

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, Nov.-Dec. 2015

B. Tech, Civil Engineering, Semester V

Roll No.....

CE 507: Design of RCC Structure

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. IS 456 : 2000 Plain and Reinforced Concrete - Code of Practice is allowed in the exam.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. Select the incorrect statement
 - A) R.C.C has better fire resistance than steel
 - B) R.C.C. structure is economical than steel structure
 - C) Strength of concrete decreases as age increases
 - D) R.C.C can be used for under water and marine structures
- ii. As per IS. 456-2000, Minimum grade of concrete for R.C.C. should be
 - A) M10
 - B) M15
 - C) M20
 - D) M25
- iii. Specific weight of Reinforced cement concrete is
 - A) 25 N/mm³
 - B) 25 kN/mm³
 - C) 25 N/m³
 - D) 25 kN/m³
- iv. As per IS: 456-2000, the maximum size of aggregate is
 - A) 1/4 of maximum thickness of member
 - B) 1/4 of minimum thickness of member
 - C) 1/5 of maximum thickness of member
 - D) 1/5 of minimum thickness of member
- v. Side face reinforcement is provided when the depth of beam exceeds
 - A) 250 mm
 - B) 450 mm
 - C) 550 mm
 - D) 750 mm
- vi. If depth of actual neutral axis is greater than depth of critical neutral axis, then
 - A) Concrete attains its permissible stress earlier
 - B) Steel attains its permissible stress earlier
 - C) Both concrete and steel reaches its permissible stresses simultaneously
 - D) None of the above
- vii. Mat is a shallow foundation supporting
 - A) number of columns in one row
 - B) only one column
 - C) number of columns in more than one row
 - D) piles
- viii. The anchorage value of the hook for a mild steel bar is generally considered as
 - A) 8 Φ
 - B) 16 Φ
 - C) 32 Φ
 - D) 48 Φ
- ix. Limit state of collapse deals with
 - A) strength and stability of the structure
 - B) durability
 - C) conditions such as deflection, cracking
 - D) all the above
- x. The ultimate average anchorage bond stress for plain bars in tension for the M20 grade of concrete is
 - A) 1.60 N/mm²
 - B) 1.92 N/mm²
 - C) 2.24 N/mm²
 - D) 2.40 N/mm²

CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION

Q.2 Short answer type questions (4 questions @ 2.5 marks)

- A column is reinforced with 4 bars of 20 mm dia. Determine the ultimate load carrying capacity of the column, using M20 grade of concrete, Fe415 grade of steel if the size of the column is 450mm x 450mm.
- What is step footing?
- Write difference between shallow foundation and deep foundation
- Draw the sketch of pile foundation.

Cumulative probability

Entries in this table are to be read down the curve to the left of the z value. For example, for $z = -0.85$, the cumulative probability is 0.2033.

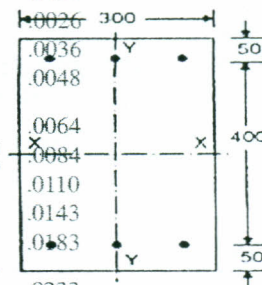
z 0

Q.3A Write the assumptions for the design of column by Limit State Method.

Q.3B What are the criteria of selection of depth of footing?

Q.4A Design a circular column to carry an axial load of 1000kN. Use M20 grade of concrete and Fe415 grade of steel.

Q.4B A short RC column 300 mm wide and 500 mm deep is reinforced with 6 bars of 20 mm diameter, arranged as shown in figure. Determine the bending moment M_u about the axis bisecting the depth, when it is subjected to $P_u = 1800$ kN. Assume M20 grade of concrete and Fe415 grade of steel. Assume cover = 50 mm.



Q.5 Design a RCC beam of rectangular section using the following data-

Effective span = 8 m, working load = 30 kN/m, $b = 300$ mm, $d = 600$ mm, cover = 50 mm, M20 grade of concrete and Fe415 grade of steel. Also design for shear.

Q.5 Design a RCC beam of rectangular section using the following data-

Effective span = 7 m, working load = 15 kN/m and 20 kN/m, $b = 250$ mm, $D = 550$ mm, cover = 50 mm, M20 grade of concrete and Fe415 grade of steel. Also design for shear.

Q.6A Find the moment of resistance of an existing I-beam having the following data-

$b_f = 700$ mm, $d_f = 600$ mm, $b_w = 240$ mm, $A_{st} = 5$ bars of 25 mm dia, $D_f = 90$ mm, M15 grade of concrete and Fe415 grade of steel.

Q.6B Design a simply supported RCC slab for an office floor having clear dimension of 4m x 10m with 230 mm walls all round. Adopt M20 grade of concrete and Fe415 grade of steel.

OR

Q.6B Design a singly reinforced concrete beam to suit the following data:

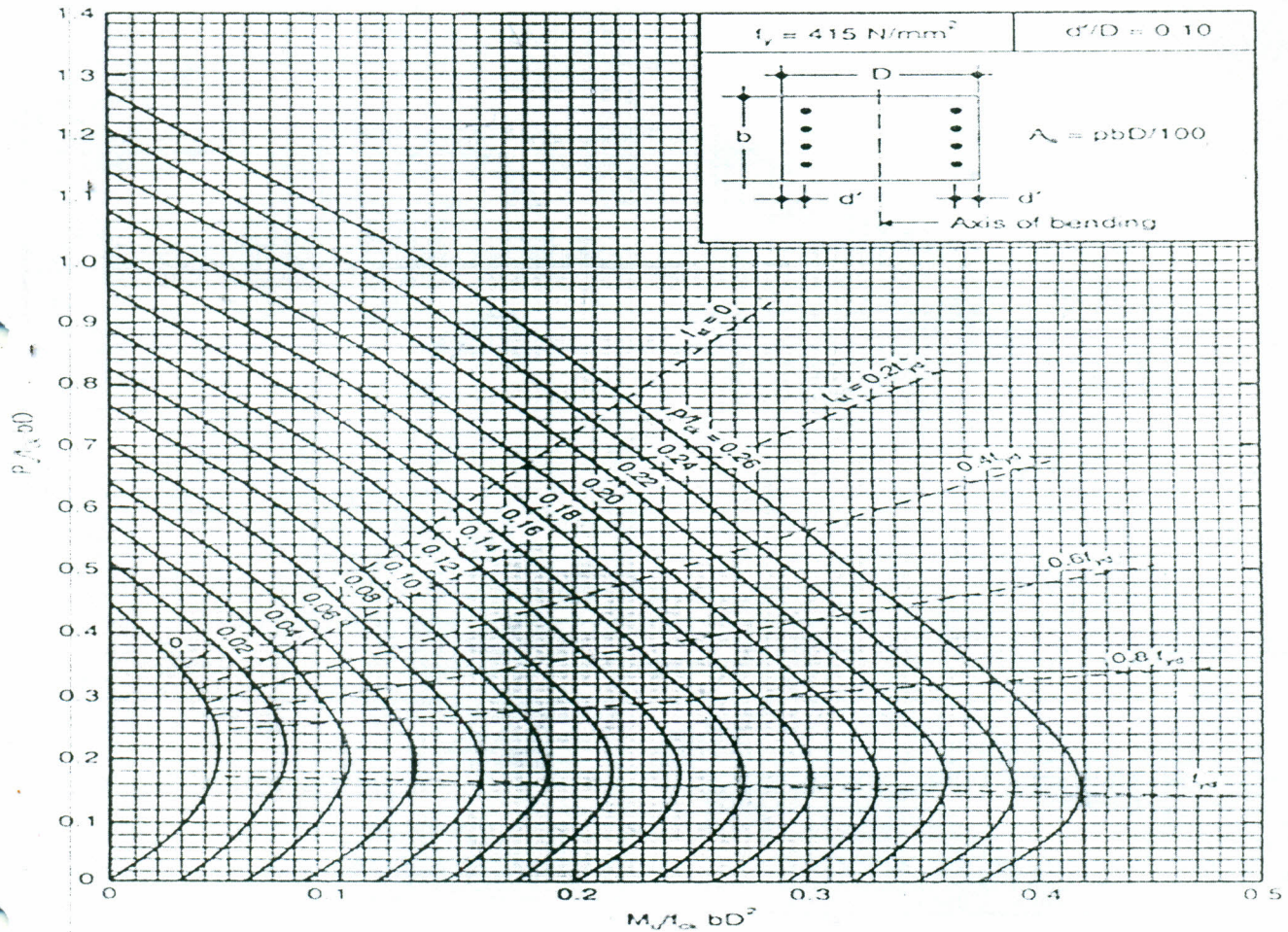
Clear span = 3m, width of supports = 200 mm, working live load = 6 kN/m, M20 Grade of concrete and Fe415 Grade of steel. Also design this beam for shear and check for ductility and deflection.

Q.7 Design a cantilever beam for flexure and shear to suit the following data-

Clear span = 2.5m, working live load = 20kN/m, cantilever beam is monolithic with R.C. column 300 mm wide and 450 mm deep, Fe415 grade of steel and M20 grade of concrete. Also design the anchorage length at the support.

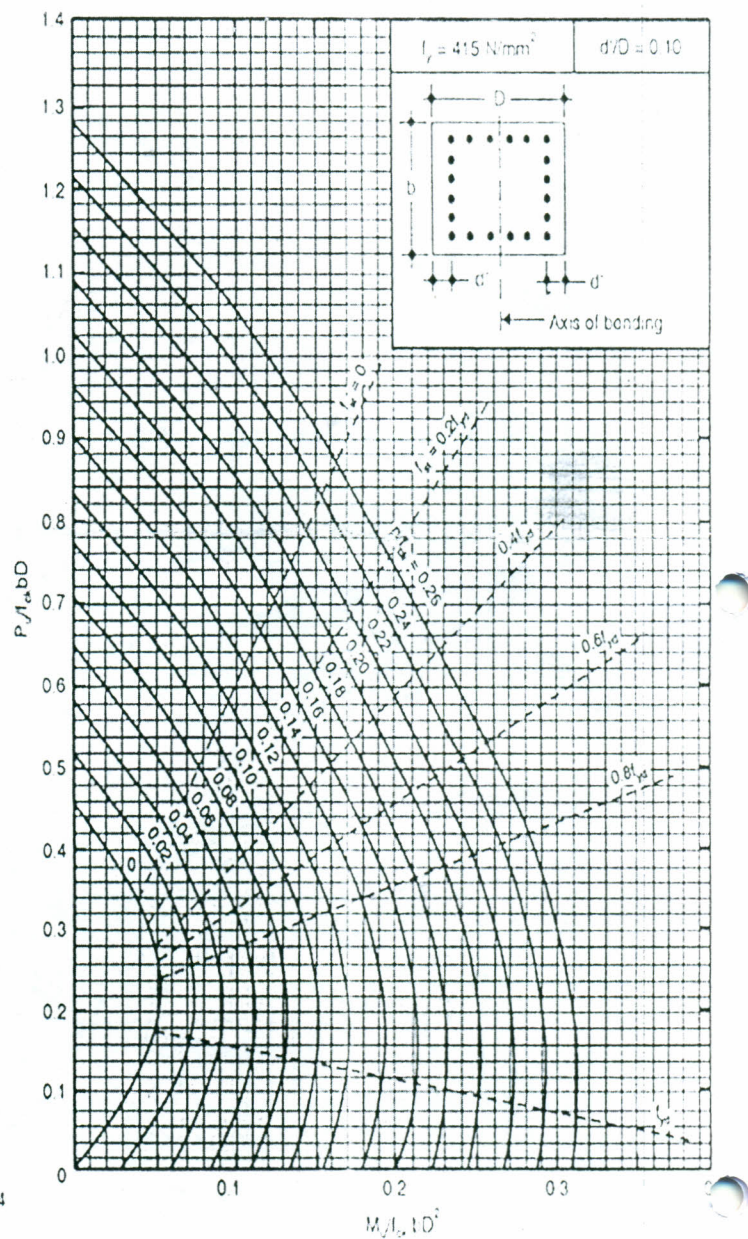
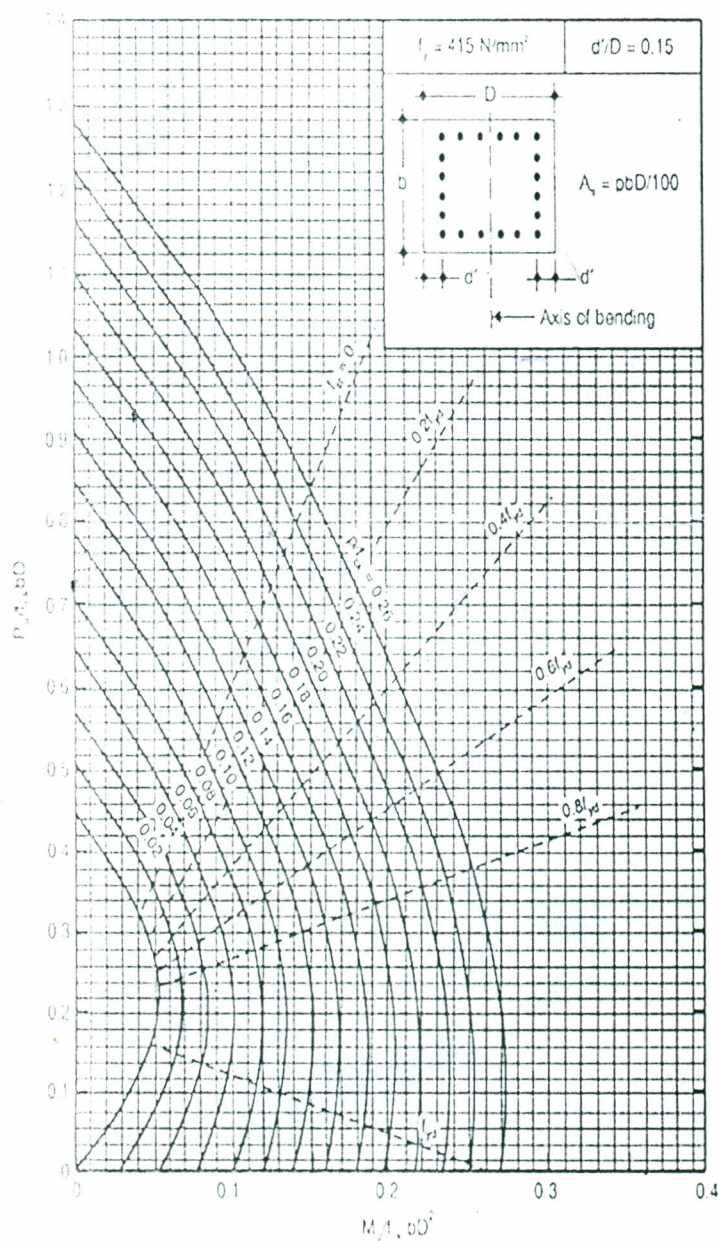
Q.8 Design a two way slab for a room of size 4mx5m with discontinuous and simply supported edges on all the sides with corners prevented from lifting to support a live load of 4kN/m² adopt M20 grade of concrete and Fe415 grade of steel. 10

Q.9 Design the reinforcement to be provided in the short column of Figure is subjected to $P_u = 2000$ kN, $M_{ux} = 130$ kNm (about the major principal axis) and $M_{uy} = 120$ kNm (about the minor principal axis). The unsupported length of the column is 3.2 m, width $b = 400$ mm and depth $D = 500$ mm. Use M 25 and Fe 415 for the design. 15



Values of f_{sc} for different values of d'/d

f_y (N/mm ²)	d'/d				Strain at yield
	0.05	0.10	0.15	0.20	
250	217.4	217.4	217.4	217.4	0.0010869
415	355	353	342	329	0.0038043
500	412	412	395	370	0.0041739



Values of f_{sc} and ϵ_{sc}

Stress level	Fe 415		Fe 500	
	Strain ϵ_{sc}	Stress f_{sc} (N/mm ²)	Strain ϵ_{sc}	Stress f_{sc} (N/mm ²)
0.80 f_{yd}	0.00144	288.7	0.00174	347.8
0.85 f_{yd}	0.00163	306.7	0.00195	369.6
0.90 f_{yd}	0.00192	324.8	0.00226	391.3
0.95 f_{yd}	0.00241	342.8	0.00277	413.0
0.975 f_{yd}	0.00276	351.8	0.00312	423.9
1.0 f_{yd}	0.00380	360.9	0.00417	434.8