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320731(20)

B. E. (Seventh Semester) Examination, Nov.-Dec. 2021

(New Scheme)

(Civil Engg. Branch)

STRUCTURAL ENGINEERING DESIGN-III

Time Allowed : Four hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) is compulsory in each question. Attempt any* ***one*** *part from part (b) & (c) for question having 14 marks. Use IS 800 : 2007 & Steel Table permitted. Assume suitable data and draw neat sketch wherever required. Right side digit indicates marks.*

Unit-I

1. (a) What is tension field action in plate girders? 2

   (b) Design a welded plate girder of span 24 m to carry superimposed load of 35 kN/m. Avoid use of

bearing and intermediate stiffness. The girder is laterally restrained. Use steel of grade Fe 410 and assume yield stress of steel to be 250 MPa. 14

(c) Design a welded plate girder 24 m in span and laterally restrained throughout. It has to support a uniform load of 100 kN/m throughout the span exclusive of self-weight. Design the girder for intermediate transverse stiffners. The steel for the flange and web plates is of grade Fe 410. Yield stress of steel may be assumed to be 250 MPa irrespective of the thickness of plates used. Connections need not be designed. Design the cross section, the end load bearing stiffener. Use post-critical method for the design. 14

Unit-II

2. (a) What is need of using equivalent uniform moment factor in the design of beam-columns? 2

(b) Check the adequacy of a beam-column ISHB 450 @ 855·4 N/m for the factored loads as shown in Fig. (a). The column is part of a non-sway frame with bottom end hinged. The effective length of the

member is 3·5 m about both the axes. Steel is of grade Fe 410. 14

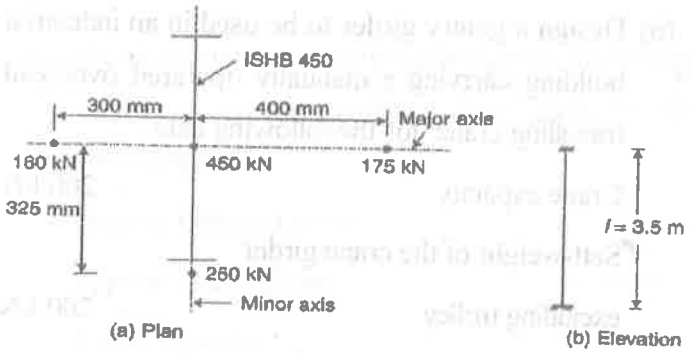

Fig. (a)

(c) Design an I-section truss member for the following data.

Effective length of the member : $L = 3{\cdot}5$ m

Factored axial tension : $T = 450$ kN

Factored moment at the two ends of the member about strong axis :

$M_z = 35$ kNm and 20 kNm, respectively,

Steel of grade : Fe 410 14

Unit-III

3. (a) Differentiate between surge load and drag load as applied to gantry girders carrying cranes. 2

(b) Design a gantry girder to be used in an industrial building carrying a manually operated overhead travelling crane, for the following data :

Crane capacity	– 200 kN
Self-weight of the crane girder excluding trolley	– 200 kN
Self-weight of the trolley, Electronic motor, hook, etc.	– 40 kN
Approximiate minimum approach of the crane hook to the gantry girder	– 1·20 m
Wheel base	– 3·5 m
c/c distance between gantry rails	– 16 m
c/c distance between columns (span of gantry girder)	– 8 m
Self-weight of rail section	– 300 N/m
Diameter of crane wheels	– 150 mm

Steel is of grade Fe 410. Design also the field welded connection if required.

The support bracket connection need not be designed. 14

(c) Design a simply supported gantry girder to carry an electric overhead travelling crane, given for the following data : 14

Span of Gantry Girder	– 6·5 m
Span of crane girder	– 16 m
Crane capacity	– 40 kN
Self-Weight of Crane Girder Excluding Trolly	– 200 kN
Self-Weight of Trolly	– 50 kN
Minimum Hook approach	– 1·0 m
Distance Between Rail	– 3·5 m
Self-Weight of Rail	– 0·3 m

Unit-IV

4. (a) Explain flexible, rigid or semi-rigid connection. 2

(b) Design a seat connection for a factored beam end reaction of 110 kN. The beam section is ISMB 250 @ 365·9 N/m connected to the flange of column section ISHB 200 @ 365·9 N/m using bolted connections. Steel is of grade Fe-410 and bolts of grade 4·6. 14

(c) Design an un-stiffened welded seat connection for a beam ISMB 250 @ 365·9 N/m transmitting an end reaction of 110 kN, due to the factored loads, to the flange of column ISHB 200 @ 365·9 N/m. The seat angle is welded to the column flange in work-shop. 14

Unit-V

5. (a) What are secondary stresses in roof trusses? 2

(b) Design the principal tie member of a fink type roof truss for the following data. Design also its connection with a 12 mm thick gusset plate using 20 mm diameter bolts of grade 4·6. Use steel of grade Fe 410. 14

Design tensile force 150 kN (due to D.L. and L.L.)

Design compressive force 40 kN (due to D.L. and W.L.

(c) Design a strut in a roof truss for the following data : 14

Length of the strut	= 2·235 m
Factored compressive force	= 50 kN (due to D.L. and L.L.)
Factored tensile force	= 17·80 kN (due to D.L. and W.L.)
Grade of steel	= Fe 410
Grade of bolts	= 4·6
Bolt diameter	= 20 mm