ME (Civil / Structural), Sem- II, A.T.K.T. 19/12/14

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affilliated to University of Mumbai)

DESIGN OF PRESTRESSED CONCRETE 19/12/14.

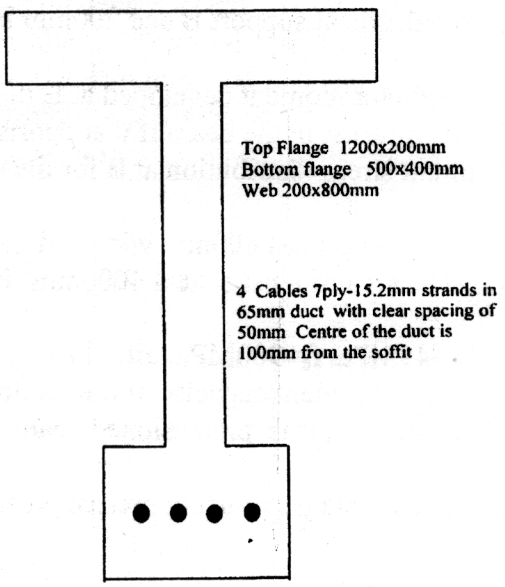
Total Marks : 100 M.E.(Civil) Sem II/(Struct) December 2014
Duration 4hrs MASTER FILE.

NOTE: 1) Question No 1 is compulsory. Answer any 4 from the remaining
2) Use of IS1343-1980, IRC-6, 18, 20 is permitted.
3) Assume the data wherever required and state it clearly

Q 1 A post tensioned prestressed concrete **bridge girder** of type 1 is shown in the figure. 20

1) Span of the girder is 22m.
2) f_p=1860MPa.
3) f_{ck}=45MPa. f_{ci}=35MPa.
4)4 cables7K-15 i.e. 7strands of 15.2mm diameter
From IS-6006-1983, area of single strand is 140mm^2. f_{pe}=.85f_p
5) DL. Bending moment=3000kNm and Shear force=420kN
6) LL. Bending moment=1000kNm and Shear force=140kN

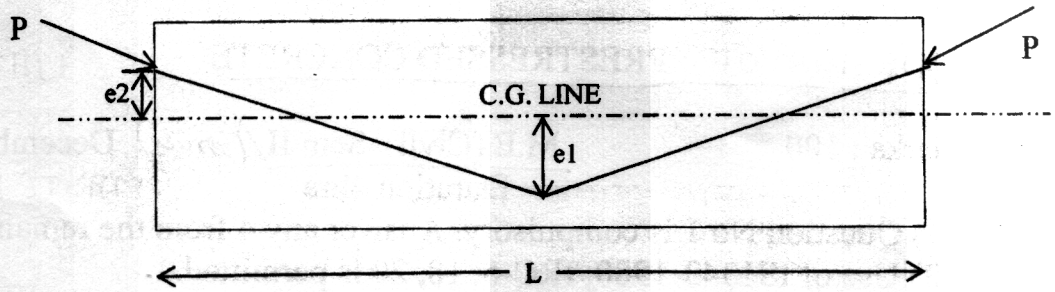
Check the ultimate flexural strength, ultimate shear strength (cracked section) and If y_{po}=112.5mm and y_o=450mm design the end block. Stress at cenroidal axis due to prestress is 5MPa.



M.E. Civil - Sem II (Structural), A.T.K.T.

Design of Prestressed concrete 19/12/14.

Q 2 a Derive the equation for deflection due to Prestress in a beam with the sloping cable profile as shown in the figure 5



b A prestressed concrete beam 150mm wide and 450mm deep and 6m span support a load of 5kN/m(UDL) over the entire span. The prestress is 225kN through the area of steel of 300mm^2.Calculate the deflection of the beam at following stages: 15
1)working load 2)Cracking load 3)1.5times the cracking load
E_c=35GPa. m=6 modulus of rupture for concrete =5MPa.
The prestressing cable is parabolic with concentric at supports and dip of 150mm at centre.

Q 3 a Explain the concordant cable 04

b A two span continuous prestressed concrete beam ABC (AB=12m & BC=10m) has a rectangular section (350x750mmdeep). The beam is prestressed by a cable carrying an effective force of 800kN. The cable has a linear profile in span AB and parabolic profile in span BC, The eccentricities of the cable at A is 50mm above the centroidal axis,100mm below centroidal axis at 7m from A,200mm above the centroidal axis at support B and 200mm below centroidal axis at mid span of BC. 16
a) Evaluate the resultant moment developed at B due to prestressing force. and
b) Sketch the line of thrust in the beam if it supports a UDL of 10kN/m.
c) draw the resultant stress distribution at B for the condition (b)

Q 4 A post tensioned T-section has 800mm wide and 250mm deep flange and the web is 200mmwide .The area of tensile steel 4000mm^2 is placed at an effective depth of 12 00mm. 20
f_p=1500MPa. f_{ck}=45MPa. f_e=900MPa. after losses. L/d=10.
Evaluate the ultimate moment capacity of the section if
a)Bonded b)Unbonded 3) it is pretensioned beam.

Q 5 a List five technical advantages of using precast prestressed unit over cast in situ unit. 05

b Explain propped and unpropped construction 05

c A composite Tee beam has precast pretensioned web 300x1000mm deep and cast in situ slab1500mmwide and 200mm thick. The differential creep and shrinkage strain is 0.0001.Determine the stresses and draw the stress diagram due to differential shrinkage in the precast and cast in situ slab.E_{slab}=28GPa. 10

Q 6 a A post tensioned I-section the top flange is 1000x250mm, bottom flange is 500x350mm, web is 150x800mm.The effective span of 25m and other data is as follows: 10
a) Superimposed Dead load of 5kN/m.
b) Superimposed Live load of 12kN/m.
c) f_{ck}=50MPa., f_p=1600MPa.,
d) Loss in prestress is20%.
e) The permissible tensile stress at transfer is 1.2MPa and that at service is zero. Determine the limits of prestressing force and eccentricities at mid span. Select a prestressing force and eccentricity and calculate the area of steel.

b A prestressed concrete Tee beam has: 10
flange 1000 x200mm deep and web is 200 x1000mm deep.
At a particular section the section is subjected to an ultimate moment of 1800kNm and ultimate shear of 225kN.Calculate the flexure -shear resistance and design the suitable shear reinforcement at a section:
i) Effective depth =1100mm ii) f_{ck}=50Mpa iii)f_p=1500MPa.
iv) Effective tensile stress at the extreme tensile face of the beam is 19.3MPa,
v)Area of prestressing steel=2310mm^2.
vi)Effective prestress in tendons after losses is 900MPa.

Q 7 A post tensioned bonded prestressed concrete beam of rectangular concrete section 350mm wide and 700mm deep is prestressed by an effective force of 180kN acting at an eccentricity of 190mm.At service condition a section of the beam is subjected to a bending moment 225kNm,torsional moment of 100kNm and transverse shear force of 90kN.f_{ck}=40MPa,f_y=415MPaand f_p=1600Mpa. Design suitable longitudinal and transverse reinforcement in the section. 20