410. (12)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a built-up column consisting of two channels placed back to back to carry an axial factored load of 1900kN. Design bolted single lacing system also. Length of the column is 10m and both the ends of the column are effectively restrained in direction and position (15)

5 a) Briefly describe the types of foundations used for columns. (5)

b) Design a gusseted base for a column ISHB 350 @72.4 kg/m with flange plates 450 × 20mm carrying a factored axial force of 3000kN. The column rests on M20 grade concrete pedestal. Design the bolted connection also. Assume Fe 410 grade steel and 4.6 grade bolts. (10)

6 a) Distinguish between laterally restrained and unrestrained beams. (4)

b) A conference hall 8mx12m is provided with a 120 mm RCC slab over rolled steel I beams spaced 4m centre to centre. The super imposed load is 4kN/m^2 and floor finish of 1.5 kN/m^2. Design one of the beam as laterally supported. (11)

PART C

Answer any two full questions, each carries 20 marks.

7 a) A roof truss shed is to be built in Chennai for an industry .The size of shed is 20mx8m.The height of building is 10m at the eaves. Determine the basic wind pressure. (5)

b) A purlin is to be designed to support a GI sheet as roofing material for a truss spaced at 3.5m c/c. purlin along the principal rafters are arranged at a distance of 1.35mc/c. The pitch of truss is 0.2m. Design a section for the purlin. Assume basic wind speed as 44m/s. (15)

8 Design a fan type roof truss for a span of 9m, with 4m spacing, using GI sheets. Slope of rafter 30^0. The wind pressure is 1.15kN/m^2 (20)

9 a) Find the safe axial load of a column, made of salwood, of size 200mm x200mm for inside location having an unsupported length of 5m (5)

b) What are the deflection considerations for the design of timber structures. (5)

c) A flitched beam is made of timber joists 100mm x 220mm with a steel plate of size 20mm x 160mm placed symmetrically between them and firmly attached to both.. Calculate the moment of resistance of the combined section when the maximum bending stress in timber is 8N/mm^2. Take Es= 20 Ew (10)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CE401

Course Name: - DESIGN OF STEEL STRUCTURES

Max. Marks: 100 Duration: 3 Hours

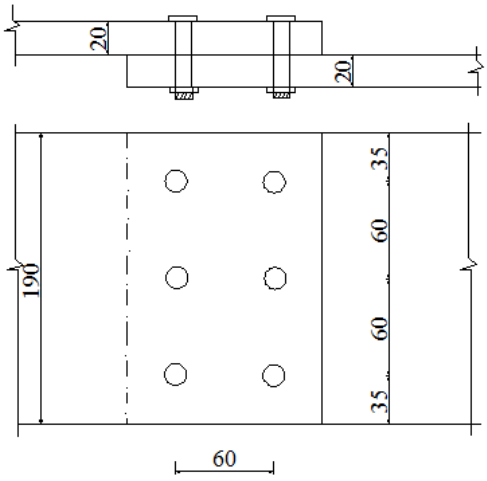
(Use of IS800, IS875, IS883 are permitted)

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Sketch different types of bolted connections (3)

b) Find the efficiency of the lap joint shown in Fig.1. Given M20 bolts of grade 4.6 and Fe 410 plates are used. (12)



Dimensions in mm

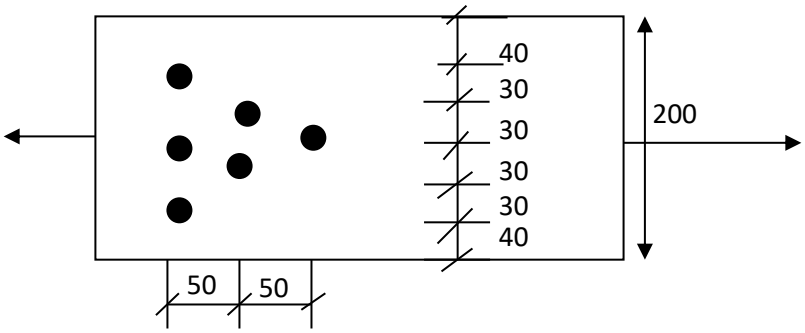
Fig.1

2 a) Explain different types of weld (3)

b) Determine the tensile strength of ISA 125 x 95 x 8 mm connected to the gusset plate of 10mm through the shorter leg by 4, M20 bolts arranged in one row. The grade of steel is Fe410. Take p = 65 mm ,Edge & End distance = 40mm (12)

3 a) Explain the purpose of lug angles in tension member connection? (3)

b) Determine the design tensile strength of the plate 200 x 10mm with the holes as shown below if the yield strength and ultimate strength of steel are 250MPa and 410MPa. M20 bolts and 10mm thick gusset plates are used. (12)



PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a column 10 m long to carry a factored axial load of 1100kN.The column is restrained in position but not in direction at both ends. Design a batten system for the column. Assume that the two channels are kept back to back. (15)

5 a) Explain the failure modes of axially loaded columns (5)

b) Determine the design load capacity of the column ISHB 300@577 N/m if the length of the column is 3m and its both ends are hinged. (10)

6 a) What are the cross section classification defined in IS 800-2007 based on slenderness of plate elements? (3)

b) Design a simply supported beam of 10m effective span carrying a total factored load of 60kN/m. The depth of beam should not exceed 500mm. The compression flange of beam is laterally supported by floor construction. Assume stiff end bearing is 75mm. (12)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Determine the design forces in the members of a Fink type roof truss for an industrial building for the following data. Overall size of building : 48 x16m., C/c spacing of trusses: 8m , Rise of truss :1/4 of span , Self weight of purlins : 318 N/m., Height of columns : 11m. Roofing : A C sheets (171N/m^2), Location : Agra. (20)

8 a) Derive the expression for calculating the force **F** in a bolt subjected to a factored load P at an eccentricity **e.** The line of action of the load is in the plane of the bolted connection and the centre of gravity of the connection is the centre of rotation. (4)

b) The trusses for a factory building are spaced at 6 m c/c. and the purlin is spaced at (16)

2m c/c. The pitch of truss is 28^0 and span of truss is 18m. The roof consists of asbestos sheets with 150 N/m^2.Design a suitable I section purlin

9 a) Design a beam of clear span 3m at spacing of 1.5m in a roof. The bearing at each end is 30cm. The dead load of roof covering is $2kN/m^2$ and live load is 2.5 kN/m^2. Assume that teak wood is used. (15)

b) Classify the timber based on grades, modulus of elasticity, durability, location and treatability. (5)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CE401

Course Name: - DESIGN OF STEEL STRUCTURES

Max. Marks: 100 Duration: 3 Hours

(Use of IS 800, IS875, IS883 are permitted. Assume suitable data wherever necessary)

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) What do you mean by prying forces? (3)

b) Design a double cover joint between the two plates of width 300 mm, if the thickness of one plate is 18 mm and the other is 10 mm. The joint has to transfer a working load of 260 kN. The plates are of Fe 410 grade. Use bolt of grade 4.6. (12)

2 a) A tie member of a roof truss consisting of an angle section ISA 75 x75x10 of Fe 410 grade, is welded to a 10mm thick gusset plate. Design a weld to transmit a load equal to full strength of the member. Assume shop welding. (10)

b) Under what circumstances do we use slot welds and plug welds? (2)

c) Explain block shear failure. (3)

3 a) What is a lug angle? (3)

b) Design a bridge truss diagonal carrying a pull of 200kN using double angle section. The centre to centre distance of intersections is 3m. The member is subjected to reversal of stresses. (12)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a built-up column consisting of two channels placed back to back to carry an axial factored load of 1500 kN. Length of the column is 6m and the column is restrained in position but not in direction at both ends. Provide single lacing system with bolted connection. (13)

b) What are the main purpose of lacings and battens? (2)

5 a) Illustrate the different elements of plate girder. (5)

b) Design a suitable slab base for a column section ISHB 200@ 365.9N/m supporting an axial load of 500 kN. The base plate is to rest on a concrete pedestal of M20 grade (10)

concrete. The load is transferred to the base plate by welded connection.

6 a) What is lateral torsional buckling of beams? (2)

b) Design the simply supported main beam of a building supporting concrete floor slab with the following data: (13)

Centre to centre distance of beams – 6m

Span of beam – 7m

Thickness of concrete slab – 240mm

Finished screed – 40mm thick

Weight of concrete slab and finished screed- 24kN/m^3

Imposed load – 4kN/m^2

PART C

Answer any two full questions, each carries 20 marks.

7 a) Design a purlin on a sloping roof truss with the dead load of 0.15 kN/m^2, a live load of 2.5 kN/m^2 and a wind load of 0.6 kN/m^2 (suction) . The purlins are 1.8m centre to centre and a span of 3.8m, simply supported on a rafter at a slope of 20^0. (16)

b) A roof truss has a span of 20m and a rise of 4m is placed at 3.5m c/c. calculate the live load on the roof truss. (4)

8 a) The details of a shed situated in Thiruvananthapuram is given below (10)

Span of truss – 15m

Rise of truss – 4m

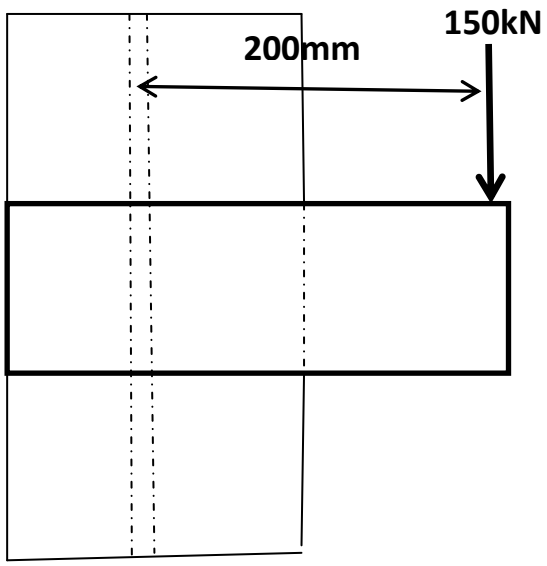
Eaves height – 8m

Spacing of truss – 3m

Spacing of purlin – 4m

Find the design wind pressure and wind load on purlin.

b) Design the bracket connection shown below. The connection supports a load of 150kN. The column section is ISHB 150@ 300.19N/m. The thickness of bracket plate is 10mm. Use M16 bolts of grade 4.6. (10)



9 a) Design a beam of clear span 4m at spacing of 2 m centre to centre in a roof for a residential building. The bearing at each end is 250 mm . The dead load of roof covering is 1.5 kN/m^2 and live load is 3 kN/m^2. Assume that deodar wood is used. (15)

b) Explain briefly classification of timber. (5)

****

Reg No.:_____ 00000CE401121904 Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S7 (S) Examination Sept 2020

Course Code: CE401

Course Name: - DESIGN OF STEEL STRUCTURES

(Use of Codes IS 800, IS 875, IS 883 . Assume suitable data wherever necessary)

Max. Marks: 100 Duration: 3 Hours

PART A

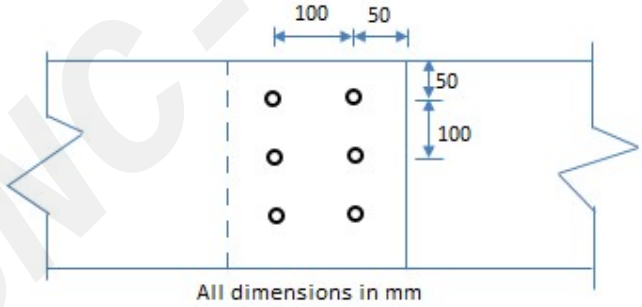
Answer any two full questions, each carries 15 marks. Marks

1 a) Sketch and briefly explain any three failure patterns of bolted connection. (3)

b) Design a tension member to carry an axial factored load of 500kN. Use a double angle rolled steel section connected (at site) to each side of a gusset plate of 10mm thick using 20mm diameter bolts of grade 4.6. (12)

2 a) What is shear lag? How it can be reduced? (5)

b) Determine the strength and efficiency of a bolted lap joint shown in figure. The bolts are of 20mm diameter, grade 4.6. The plates are of 12mm thick and grade Fe410. (10)



3 a) Differentiate between bearing type connection & friction type connection. (5)

b) A tie member consisting of an angle section ISA100x75x8, designed to transfer a factored axial load of 280kN, is to be welded to a gusset plate of 10mm thick, using 6mm fillet weld. Design the weld, if the weld is provided on three sides by overlapping the angle on the gusset plate, at a shop. Also sketch the connection showing the weld lengths. (10)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Explain the classification of cross sections as per the IS 800: 2007 based on yield and plastic moments & rotational capacities. (5)

b) Determine the design compressive load capacity of a column made of a rolled steel section ISMC200@217N/m if length of the column is 3m, with both ends fixed. (10)

5 a) Differentiate between web buckling & web crippling. (5)

b) An ISLB600@976.1N/m has been used as a simply supported beam over a span of 7.2m. Determine the safe uniform load that the beam can carry in flexure if the compression flange of the beam is restrained against lateral buckling. (10)

6 a) Design a built up column with two channels placed back-to-back and separated apart. The column is of 6m effective length and supports a factored load of 1500kN. Also design the bolted lacing system. (15)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Explain various loads and load combinations to be considered in the design of a roof truss. (4)

b) Design an I section purlin for an industrial building, located at Chennai, with Galvanised iron sheets as the roofing material. (16)

Span of the truss =13m

Spacing of trusses = 6m c/c

Spacing of purlins = 1.2m c/c

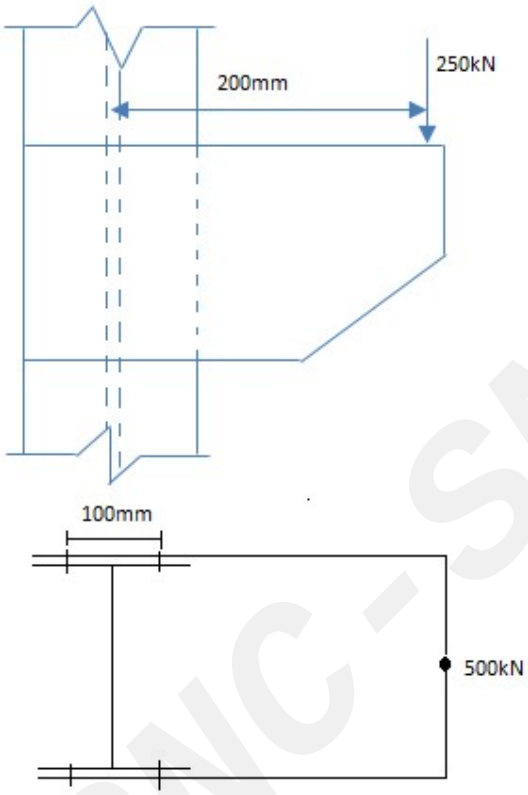
Wind pressure intensity = 2 kN/m^2

Weight of GI sheets =130N/m^2

Grade of steel : Fe 410

8 a) Classify the timber based on grades, modulus of elasticity, durability, location and treatability. (5)

b) Design a bolted bracket connection (in plane) to support an end reaction of 500kN due to the factored loads supported by the beam, as shown in figure below. The eccentricity of the end reaction is 200 mm. The steel used is of grade Fe410 and bolts are of 20mm diameter, grade 4.6. The thickness of bracket plate may be taken as 10 mm. The column section is ISHB200 @366N/m. (15)



9 a) Write a note on grouping of timber based on modulus of elasticity & extreme fibre stress as per IS 883: 1994. (4)

b) Design a Teak wood beam to carry a uniformly distributed load of 15kN/m including self weight of the beam. The beam is simply supported over a clear span of 6m & the width of end bearings is 300mm. (16)

****

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: CE401

Course Name: DESIGN OF STEEL STRUCTURES

(Use of IS 800, IS 875, IS 883 are permitted. Assume suitable data wherever necessary)

Max. Marks: 100 Duration: 3 Hours

PART A

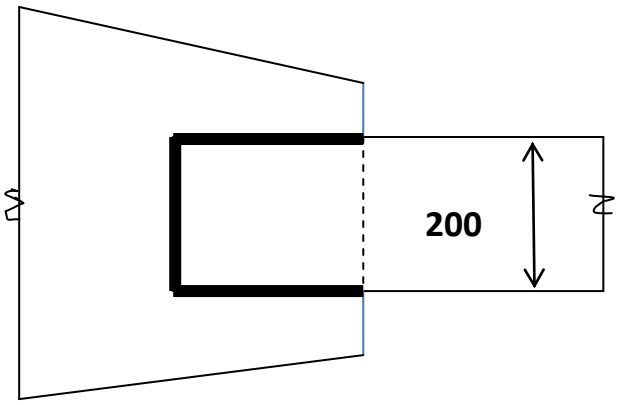
Answer any two full questions, each carries 15 marks. Marks

1 a) What are the three classifications of loads as per IS 800: 2007 (3)

b) Two flat plates (Fe 410 Grade Steel), each 240 mm x 10mm are to be jointed using 20 mm diameter, 4.6 grade bolts, to form a lap joint. The joint is supposed to transfer a working load of 200 kN. Design the joint and also find the efficiency of joint. (12)

2 a) An ISLC 350 @38.8kg/m is used to transmit a factored force of 1000kN. The channel section is connected to a gusset plate 12 mm thick. Design a fillet weld if the overlap is limited to 350 mm. Use slot welds if required. (10)

b) A tie member in a truss girder is 200 mm x 14 mm in size. It is welded to a 10mm thick gusset plate by a fillet weld. The overlap of the member is 350 mm and the weld size is 6 mm. Determine the design strength of the joint (5)



3 a) Design a single angle tension member subjected to a factored tensile load of 270kN. The length of the diagonal is 3.0 m. The tension member is connected to a (12)

gusset plate 12 mm thick with one line of 20 mm diameter bolts of grade 4.6. Use steel of grade Fe 410.

b) Explain shear lag effect. (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a column to support a factored load of 1100 kN. The column has an effective length of 7.0 m with respect to z-axis and 4.5 m with respect to y-axis Use steel of grade Fe 410. (10)

b) Design a suitable slab base for a column section ISHB 350@ 710.2N/m supporting an axial load of 1000 kN. The base plate is to rest on a concrete pedestal of M20 grade concrete. The load is transferred to the base plate by direct bearing of column flanges. Use steel of grade Fe 410. (5)

5 Design a built-up column consisting of two channels placed back-to-back to carry an axial factored load of 1600 kN. Length of the column is 7m and the column is restrained in position but not in direction at both ends. Also design the bolted lacing system. Use grade Fe 410. (15)

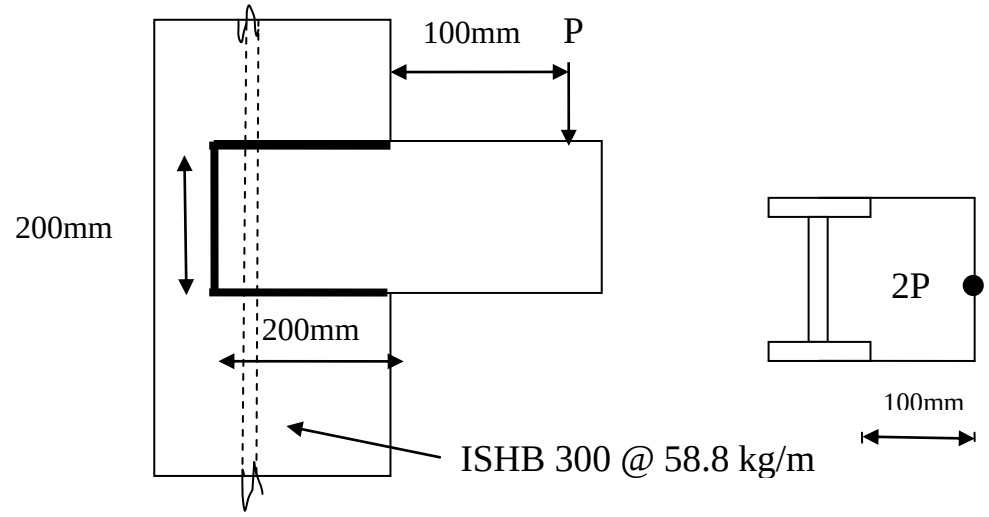
6 a) A conference hall 8m x 18m is provided with a RCC slab over rolled steel beams spaced 3m centre to centre. Design the simply supported main beam supporting concrete floor slab if thickness of concrete slab is 120mm and a wearing coat of 40mm thick is provided over the slab. Weight of concrete slab and wearing coat is $24kN/m^3$. (12)

b) List the different elements of a welded plate girder. (3)

PART C

Answer any two full questions, each carries 20 marks.

7 a) A bracket plate is used to transfer the reaction of a beam to a column flange as shown in Fig. The bracket plate is connected to the column flange by a 6 mm fillet weld. Compute the maximum load that can be placed over the bracket plates at a distance of 100 mm from the flange of the column section. (10)



b) A roof truss has a span of 12m and a rise of 2.5m is placed at 4m c/c. Calculate the live load on the roof truss. (4)

c) Determine the design wind pressure on a pitched roof near Pune (6)

Given Structure:

An industrial shed situated on flat terrain with sparsely populated buildings.

The span of roof truss is 18 m and rise is 3 m

Height of building at eaves: 10 m

8 a) A deodar wood column of 3m unsupported length has a cross section of 150mm x 200mm. Calculate the safe axial load carrying capacity of column when used for outside location. (6)

b) Design an I section purlin for an industrial building with Galvanised iron sheets as the roofing material. (14)

Spacing of trusses = 6m c/c Spacing of purlins = 1.5m c/c

Inclination of main rafter to horizontal - 30^0 Wind pressure = 2 kN/m^2

Live load = 1kN/m^2 Weight of GI sheets =130N/m^2

Grade of steel : Fe 410

9 a) Design a Sal wood timber joist of clear span 6m placed at centre to centre spacing of 3m in a roof. The bearing at each end is 30cm. The dead load of roof covering is 1.5kN/m^2 and live load is 3 kN/m^2 (15)

b) Classify the timber based on modulus of elasticity, durability, and treatability. (5)

****