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| *Kafr El-sheikh University* | | *Second Year* |
| *Faculty of Engineering* | ***2015-2016*** | *Reinforced concrete Structures 1(a)* |
| *Civil Engineering Department* | | *First Semester* |
| *Final Term Exam* | ***Max. Degree: 85*** | *Time allowed: 4 Hours* |

**Remarks:** Any missing data may be reasonably assumed.
If not mentioned; consider $f_{cu}$ = 25 N/mm$^2$ and Steel grade is 360/520.

## Question No. (1) (20 Marks)

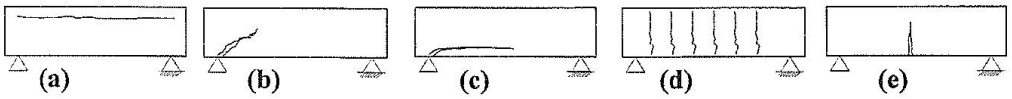
**a) Define the following using drawings whenever possible:**

*Design objectives – Under reinforced section – Diagonal tension – Modular ratio – Safety margin.*

**b) Answer briefly the following using drawings wherever possible:**

1. *Steel is considered the most suitable reinforcement for concrete sections, Explain.*
2. *Differentiate between anchorage length ($L_a$) and development length ($L_d$).*
3. *What are the functions of compression steel in flexural members?*
4. *Shrinkage reinforcement is supplied in RC beams when …… (Complete)*
5. *State the basic philosophy for working and ultimate limit state design methods.*

**c)** *For the shown crack patterns of the simply supported beams; state the different possible reasons for these cracks.*




## Question No. (2) (30 Marks)

1) ***Using first principal approach*** *it is required to design a reinforced concrete rectangular section to withstand an applied ultimate moment $M_u$= 450 kN.m for the* ***minimum depth****, consider the width of the section equals 250 mm, steel grade 240/350 and concrete strength $f_{cu}$ = 25 N/mm$^2$.*

2) *For some architectural reasons, the depth of the beam is limited to 550 mm,* ***redesign the previous section*** *to accommodate the same moment without exceeding the given depth limit.*

3) *For the shown cross section in Fig. (1), it is required to calculate:*

- *The cracking moment ($M_{cr}$).*
- *The allowable moment ($M_{all}$).*
- *The nominal moment ($M_n$).*
- *The maximum area of steel ( $A_{smax}$ ).*

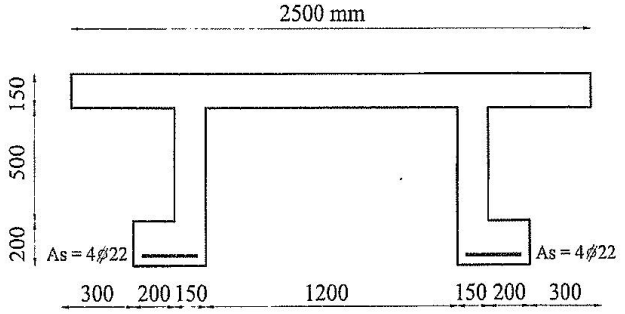



***Fig. 1***

## Question No. (3) (35 Marks)

**For the part of the structural plan of a residential building shown in Fig. (2); it is required to:**

1. *Draw the load distribution of slabs on the structural plan.*
2. *Calculate load on beam on axis C-C.*
3. *Draw with a suitable scale the S.F.D and B.M.D due to* ***ultimate total loads only****.*
4. *Design critical sections of that beam for* ***flexure and shear for the case of total loads only****.*

5. *Using moment of resistance diagram (MRD), show **flexure and shear reinforcement details** for the beam in elevation and cross sections to a suitable scale.*
6. *Calculate development and anchorage lengths and then show it on the reinforcement elevation section.*

***Consider** slab thickness = 120 mm, width of all beams = 250 mm, flooring = 1.60 kN/m$^2$, live load = 2.5 kN/m$^2$ and walls exist over all beams with intensity of 2.5 kN/m$^2$, floor height 3.0 m and total beam thickness 750 mm, column dimensions 250×250mm, $f_{cu}$ = 30 N/mm$^2$ , steel grade is 400/600.*

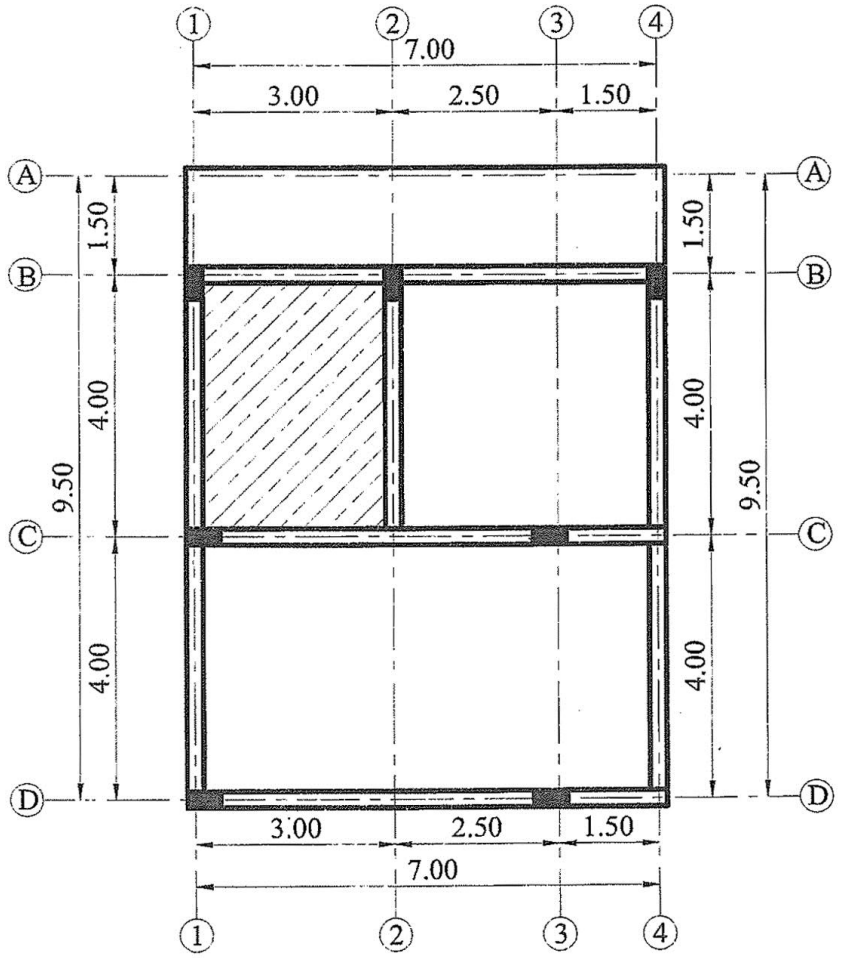



***Fig. (2)***

**With best wishes**

**Course Coordinator:** **Dr. Ahmed Taha Baraghith**