

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS-2022

M.Tech-II Semester (SE)

COURSE CODE (CREDITS): 12M1WCE231 (3)

MAX. MARKS: 35

COURSE NAME: Prestressed Concrete Design

COURSE INSTRUCTORS: Dr. Saurav

MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. A post tension roof girder spanning over 30 has an unsymmetrical I section with a second moment of area of the section of $72490 \times 10^6 \text{ mm}^4$ and an overall depth of 1300mm. The effective eccentricity of the group of parabolic cables at the centre of span is 580 mm towards the soffit and 170 mm towards the top of the beam at supports. The cables carry an initial prestressing force of 3200kN. Estimate the deflections at the following stages and compare them with the permissible values according to the Indian Standard code IS: 1343 limits

[5]

- Instantaneous deflection due to prestress and self weight.
- Resultant maximum long term deflection allowing for loss of prestress and Creep of Concrete.

Given

Self weight= 10.8 kN/m, Live load= 9kN/m, $E_c = 34 \text{ kN/mm}^2$, $\Phi = 1.6$, Loss of prestress= 15%

Q2. A rectangular prestressed beam 150 mm wide and 300 mm deep is used over an effective span of 10m. The cable with zero eccentricity at the supports and linearly varying to 50 mm at the centre, carries an effective prestressing force of 500kN. Find the magnitude of the concentrated load Q located at the centre of the span for the following conditions at the centre of span section:

[5]

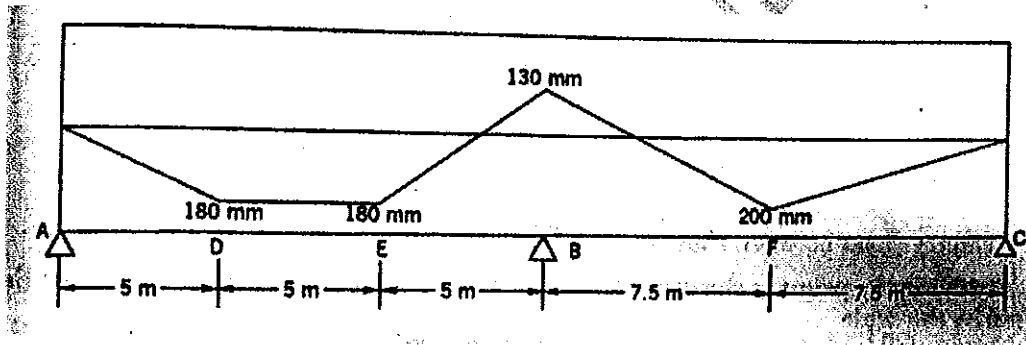
- If the load counteracts the bending effect of the prestressing force neglecting self weight of the beam
- if the pressure line passes to the upper kern of the section under the action of the external load, self weight and the prestress.

Q3. Concrete beam with a single overhang is simply supported at A and B over a span of 8 and the overhang BC is 2m. The beam is of rectangular section 300 mm wide and 900 mm deep and supports a uniformly distributed live load of 3.5kN/m over the entire length in addition to its self weight. Determine the profile of the prestressing cable with an effective force of 500 kN which can balance the dead and the live loads on the beam. Sketch the profile of the cable along the length of the beam

[5]

Q4. A post tensioned prestress beam of rectangular section 250mm × 580mm is to be designed for an imposed load of 12kN/m uniformly distributed on a span of 12m. The stress in the concrete must not exceed 17N/mm² in compression and 1.4 N/mm² in tension at any time and the loss of prestress may be assumed to be 15%. Calculate the minimum prestressing force and the corresponding eccentricity using **Magnel's graphical method**. [6]

Q5. Figure below shows a two span continuous beam. Corresponding to the cable profile provided locate the pressure line due to prestress alone. The prestressing forces 1200 kN. [6]



Q6. A prestressed concrete beam of a symmetrical I section has the following properties [5]

Area of cross section 55000 mm²

Second moment of area about the neutral axis = 1.89×10^9 mm⁴

Static moment of the section about the neutral axis taken about the centroid = 4.68×10^6

Thickness of the web = 50mm

The Beam is concentrically prestressed in the horizontal direction by 24 wires of 5 mm diameter and vertically by similar wires and 150 mm centres carrying an effective prestress of 900 N/mm².

Calculate the principal stresses at the centroid when a shearing force of 80 kN acts on the section.

Q7. Explain with sketches "Hoyer's long line system of Pretensioning" Can this system be used for post tensioning? Justify with proper reasons. [3]