DEPARTMENT OF CIVIL ENGINEERING: IIT DELHI
SEMESTER II : : 2008-09
CEL 718 : DESIGN OF STEEL STRUCTURES

MAJOR TEST

Max. marks = 45 **Use of IS: 800-2007 is permitted** **Time allowed = 2 hrs.**

1. A simply supported beam is under the action of an axial compressive force P and of a transverse concentrated load Q acting at its mid-span. Derive an expression for the mid-span vertical deflection of the beam.

9 marks

2. A built-up plate girder (I-Section) has been provided with transverse stiffeners at the supports as well as within the span. Using the Simple Post-Critical Method, determine the Nominal Shear Strength of the girder.
Given data : $E = 2 \times 10^5$ MPa $\mu = 0.2$
Depth of the web = 1000 mm
Spacing on intermediate stiffeners = 900 mm
Thickness of the web = 16 mm
Yield Strength of the web = 400 MPa

9 marks

3. a) Determine the Period of Structural Adequacy (PSA) for a steel beam protected against fire by using recommended insulation.
Given data: Ultimate strength of steel = 500 MPa
Maximum allowable stress = 100 MPa
Thickness of fire protection material = 10 mm
Exposed surface area to mass ratio = 4×10^3 mm^2/kg.

b) Compare the effect of sustained elevated temperature on high carbon steels and on work-hardened low carbon steels.

5 +4 = 9 marks

4.a) Determine the Reliability Index against limit state of collapse in flexure of a steel Cantilever under the simultaneous action of total weight F_1 and an end load F_2 for the following details:
Span of the Cantilever = 6 m
Ultimate moment of resistance = R N-m
The mean values and standard deviation values (μ, σ) for F_1, F_2 and R are given as (500 N, 10 N), (5000 N, 500 N) and (30000 N-m, 1000 N-m) respectively.

b) Derive an expression for factor of safety in reference to mean value in terms of standard deviation and target reliability index.

4 + 5 = 9 marks

5. Suggest the detailed step-wise procedure for carrying out the Elastic Analysis and the Limit State Design of steel Moment Frames as per the Codal recommendations.

9 marks