6. (a) What are the advantages of pre-stressing in the design of concrete members subjected to axial tension ? Also mention the load factors generally specified against cracking and collapse in such members.

   (b) Explain the concept of design of pre-stressed pipe and circular water tanks. 10,10

7. (a) State advantages of pre-stressed concrete over RCC. Why high strength concrete and high strength steel is required ?

   (b) What are the methods to estimate the width of cracks in pre-stressed concrete members ? Explain briefly. 10,10

8. Write short notes on the following :

   (a) Partial pre-stressing

   (b) Muller's theorem and Guyen theorem

   (c) Principles of design of prismatic continuous beams

   (d) Design criteria for cylindrical pipes 20

Roll No. : .....

Total No. of Questions : **8**] [Total No. of Pages : **4**

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M.Tech. (Civil Engg.) 1st Semester Examination, March–2021

(Specialisation in Structural Engg.)

(Elective–II)

PRE-STRESSED CONCRETE

Paper–CE–618

*Time : **Three** Hours]* *[Maximum Marks : **100***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note :– (i) Attempt *five* questions in all.

(ii) All questions carry equal marks.

(iii) Use of IS : 456; IS : 1343 is allowed. Assume missing data, if any, suitably.

1. A pre-stressed concrete beam, 200 mm wide and 300 mm deep is pre-stressed with wires (area = 320 mm^2) located at a constant eccentricity of

50 mm and carrying an initial stress of 1000 N/mm^2. The span of beam is 10 m. Calculate the percentage loss of stress in wires if (a) the beam is pre-tensioned and (b) the beam is post-tensioned, using the following data :

E_s = 210 kN/mm^2 and E_c = 35 kN/mm^2

Relaxation of steel stress = 5 per cent of the initial stress

Shrinkage of concrete = 300×10^{-6} for pre-tensioning and 200×10^{-6} for post-tensioning

Creep coefficient = 1.6, Slip at anchorage = 1 mm

Frictional coefficient for wave effect = 0.0015 per m. 20

2. (a) A pre-tensioned T-Section has 1200 × 150 mm flange, 300 × 1500 mm rib. The area of tensile steel is 4700 mm^2 located at an effective depth of 1600 mm. Calculate the flexural strength of the T-section using f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2.

   (b) Compare the design criteria of pre-stressed concrete members' w.r.t. different codes in detail. 10,10

3. (a) What do you mean by pre-stressing ? Differentiate between pre-tensioning and post-tensioning system of pre-stressing.

   (b) Why limited pre-stressing is being used ? Describe the composite construction of pre-stressed and in-situ concrete. 10,10

4. (a) A pre-stressed concrete beam 500 mm wide and 750 mm deep has a simply supported span of 7 m. It is pre-stressed with a linearly bent tendon with zero eccentricity at ends and an eccentricity of 150 mm below the beam axis at mid span. The beam carries a concentrated load of 250 kN at centre besides its self weight. Compute the stresses at mid span.

   (b) What are the different methods of pre-stressing shell structures ? Explain the applications of pre-stressing long span shell structures in detail. 10,10

5. (a) How do you estimate the stresses developed due to differential shrinkage in the composite pre-stressed construction ?

   (b) Outline the design principles of pre-stressed compression members and its application in the design of flag mast. 10,10