University of Mumbai

Program: **Civil Engineering**
Curriculum Scheme: Rev 2019
Class: TE Semester VI
Course Code: CEC601 and Course Name: Design & Drawing of Steel Structures

SAMPLE QUESTION BANK

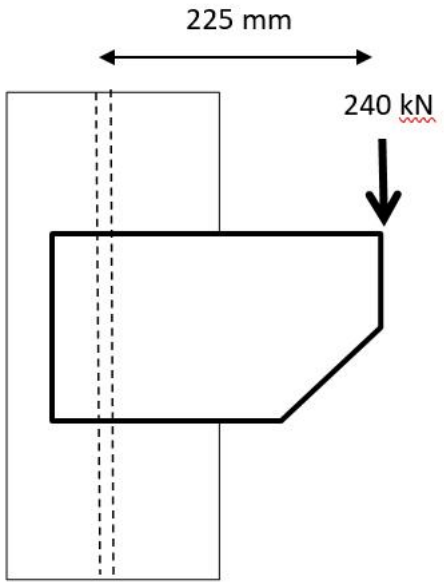
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	The value of imperfection factor for a compression member for buckling class "a" is-
Option A:	0.34
Option B:	0.45
Option C:	0.21
Option D:	0.76
2.	Depth of intermediate batten is taken as_____ times the depth of end batten
Option A:	1/2
Option B:	3/4
Option C:	1
Option D:	2
3.	If effective height of laced built-up column is 10 m & minimum radius of gyration (r_{zz}) of the channel section is100mm, then the Effective slenderness ratio of laced column shall be-
Option A:	105
Option B:	110
Option C:	100
Option D:	120
4.	In case of Plate Girder to prevent the local crushing of the web due to concentrated Loading following stiffener is provided
Option A:	Bearing stiffeners
Option B:	Diagonal stiffeners
Option C:	Intermediate transverse web stiffeners
Option D:	Load carrying stiffeners
5.	If Bolt diameter d=30mm, then d0,e & p respectively are
Option A:	32,50 & 75mm
Option B:	32,45 & 65mm
Option C:	33,50 & 65mm
Option D:	33,50 & 75mm
6.	As per IS 875 the mean probable design life span for a hospital building is taken as
Option A:	5 years
Option B:	25 years
Option C:	50 years

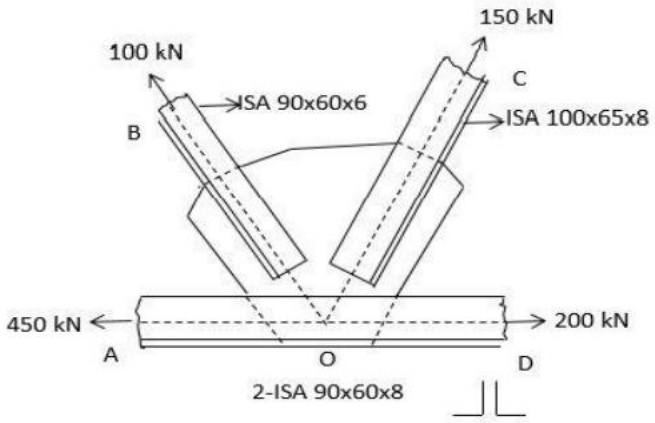
Option D:	100 years
7.	Thickness of Single lacing should
Option A:	Not be less than 1/40th of the effective length
Option B:	Not be less than 1/50th of the effective length
Option C:	Not be less than 1/60th of the effective length
Option D:	Not be less than 1/25th of the effective length
8.	What is the minimum specified overlapping length of fillet weld?
Option A:	Two times the size of weld or 60mm whichever is smaller
Option B:	Four times the size of weld or 60mm whichever is smaller
Option C:	Four times the thickness of Plate or 40mm whichever is larger
Option D:	Half the size of weld or 40mm whichever is larger
9.	For the bolt of grade 5.6 the yield stress ‘fy’ in Mpa is
Option A:	240 Mpa
Option B:	500 Mpa
Option C:	600 Mpa
Option D:	300 Mpa
10.	Area of openings for buildings of large permeability is more than
Option A:	10% of wall area
Option B:	20% of wall area
Option C:	30% of wall area
Option D:	50% of wall area
11	What is the net section area of steel plate 40cm wide and 10mm thick with one bolt if diameter of bolt hole is 18mm?
Option A:	38.2 cm^2
Option B:	20 cm^2
Option C:	240 mm^2
Option D:	480 mm^2
12.	The effective length of fillet weld of length 200 mm and size 12 mm is
Option A:	188 mm
Option B:	176 mm
Option C:	388 mm
Option D:	200 mm
13.	What is the intensity of imposed load on the plan area of a roof truss with 20° slope ? Consider access is not provided accept for maintenance.
Option A:	0.55 kN/m^2
Option B:	0.75 kN/m^2
Option C:	0.45 kN/m^2
Option D:	0.4 kN/m^2

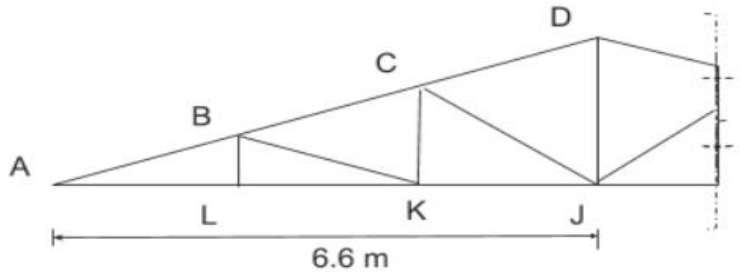
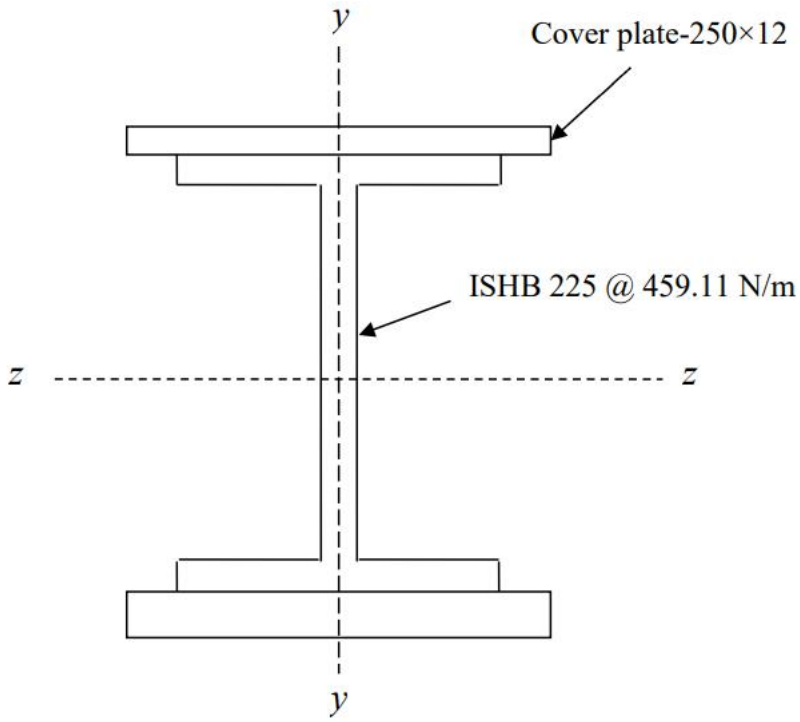
14.	Twp plates of 16 mm and 14 mm thickness are joined by filled weld,the maximum size of filled weld will be
Option A:	18.5 mm
Option B:	17.5 mm
Option C:	12.5 mm
Option D:	15.5 mm
15.	What is the mass density of steel ?
Option A:	7150 kg/m^3
Option B:	7850 kg/m^3
Option C:	6850 kg/m^3
Option D:	2400 kg/m^3
16.	A 16 mm diameter bolt of grade 4.6 is in single shear.The shearing strength of bolt will be……. (assume threads in shear planes)
Option A:	29 kN
Option B:	58 kN
Option C:	45 kN
Option D:	90 kN
17.	If the ultimate stress of fillet weld is 400 MPa and the effective throat thickness is 4.5 mm .Calculate strength of weld in case of site welding ?
Option A:	284 N/mm
Option B:	400 N/mm
Option C:	589 N/mm
Option D:	693 N/mm
18.	What is the shear lag width for ISA 100X75 X 10 in case of bolted connection (outstanding leg is shorter side , assume gauge distance as 45 mm)
Option A:	100 mm
Option B:	130 mm
Option C:	105 mm
Option D:	110 mm
19.	What is the shear lag width for ISA 75 X75 X 8 in case of welded connection
Option A:	75 mm
Option B:	80 mm
Option C:	65mm
Option D:	83 mm
20.	The design bending strength of laterally unsupported beams is governed by
Option A:	Torsion
Option B:	Bending
Option C:	lateral torsional buckling
Option D:	yield stress

21.	Local buckling can be prevented by
Option A:	changing load on member
Option B:	changing material
Option C:	increasing width-thickness ratio
Option D:	limiting width-thickness ratio
22.	Clip and seating angle connection is provided for
Option A:	lateral support
Option B:	bending support
Option C:	frictional support
Option D:	hinged support
23.	Lacing shall be designed to resist a total transverse shear equal to ____ of axial force in member
Option A:	5%
Option B:	1%
Option C:	4.3%
Option D:	2.5%
24.	A plate girder is used when
Option A:	span is large and loads are heavy
Option B:	span is small and loads are heavy
Option C:	span is small and loads are light
Option D:	span is large and loads are light
25.	Which of the following causes web buckling in plate girder?
Option A:	diagonal tension and diagonal compression
Option B:	diagonal tension
Option C:	diagonal compression
Option D:	neither diagonal tension nor diagonal compression
26.	Which of the following assumptions is not an ideal beam behavior?
Option A:	compression flange of beam is restrained from moving laterally
Option B:	compression flange of beam is not restrained from moving laterally
Option C:	any form of local buckling is prevented
Option D:	local and lateral instabilities of beam are prevented
27.	A beam can be subjected to which of the following shear?
Option A:	beam is not subjected to shear
Option B:	longitudinal or transverse shear
Option C:	transverse shear only
Option D:	longitudinal shear only

28.	The flange is classified as plastic if outstand element of compression flange of rolled section is less than
Option A:	9.4ε
Option B:	8.4ε
Option C:	10.5ε
Option D:	15.7ε
29.	The strength of compression members subjected to axial compression is defined by curves corresponding to _____ classes
Option A:	e, f, g
Option B:	b, e, f
Option C:	a, d
Option D:	a, b, c and d
30.	Long compression members will _____
Option A:	buckle plastically
Option B:	buckle elastically
Option C:	buckle inelastically
Option D:	not buckle

	Sample Questions 05 Marks each
Q 1)	A single unequal angle 100 X 65 X 6 is connected to a 10 mm thick gusset plate at the ends with 16 mm diameter bolts to transfer tension. Determine the design tensile strength if the gusset is connected to a) a longer leg and b) a shorter leg.
Q 2)	Design a batten column that consists of two ISMC 300 @ 351.2 N/mm placed back-to-back, carrying a factored load of 1000 kN. The built-up column is restrained in position but not in direction at both ends.
Q 3)	Design a bolted bracket connection to support an end reaction of 240kN due to factored load, the column section is ISHB 200@392.4N/m and the load acts at an eccentricity of 225 mm from the web of the column, the thickness ss of bracket plate may be taken as 12 mm and bolt diameter as 20 mm. 

Q 4)	Design channel section purlins for an industrial building roof for the following data: • Distance between c/c of trusses = 5.0 m • Distance between c/c of purlins = 1.60 m • Inclination of the roof surface to the horizontal = 30° • Weight of G.I. sheets = 133.1 N/mm2 Wind load normal to the roof = 1500 N/m2 The steel of grade: Fe 410
Q 5)	A discontinuous strut of length 3.5 m consists of two unequal angles ISA 100×75×10 and is connected to a 12 mm thick gusset plate by its longer leg on the opposite side of the gusset plate. Determine the strength of the member (Take an effective length of the strut as 0.85 times the true length)
Q 6)	Calculate the number of M20, grade 4.6 bolts required for the connection of the member AD as shown in the figure. (Thickness of gusset plate = 12 mm, Assume pitch and gauge distance 60 mm and 40 mm respectively) 
Q 7)	An ISMB 500 @852.5 N/m transmits an end reaction of 300 kN and a bending moment of 150 kNm, under factored loads, to the flange of a column 300 @576.8 N/m.Design the welded connections.
Q 8)	An ISA 90 × 90 × 8 used as tension nemembers connected to a 10 mm gusset plate by a fillet weld of size 5 mm. The design strength of the member is 300 kN. Calculate the length of the weld.
Q 9)	Design member AB as a compression member. The structure is situated in Mumbai industrial area with a rise of 1/3. • Spacing between trusses- 3 m • Span of truss- 13.2 m • Self-weight of Purlin- 220 N/m • Weight of GI sheets= 150 N/m^2

	Value of K_1= 1.0, K_2= 0.98, K_3= 1.0 and (C_{pe} - C_{pi}) = - 0.3 
Q 10)	A compound column consisting of ISHB 225 @ 459.11 N/m with one cover plate of 250×12 mm on each flange (as shown in the figure). Calculate the minimum radii of gyration for the compound section. 
Q 11)	Design a laced column 11 m long to carry the factored axial load of 1080 kN. The column is restrained in position but not in direction at both ends. Provide a single lacing system. Use 2 channel sections placed toe to toe. Assume steel of grade Fe 410 and bolts of grade 4.6. Design the lacing system with bolted connections.
Q 12)	A Column ISHB 300@576.83 N/m strengthened with two cover plates of size 350 x 20mm to carry factored axial load of 2000kN, Calculate size, thickness, and the number of bolts required for the Gusset base assuming M20 concrete grade and 24mm bolt diameter, draw diagrams showing all details.
Q 13)	Design a welded plate girder of span 22 m and laterally supported throughout. It supports a UDL of 85 kN/m throughout the span exclusive of self-weight. Design central section of plate girder for bending and shear. Use Fe 410
Q 14)	Design a laterally unsupported beam for the following data. • Effective span: 4 m • Maximum bending moment: 550 kN-m

	• Maximum shear force: 200 kN The steel of grade: Fe 410
Q 15)	Design a beam of span 6.50 m to carry a uniformly distributed factored load of 20 kN/m and two concentrated factored loads of 100 kN each at 2 m, from either end of the beam. The rolled steel I-section available is ISMB (Fe-410 grade steel). Design the beam section if the compression flange is supported laterally.

	Sample Questions 10 Marks each
1	A diagonal member of a roof truss carries a maximum pull of 300 kN.Design the section and its connection with 16 mm thick gusset plate .The length of connection is limited to 340 mm. Use Fe 410 and grade of bolt 4.6 .
2	Design a built up column using batten system 9 m long to carry a factored axial load of 1300 kN.Column is fixed at both ends .Assume the channel sections placed back to back and use 4.6 grade bolts for connection .Draw neat sketch to show details of design
3	A Column ISHB 300@576.83 N/m strengthened with two cover plates of size 350 x 20mm to carry factored axial load of 2000kN, Calculate size, thickness and number of bolts required for the Gusset base assuming M20 concrete grade and 24mm bolt diameter, draw diagrams showing all details.
4	Design a welded plate girder of span 18 m and laterally supported throughout. It supports a UDL of 85 kN/m throughout the span exclusive of self weight .Design central section of plate girder for bending and shear.Use Fe 410
5	An ISMB 500 @852.5 N/m transmits an end reaction of 300 kN and bending moment of 150 kNm,under factored loads,to flange of a column 300 @576.8 N/m.Design the welded connections.
6	Determine the design bending stress of ISLB 350 @486 N/m ,considering the beam to beam a) Laterally supported b) Laterally unsupported .Design Shear Force V is less than the design shear strength .The unsupported length of the beam is 3.0 m .Assume steel grade as Fe 415.
7	Design a double angle discontinuous strut to carry a factored load of 135 kN .The length of the strut is 3.0 m between intersections .The two angles are placed back to back with long leg connected .Use Fe 410. i)Angles are placed on opposite side of 12 mm gusset plate. ii) Angles are placed on same side of gusset plate.
8	Design a built up column with two channel sections which are placed face to face to support a factored axial compressive load of 1700 kN,if the effective length of column is 6.2 m .Design appropriate section ,spacing between channel and suitable bolted lacing system for d= 20 mm
9	Design a Column to support factored load of 700kN using ISHB section only, the height of column is 7 m and both the ends of column are fixed. Use steel of grade Fe410.
10	A column ISHB350@710.2 N/m carries an axial compressive load of 2000kN. The base rests on M25 grade of concrete pedestal. Design a bolted gusset base using 25mm thick gusset plate, calculate ONLY the dimensions of base plate (Size and thickness) & number of bolts required if bolt diameter = 24 mm (no need to calculate dimensions of gusset plate)
11	A tie member in roof truss consists of ISA 75x75x6mm. Determine the safe load that can be carried by the member if: (i) Angles are provided on the same side of gusset plate (ii) Angles are provided on either side of gusset plate

	Assume 16mm dia. rivets for connection
12	Design a welded stiffened seat connection to support ISMB 350 @ 514 N/m with the flange of column section ISHB 350 @ 710.2 N/m. The beam has to transmit an end reaction of 250kN
13	Design laterally unsupported beam for the span = 4.5m & steel of grade Fe410. The maximum bending moment = 400 kNm The maximum shear force = 230 kN
14	Design a bolted bracket connection for a Column section ISHB 150@ 300.19 N/m to support end reaction of beam of 4.5 m in length which carries factored UDL of 250 kN/m. (assume suitable diameter of bolt) The eccentricity of the end reaction is 250mm, thickness of bracket plate is 15 mm. Steel grade is of Fe410 and bolt is of grade 4.6. For Section ISHB 150@ 300.19 N/m Gauge (g) = 90 mm, thickness of flange (tf) = 9.0 mm
15	Draw the following diagram neatly (1) Double cover double bolted butt joint (top and side view) (3Marks) (2) ISA 100 x 75 x 10 connected to 10 mm thick gusset plate using 4 bolts of 20mm diameter ((Side view and Cross section at bolt) (3 Marks) Web Crippling and Bearing length (4 Marks)
16	A tie member consisting of an ISA 80 mm × 50 mm × 8 mm (Fe 410 grade steel) is welded to a 12 mm thick gusset plate at site. Design welds to transmit load equal to the design strength of the member.
17	A tension member 0.95 m long is to resist a service dead load of 20 kN and a service live load of 60 kN. Design a rectangular bar of standard structural steel of grade Fe 410. Assume that the member is connected by one line of 16 mm diameter bolts of grade 4.6.
18	Design a bridge truss diagonal subjected to a factored tensile load of 300 kN. The length of the diagonal is 3.0 m. The tension member is connected to a gusset plate 16 mm thick with one line of 20 mm diameter bolts of grade 8.8.
19	Design a column of effective length 5.90 m. It is subjected to a factored axial compressive load of 2000 kN. Provide two channels back-to-back connected with battens by site welded connection. Use steel of grade Fe 410.
20	Design a built-up column 9 m long to carry a factored axial compressive load of 1100 kN. The column is restrained in position but not in direction at both the ends. Design the column with connecting system as battens with bolted connections. Use two channel sections back-to-back. Use steel of grade Fe 410.
21	Design a built-up column 10 m long to carry factored axial load of 1080 kN. The column is restrained in position but not in direction at both the ends. Provide single lacing system with bolted connections. Assume steel of grade Fe 410 and bolts of grade 4.6. (a) Design the column with two channels placed back-to-back
22	A simply supported steel joist of 4.0 m effective span is laterally supported throughout. It carries a total uniformly distributed load of 40 kN (inclusive of self weight). Design an appropriate section using steel of grade Fe 410.
23	Design a slab base for a column ISHB 350 @ 710.2 N/m subjected to an factored axial compressive load of 1500 kN. The base rests on concrete pedestal of grade M20.
24	A column ISHB 350 @ 661.2 N/m carries an axial compressive factored load of 1700 kN. Design a suitable bolted gusset base. The base rests on M15 grade concrete pedestal. Use 24 mm diameter bolts of grade 4.6 for making the connections.
25	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 without intermediate transverse stiffeners. 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. Design the cross section, the end load bearing stiffener and connections.