Banha University
Faculty of Engineering - Shoubra
Civil Engineering Department

REINFORCED CONCRETE 1 - A

For 2nd Year Civil – 1st Term

Prof. Youssef Hashem, Prof. Ahmed Abd-alFattah,
Assoc. Prof. Fouad Bakheet, Assoc. Prof. Taha Awad & Assoc. Prof. Tarek Sayed

Previous Final Examinations

Benha University
Faculty of Engineering- Shoubra
Civil Engineering Department
Seond Year Civil

Final 1st Term Exam
Date: 11/1/ 2014
Reinforced Concrete 1A
Duration : 3 hours

- يسمح فقط باستخدام كتاب جداول ومنحنيات التصميم للخرسانة المسلحة **R.C. Design Aids**
- Take: f_{cu}**= 30 MPa,** f_y**= 240 MPa (for** $\Phi \leq$ **8 mm) ,** f_y**= 360 MPa (for** $\Phi \geq$**10 mm),** $\Phi \leq$ **25 mm**.
- Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.
- Answer all the following questions
- No. of questions:3
- Illustrate your answers with sketches when necessary.
- Total Mark: 60 Marks
- The exam. consists of one page

Question (1) [15 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

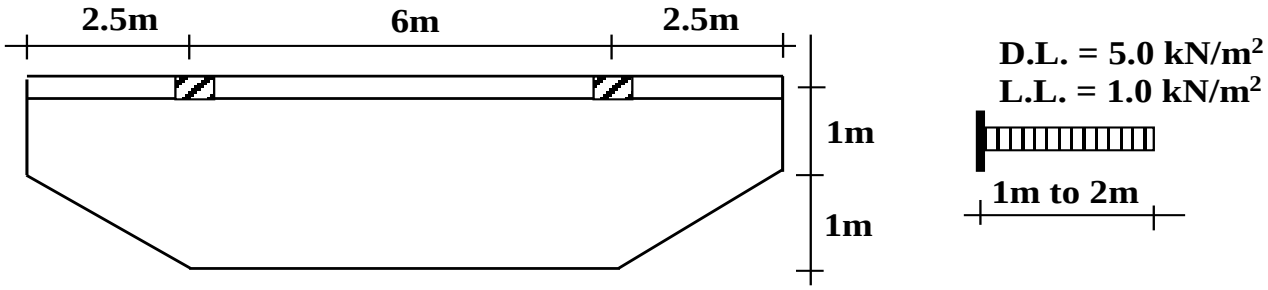
Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 300x900 mm,** t_s **= 120 mm**) of a simply-supported beam (**L= 6 m**):

a. R-Section (**a = 2** a_{min})
b. R-Section (**a = 1.2** a_b)
c. T-Section (**a =** a_{min})
d. T-Section (**a =** a_{max})

Question (2) [27 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

For the overhanging beam (**bxt = 300x800 mm,** t_s **=160 mm**) in the shown plan of a shed roof under the given slab service dead **(D.L.)** & live **(L.L.)** loads and **beam own weight= 5 kN/m'**, it is required to:

a. Draw the max. ultimate B.M.D., S.F.D. and T.M.D.
b. Design & draw critical sections for max. negative B.M & max. positive B.M.
c. Design & draw critical sections for shear and torsion as R-sections



Question (3) [18 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

a. Design and draw a circular column section (**1.0% $\leq \mu \leq$ 1.5 %, d `= 50 mm**) to carry a compression load of **4000 kN** for the following eccentricity cases:
   - e = e_{min} (use spirals)
   - e = 0.5 m (use interaction diagrams)

b. Design and draw a rectangular column section **(b= 400 mm, 1.5 % $\leq \mu \leq$ 2.0 %, d `= 50 mm)** to resist a compression force (**$P_{D.L}$= 1200 kN, $P_{L.L}$= 1800 kN**) and (**$M_{D.L}$= 400 kN.m, $M_{L.L}$= 600 kN.m**) using the following interaction diagrams:
   - Interaction diagrams with uniform steel arrangement
   - Interaction diagrams with equal top & bottom steel $A_s = A'_s$

BOARD OF EXAMINERS: Professor Ahmed Abdel-Fattah Mahmoud
Associate Professor Fouad Bakheet Aboud
Assistant Professor Ahmed Saudi Abdel-Maula
Assistant Professor Tarek Sayed Mustafa

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Tuesday 13/1/2015
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions : 3**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- Take: **f_{cu}= 30 MPa, f_y= 240 MPa for $\Phi \leq$ 8 mm, f_y= 360 MPa for $\Phi \geq$10 mm, $\Phi \leq$ 25 mm**.
- Any missing data may be reasonably assumed according to ECP 2012 & economical design rules.

Question (1) [15 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

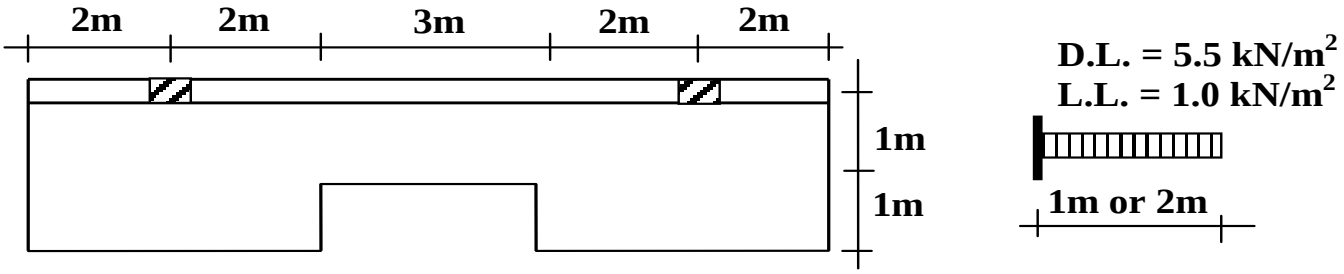
Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 250x700 mm, t_s = 120mm**) of a continuous beam (interior span **L= 7m**):

a. T-Section (**d = d_{min}**)
b. R-Section (**d = $d_{balanced}$**)
c. L-Section (**d = d_{max}**)
d. Trapezoidal section (**b_{top}= 3b, d = d_{min}**)

Question (2) [27 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

For the overhanging beam (**bxt = 350x800 mm, t_s =180 mm**) in the shown plan of a shed roof under the given slab service dead **(D.L.)** & live **(L.L.)** loads and **beam own weight= 5 kN/m'**, it is required to:

c. Draw the max. ultimate B.M.D., S.F.D. and T.M.D.
d. Design & draw critical sections for max. negative B.M & max. positive B.M.
c. Design & draw critical sections for shear and torsion as R-sections



Question (3) [18 Marks] {ILO's: a4, a6, a13, b2, b4, b15, c6, c10}

a- Calculate the ultimate compression load carried by a circular column section (**D = 800 mm**) with uniform steel arrangement (**A_s = 16 ϕ 20**) for the following eccentricity cases:
- e = e_{min} (use spirals with ϕ = 8mm, p = 50mm)
- e = 0.25 D (use interaction diagrams)

b. Design and draw a rectangular column section **(t = 3 b, 1.5 % $\leq \mu \leq$ 2.0 %, d `= 50 mm)** to resist a compression force (**$P_{D.L}$= 1600 kN, $P_{L.L}$= 1200 kN**) and (**$M_{D.L}$= 600 kN.m, $M_{L.L}$= 400 kN.m**) using the following interaction diagrams:
- Interaction diagrams with uniform steel arrangement
- Interaction diagrams with equal top & bottom steel $A_s = A'_s$

Board of Examiners: **Professor Ahmed Abdel-Fattah Mahmoud**
Associate Professor Fouad Bakheet Aboud
Assistant Professor Ahmed Saudi Abdel-Maula
Assistant Professor Tarek Sayed Mustafa

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Sunday 24/1/2016
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions : 3**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- Take: f_{cu}= **30 MPa,** f_y= **360 MPa for** $\Phi \geq$ **10 mm,** f_y= **240 MPa for** $\Phi \leq$ **8 mm,** $\Phi \leq$ **25 mm**.
- Any missing data may be reasonably assumed according to ECP 2012 & economical design rules.

Question (1) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

Using the first principles for USLS, calculate M_u and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 300 mm x 800 mm,** t_s **= 120 mm**):

a. T-Section (**a =** a_{min})
b. R-Section (**a = 1.1** $a_{balanced}$)
c. L-Section (**a =** a_{max})
d. Trapezoidal section (b_{top}= **3b, a =** $a_{balanced}$)

Question (2) [27 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

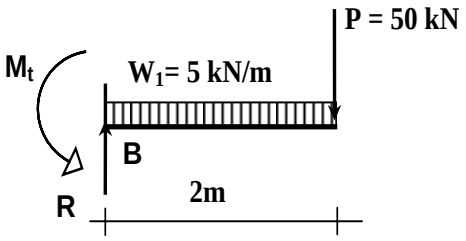
In the shown figure, the simple beam ABA supports a cantilever beam at B under the given service loads.

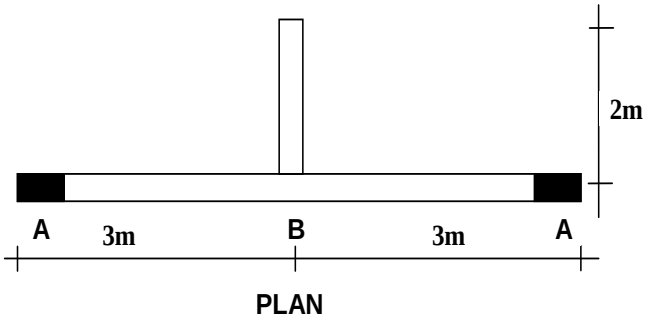
a- For the cantilever beam (**span = 2 m, bxt = 250x600 mm),** it is required to:

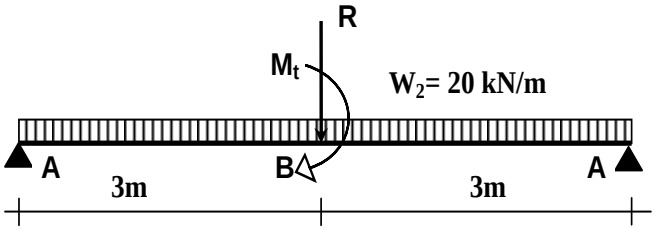
- Draw the max. ultimate B.M.D. & S.F.D.
- Design & draw critical sections for bending & shear as R-sections

b- For the simple beam A-B-A (**span = 6 m, bxt = 300x700 mm &** t_s **=120 mm**), it is required to:

- Draw the max. ultimate B.M.D., S.F.D. & T.M.D.
- Design & draw critical sections for bending as L-sec. & for shear & torsion as R-sec.







Question (3) [18 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a. Design & draw a circular column section under an ultimate compression load of **3000 kN** for the following eccentricity cases:

- e = e_{min} (use spirals)
- e = 0.5 D (use interaction diagrams)

b. Design & draw a rectangular column section **(b=400 mm, 1%** $\leq \mu \leq$ **2.0 %, d `= 50 mm)** to resist a compression force (**$P_{D.L}$= 1200 kN, $P_{L.L}$= 1800 kN**) and a bending moment (**$M_{D.L}$= 500 kN.m, $M_{L.L}$= 600 kN.m**) using the following interaction diagrams:

- Interaction diagrams with uniform steel arrangement
- Interaction diagrams with equal top & bottom steel $A_s = A'_s$

Board of Examiners: Prof. Dr. Ahmed Abd-El Fattah, Associate Prof. Dr. Fouad Bakheet & Assistant Prof. Dr. Tarek Sayed

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Satday 31/12/2016
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions : 3**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- **f_{cu}= 30 MPa, f_y= 360 MPa for Φ ≥ 10 mm, f_y= 240 MPa for Φ = 8 mm, Φ ≤ 25 mm**
- Any missing data may be reasonably assumed according to ECP 2012 & economical design rules.

Question (1) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

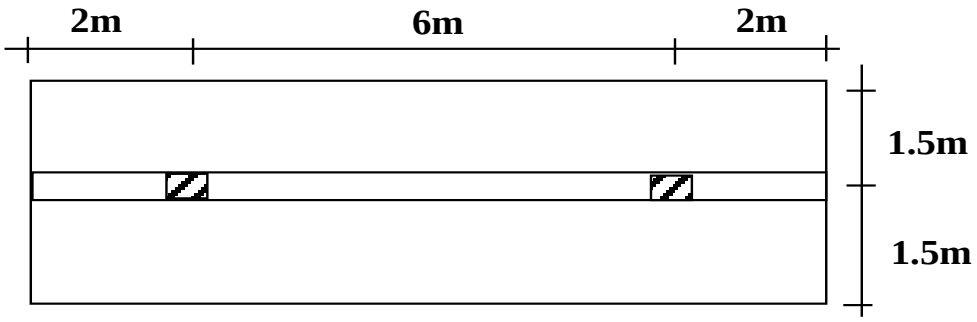
Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following sections (**bxt = 400x600 mm, t_s = 140mm**) of a cantliver beam of length **L_c= 2m**:

a. T-Section (**A_s = $A_{s\ min}$**)
b. R-Section (**C = C_{max}**)
c. L-Section (**d = d_{min}**)
d. R-Section (**A_s=4Φ25, A_s'= 4Φ16**)

Question (2) [27 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

The shown overhanging beam (**bxt = 300x700 mm, t_s =150 mm**) supports the slab service dead & live loads of a double-cantilever roof **(D.L.= 5 kN/m^2, L.L.= 1 kN/m^2) and beam own weight (4.2 kN/m')**. For the overhanging beam, it is required to:

e. Draw the max. ultimate B.M.D.
f. Design & draw critical sections for max. negative B.M & max. positive B.M.
g. Draw the max. ultimate S.F.D. and T.M.D.
h. Design & draw critical sections for shear and torsion as R-sections



Question (3) [18 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Design and draw a **Spiral** circular column to resist ultimate load of P_u = 4000 kN (let μ = 1.0% as a start value)
b- Using interaction diagrams, find the ultimate capacity (P_u) of the column cross section has the following properties: b = 400 mm, t = 800 mm, d`= 50 mm, top and bottom steel arrangement $A_s$ = $A_s$` = 8 Φ 25, e = 2000 mm.
c- Design and draw a rectangular column cross section b = 400 mm, d`= 50 mm, (let t = 1200 mm as start value) with uniform reinforcement arrangement (1.0 % ≤ μ ≤ 2.0 %), using column interaction diagrams $P_{u\ (comp)}$ = 5000 kN , M_u = 1000 kN.m.
d- Design and draw a rectangular column section (b = 300 mm, t = 600 mm, d`= 50 mm) to resist a **tension** force T_u = 400 kN & bending moment M_u = 300 m.kN.

Board of Examiners: ***Assoc. Prof. Fouad Bakheet, Assist. Prof. Ahmed Saudi & Assist. Prof. Tarek Sayed***

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Satday 23/12/2017
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

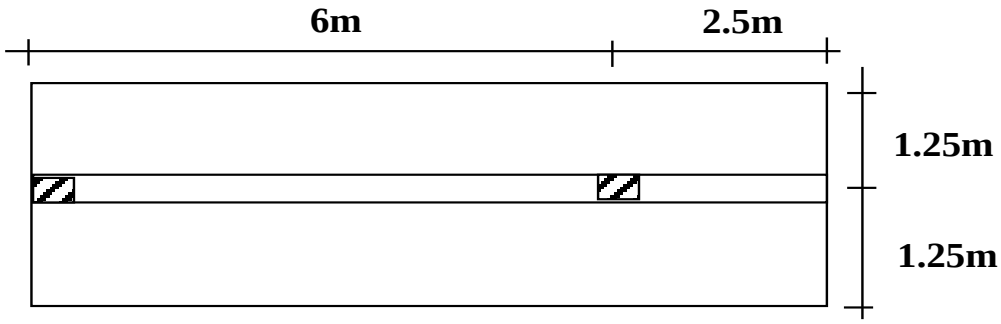
- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions : 4**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- **f_{cu}= 30 MPa, f_y= 360 MPa for Φ ≥ 10 mm, f_y= 240 MPa for Φ = 8 mm, Φ ≤ 25 mm**
- Any missing data may be reasonably assumed according to ECP 2016.

Question (1) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

The shown overhanging beam (**bxt = 300x700 mm, t_s =120 mm**) supports the slab service dead & live loads of a double-cantilever roof **(D.L.= 4 kN/m^2, L.L.= 1 kN/m^2) and beam own weight (4.35 kN/m')**.

For the overhanging beam, it is required to:
a- Draw the max. ultimate B.M.D.
b- Design & draw critical sections for max. negative B.M & max. positive B.M.



Question (2) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

For the **overhanging beam given in Question (1)**, it is required to:
a- Draw the max. ultimate S.F.D. and T.M.D.
b- Design & draw critical sections for shear and torsion as R-sections

Question (3) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 300x800 mm, t_s = 140mm**) of a continuous beam (interior span **L= 6m**):
i. **T-Section (d = d_{min})** ii. **R-Section (d = $d_{balanced}$)** iii. **L-Section (d = d_{max})**

b- Design & draw a **Spiral** circular column to resist ultimate load of **P_u = 3600 kN** (let μ = 1.0%)

Question (4) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

e- Using interaction diagrams, design & draw a Circular column section (**D = 700 mm, d`= 50 mm)** to resist a compression force **P_u = 3000 kN** & bending moment **M_u = 600 m.kN**. **(1.0 % ≤ μ ≤ 2.0 %)**.
f- Design & draw a rectangular section (**b = 300 mm, t = 600 mm, d`= 50 mm**) to resist a tension force **T_u = 400 kN** & bending moment **M_u = 100 m.kN**.
g- Design & draw a rectangular column section (**b = 400 mm, t = 1000 mm, d`= 50 mm**) to resist a compression force **P_u = 350 kN** & bending moment **M_u = 1200 m.kN**.

Board of Examiners: ***Prof. Youssef Hashem, Assoc. Prof. Fouad Bakheet, Assist. Prof. Ahmed Saudi, Assist. Prof. Tarek Sayed & Assist. Prof. Ahmed Salah***

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Satday 29/12/2018
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

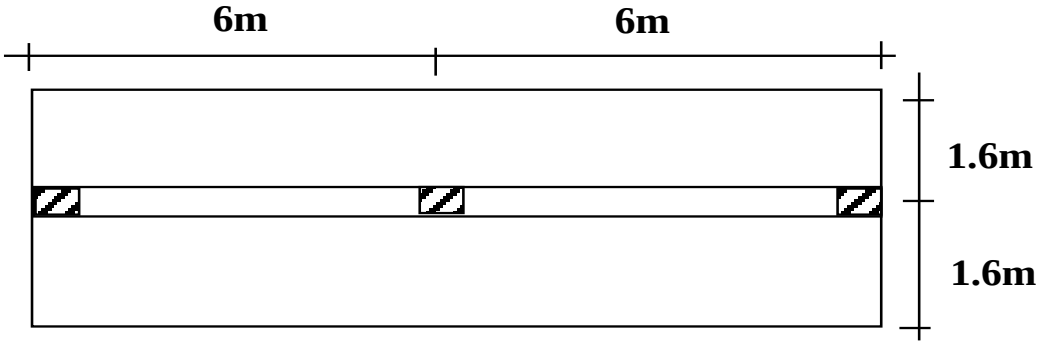
- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions: 4**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- **f_{cu}= 30 MPa, f_y= 360 MPa for Φ ≥ 10 mm, f_y= 240 MPa for Φ = 8 mm, Φ ≤ 25 mm**
- Any missing data may be reasonably assumed according to ECP 2016.

Question (1) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

The shown **continuous beam** (**bxt = 300x700 mm, t_s =140 mm**) supports the slab service dead & live loads of a double-cantilever roof **(D.L.= 4 kN/m^2, L.L.= 1 kN/m^2) and beam own weight (4.35 kN/m')**.

For the projected continuous beam, it is required to:
a- Draw the max. ultimate B.M.D.
b- Design & draw critical sections for max. negative B.M & max. positive B.M.



Question (2) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

For the **continuous beam given in Question (1)**, it is required to:
a- Draw the max. ultimate S.F.D. and T.M.D.
b- Design & draw critical sections at supports for shear and torsion as R-sections

Question (3) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 250x600 mm, t_s = 120mm**) of a simply supported beam (**L= 5m**):
i. **L-Section (d = d_{min})** ii. **R-Section (d = $d_{balanced}$)** iii. **T-Section (d = d_{max})**

b- Design & draw a **square** column to resist ultimate load of **P_u = 5400 kN (let μ = 1.5%)**

Question (4) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Using interaction diagrams, find the ultimate capacity (**P_u**) of the following column section: **b = 400 mm, t = 800 mm, d`= 50 mm, top and bottom steel arrangement $A_s$ = $A_s$` = 8 Φ 25, e = 400 mm**.

b- Design & draw a rectangular section (**b = 300 mm, t = 1200 mm, d`= 50 mm**) to resist a tension force **T_u = 350 kN** & bending moment **M_u = 1000 m.kN**.

c- Using column interaction diagrams, design & draw a Circular column section to resist a compression force **P_u = 5000 kN** & bending moment **M_u= 500 m.kN**. (**D= 600 mm, d`= 50 mm, 1.0 % ≤ μ ≤ 2.0 %**).

Board of Examiners: ***Prof. Youssef Hashem, Assoc. Prof. Fouad Bakheet, Assist. Prof. Ahmed Saudi, Assist. Prof. Tarek Sayed & Assist. Prof. Ahmed Salah***

Benha University
Faculty of Engineering at Shoubra
Civil Engineering Department
Second Year Civil

Final 1st Term Exam
Date: Sunday 29/12/2019
Subject: Reinforced Concrete 1A
Code: CVE 213
Duration: 3 hours

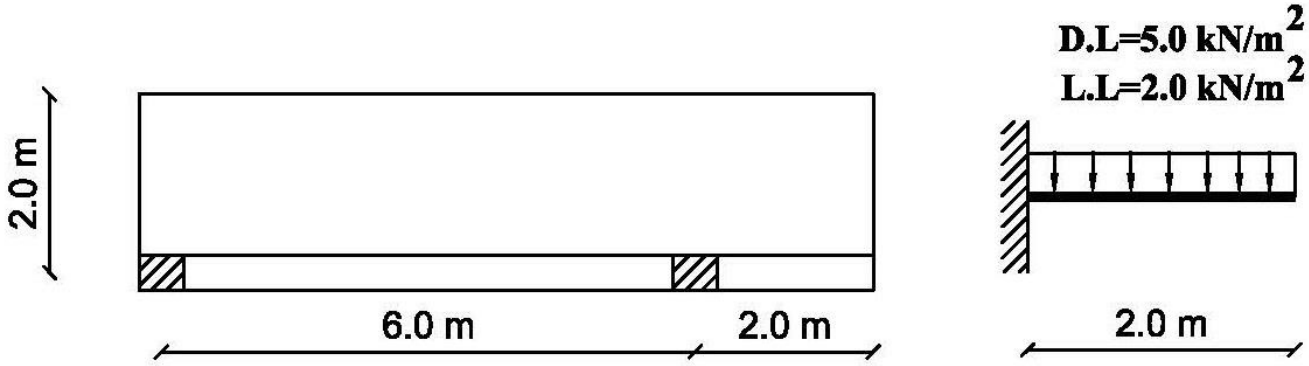
- **Answer all the following questions**
- **Illustrate your answers with sketches when necessary**
- **No. of questions: 4**
- **Total Mark: 60 Marks**

- **Open Book Examination - Handbook of RC Design Aids is only allowed**
- **f_{cu}= 30 MPa, f_y= 400 MPa for Φ ≥ 10 mm, f_y= 240 MPa for Φ = 8 mm, Φ ≤ 25 mm**
- Any missing data may be reasonably assumed according to ECP 2016.

Question (1) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

For the shown overhanging beam (**bxt = 300*800, t_s = 200mm**) in the shown plan of a shed roof under the given slab service loads and own wiegth of beam = **5.0 kN/m/**, it is reqired to:.

a- Draw the max. ultimate B.M.D.
b- Design & draw the critical sections for max. negative B.M & max. positive B.M.



Question (2) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

For the **overhanging beam given in Question (1)**, it is required to:

a- Draw the max. ultimate S.F.D. and T.M.D.
b- Design & draw the critical sections for shear and torsion

Question (3) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Using the first principles for USLS, calculate **M_u** and corresponding **strain ductility** for the following singly-reinforced sections (**bxt = 250x700 mm, t_s = 120mm**) of a simply supported beam (**L= 6m**):

i. **R-Section (a = 2 a_{min})** ii. **R-Section (a = 1.2 a_b)** iii. **T-Section (a = a_{max})**

b- Design & draw a **Spiral circular** column to resist ultimate load of **P_u = 4000 kN** (let μ = 1.5%)

Question (4) [15 Marks] {ILO's: a1, a2, a3, b1, b2, b3, c1, c2}

a- Using interaction diagrams, design & draw a Circular column section to resist a compression force **P_u = 4000 kN** & bending moment **M_u= 700 m.kN**. **(D= 700 mm, d`= 50 mm, 1.0 % ≤ μ ≤ 2.0 %).**

b- Design & draw a rectangular section (**b = 300 mm, t = 700 mm, d`= 50 mm**) to resist a tension force **T_u = 600 kN** & bending moment **M_u = 200 m.kN**.

c- Using interaction diagrams, find the ultimate capacity (**P_u**) of the following column section: **b = 400 mm, t = 800 mm, d`= 50 mm, top and bottom steel arrangement $A_s$ = $A_s$` = 10 Φ 25, e = 200 mm.**

Board of Examiners: ***Prof. Youssef Hashem, Assoc. Prof. Fouad Bakheet, Assoc. Prof. Taha Awad, Assist. Prof. Tarek Sayed & Assist. Prof. Ahmed Salah***