Roll No_____

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION-2017

M.Tech 2nd Semester

COURSE CODE: 12M1WCE212   MAX. MARKS: 35

COURSE NAME: Design of Steel Structures

COURSE CREDITS: 3   MAX. TIME: 2 HRs

*Notes: All questions are compulsory. Carrying mobile phone during examinations will be treated as case of unfair means. Illustrate your answers with neat sketches wherever necessary. For any missing data or information, you are free to make whatever simplifying assumptions that you wish, **provided you supply a credible justification**. Cite the appropriate clause no., table no. and figure no. from IS codes, wherever it is required. IS 800 and IS 808 are allowed. Grade of steel is Fe410, unless noted otherwise.*

Q.1 A built-up beam is fabricated by mounting an ISLC 200 @ 20.61 kg/m over an ISMB 450 as shown [5]
in *Fig # 1*. M12 high strength bolts of grade 8.8 have been used to connect the channel and I section. The beam carries a concentrated load of 250 kN at mid-span as shown in the figure. Calculate the required spacing (pitch) of the bolts. Given $I_{zz} = 39289 mm^4$.
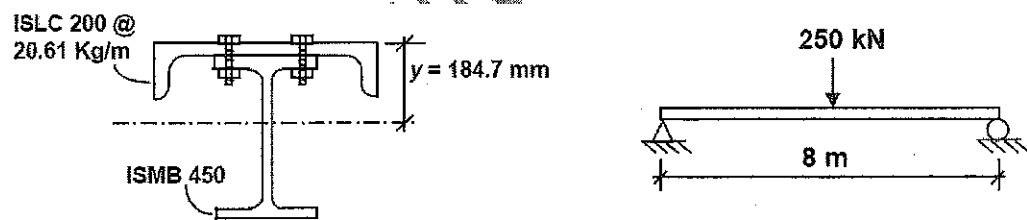

Fig # 1

Q.2 A circular hollow section is used for a simply supported beam to carry the load shown in *Fig #1*. The [5]
section has an outer diameter of 350 mm and wall thickness of 10 mm. Comment on whether the section is adequate to carry the load safely or not. Grade of steel YSt 310 ($f_y = 310 MPa$).

Q.3 A strut of a space frame member having length of 3 m has to carry out a factored compressive load of [5]
230 kN. Design a single angle section to carry the load. Assume the ends are pinned.

Q.4 The details of a plate girder are shown in *Fig # 2*. The girder is simply supported having span of 20 [12]
m. At supports the girder is placed on bearing plates having stiff bearing length of 200 mm. The girder is required to carry a factored banding moment and shear force of 4500 kNm and 2800 kN respectively. (a) Determine the maximum support reaction that can be safely transferred. (b) Determine the shear capacity of the girder utilizing *tension field action*. (c) Design the weld to

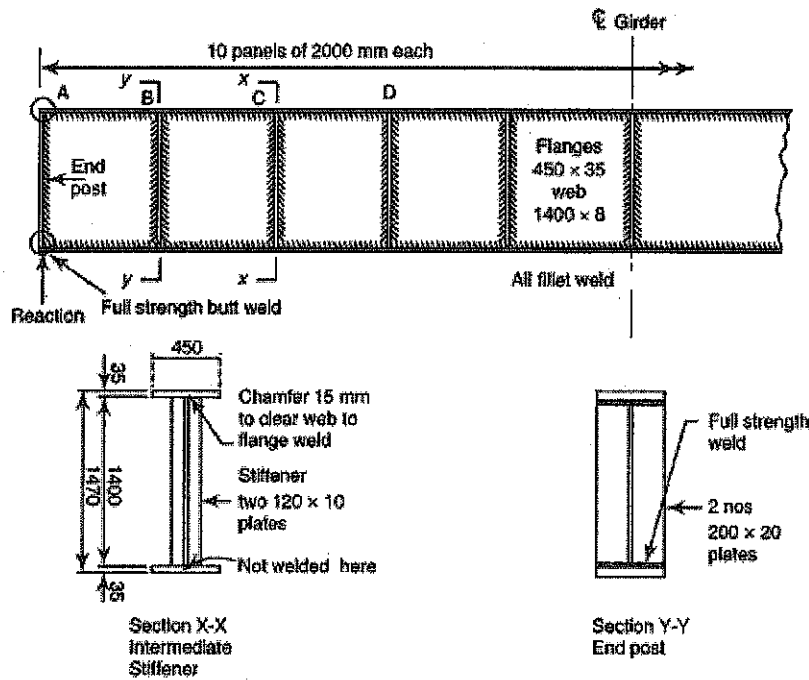connect the end post with the web plate. Also design the weld to connect intermediate stiffeners with the web plate.

Fig # 2

Q.5 A bolted splice is provided for a crane girder to transfer a factored bending moment of 120 kNm and [8] a factored shear force of 80 kN. An ISMB 400 is used for the girder. Assume that the flange splice carries all the moment and the web splice carries only the shear force. A detail of the splice is shown in *Fig # 3*. The crane operates 250 days per year and 6 hrs per day. The crane makes a maximum of three trips per hour. Design life of the building is 50 years. Carry out fatigue assessment as per IS 800-2007 and comment on whether the splice is safe against fatigue failure or not.
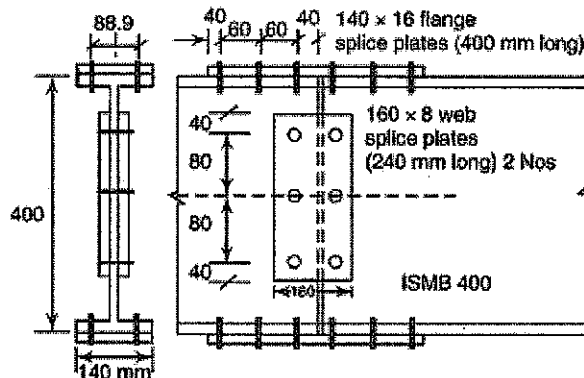

Fig # 3