

Code No: R31012

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Building Planning and Drawing
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any THREE questions from Part-A (3 x 15 Marks)

Answer any one question from Part-B (30 Marks)

PART-A (3X15=45)

- 1 (a) Explain the importance of building bye laws in the construction of structures? 5
(b) What are the different factors considered while selecting a site for the construction of a Residential house? Explain in detail? 10
- 2 (a) How the area will be divided into different components in a residential house? 5
(b) Explain different requirements of bed room and living room in residential houses? Elaborate the planning with neat sketches. 10
- 3 (a) A Bank is planning to open its new branch in a town at a site measuring 80X60 m. The main entrance of the building is in North East direction. Explain the principles of planning? 10
(b) Design the layout of the above Bank? 5
- 4 (a) What is meant by Gantt chart? Explain the importance of this chart? 7
(b) What is the significance of Critical Path Method? State the application of this method? 8
- 5 (a) How different stages in Project planning divided? Explain briefly? 7
(b) Draw sign convention for the following materials: 8
i) Brick ii) Concrete
ii) Copper alloys iv) Steel

PART-B (1X30=30)

- 6 (a) Draw Plan, elevation and Isometric view of Flemish bond of 2½ brick wall. 15
(b) Draw elevation and sectional plan of Panelled window of size 900X1000 mm. size. 15

OR

- 7 (a) Draw King Post Truss of 16 m. span and indicate all the components clearly. 15
(b) Plan a residential building for a plinth area of 175 m². The site located in hot-arid region, rectangle in shape. Building faces East. The requirements are : 15
(i) Master bed room, (ii) Children bed room,
(iiI) Living room, (iv) Kitchen and dining hall,
(v) Stair case.
Sketch the plan, sectional elevation passing through one door and one window.



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R10

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Max Marks: 75

Answer any THREE questions from Part-A (3 x 15 Marks)

Answer any one question from Part-B (30 Marks)

PART-A (3X15=45)

- 1 (a) Explain the phenomenon to calculate the total number of floors for a building by using the factor 'FAR'? 5
(b) Explain how the provision is made for different open spaces with sizes, according to Bye Laws? 10
- 2 (a) Name the rooms which can be used to serve different purposes in a residential house? Explain briefly along with different sizes? 5
(b) Explain the requirements of a residential building to accommodate a small family ? 10
- 3 (a) Plan a Primary health centre having the following accommodations. (Areas shown against room are approximate). 8
1) Area of ward per bed = 3 m²
2) Laboratory = 5 m²
3) Waiting room = 5 m²
4) Nurses room = 6 m²
5) Store room = 5 m²
6) Sanitary block with 2 bath and w/c = 5 m²
Explain the planning of the above PHC in detail? Include any component if required?
(b) Design the layout of the above PHC. 7
- 4 (a) List out the different stages involved in construction planning? Explain in detail. 7
(b) Differentiate clearly between PERT and CPM methods? 8
- 5 (a) What will happen if building bye laws are not maintained in the construction? 7
(b) Draw the sign conventions for the following materials: 8
i) Glass ii) earth
iii) Cast iron iv) Plaster

PART-B (1X30=30)

- 6 (a) Draw Plan, elevation and Isometric view of English bond of 2 brick wall. 15
(b) Draw elevation and sectional plan of partly Panelled and glazed window of size 800X1000 mm. size. 15

OR

- 7 (a) Draw Queen Post Truss of 12 m. span and indicate all the features clearly. 15
Plan a residential building, given the sizes of different rooms. Building faces West. 15



Code No: R31012

R10

Set No: 2

- (i) Master bed room = 15 m²
- (ii) Living room = 20 m²
- (iii) Dining area = 8 m²
- (iv) Kitchen = 10 m²
- (v) Verandah = 7 m²

Sketch the plan, sectional elevation passing through kitchen and verandah.

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R10

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Building Planning and Drawing
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any THREE questions from Part-A (3 x 15 Marks)
Answer any one question from Part-B (30 Marks)

PART-A (3X15=45)

- 1 (a) Define FSI? And state the importance of this factor? 5
(b) Classify buildings according to the use or the character of occupancy? And explain in detail all the type of buildings? 10
- 2 (a) Which rooms are required for different income groups? Explain. 5
(b) Explain the different space requirements of different rooms of a residential building? 10
- 3 (a) A Corporate school wants to start its new play school in a locality. The School should have the following accommodations. 8
7) 4 class rooms each = 12 m²
8) Principal room = 8 m²
9) 3 toilets each = 6 m²
10) Hall with indoor game equipments = 15 m²
Explain the planning of the above School in detail? Also Include out side play area.
(b) Draw layout plan of the School with all components? 7
- 4 (a) Define Bar chart? And explain different advantages of it? 7
(b) Explain the importance of CPM technique in project scheduling? 8
- 5 (a) In a Construction project different activities are listed below. 7
Foundation work, Columns, Beams, Slab, Doors, windows, ventilators etc. All other finishing works
Propose a project plan to complete the above work in 8 months. Include any other activities if necessary.
(b) Draw the sign conventions for the following materials: 8
(i) Brick (ii) Timber (iii) Steel (iv) Zinc

PART-B (1X30=30)

- 6 (a) Draw Plan, elevation and Isometric view of English bond of 2 1/2 brick wall. 15
(b) Draw elevation and sectional plan of Panelled door of size 1000X2000 mm. size. 15

OR

- 7 (a) Draw Queen Post Truss of 16 m. span and indicate all the features clearly. 15
(b) Plan a residential building having a plot size of 250 sq.yds. Draw the plan with 15

1 of 2



Code No: R31012

R10

Set No: 3

different rooms of suitable sizes. 1) Kitchen 2) Living room with dining area
3) Master bed room with attached bath room 4) Children bed room
5) Bath room with w/c.

Sketch the plan, sectional elevation passing through main door and one window. Main door face North side.

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Code No: R31012

R10

Set No: 4

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Building Planning and Drawing
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any THREE questions from Part-A (3 x 15 Marks)

Answer any one question from Part-B (30 Marks)

PART-A (3X15=45)

- 1 (a) State any four building bye-laws? 5
(b) Explain the provision of height of buildings and requirement of lighting & ventilation as per building bye-laws? 10
- 2 (a) What are the various factors considered in planning a residential building? 5
(b) Discuss various requirements of bed room and living hall in residential houses? Elaborate the planning with neat sketches. 10
- 3 (a) A post office is to be built at a site of 60X45m. The plot is North West corner one with main road along northern side. Explain in detail the planning of the above post office? 8
(b) Also Design layout plan of the above post office. 7
- 4 (a) Explain clearly the importance of Dummy activity? Also explain when it will be included in a net work diagram. 5
(b) A project involves eight activities represented by A,B,C,----,H .Activity , time allotted to each activity and predecessor activities are given as below. 10

Activity	Time allotted in days.	Predecessor activity
A	3	-
B	4	A
C	2	B
D	5	B
E	6	C
F	3	C,D
G	4	F
H	2	E,G

Draw the network diagram. Calculate Earliest Start Time, Earliest Finish Time, Latest Start Time and Latest Finish Time together with Float in each activity. Also mark the Critical Path.

- 5 (a) Differentiate between CPM and PERT along with examples? 7
(b) Draw the sign convention for the following materials: 8
i) Stone ii) concrete
ii) Cast iron iv) Timber



Code No: R31012

R10

Set No: 4

PART-B (1X30=30)

- 6 (a) Draw elevation and Isometric view of different stone masonry walls? 15
(b) Draw elevation and sectional plan of Partly Panelled and glazed door of size 1100X2100 mm. size. 15

OR

- 7 (a) Draw King Post Truss of 15 m. span and indicate all the components clearly. 15
(b) Draw a plan of residential building to accommodate 5 persons. Assume all the standard dimensions and draw the elevation and sectional elevation? The building faces East direction. 15

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Code No: R31013

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

CONCRETE TECHNOLOGY
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the classification of admixtures.
(b) Explain the various tests to obtain the physical properties of cement.
2. (a) Explain the alkali-aggregate reaction and the factors influencing the alkali-aggregate reaction.
(b) Explain the importance of grading of aggregates and describe the various types of gradation.
3. (a) Define workability and explain the factors affecting the workability of concrete.
(b) Distinguish between segregation and bleeding of concrete.
4. (a) Define curing and explain the various methods of curing of concrete.
(b) Explain the influence of water-cement ratio on the strength of concrete.
5. (a) Explain the various non-destructive testing methods of concrete.
(b) Explain the different methods of obtaining the tensile strength of concrete.
6. (a) Explain the various elastic moduli of concrete.
(b) Explain the factors affecting the shrinkage and creep of concrete.
7. (a) Explain the various factors influencing the durability of concrete.
(b) Explain the procedure for the mix design of M25 grade of concrete as per the Bureau of Indian standards method.
8. Explain the following:
 - (a) Self-consolidating concrete
 - (b) Cellular concrete
 - (c) High density concrete



Code No: R31013

R10

Set No: 2

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

CONCRETE TECHNOLOGY
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the mechanism of hydration of cement.
(b) Explain the procedure to obtain the setting times of cement.
2. (a) Explain the classification of aggregates.
(b) Describe the various mechanical properties of aggregates.
3. (a) Define the workability of concrete and explain the various methods of measurement of workability of concrete..
(b) Explain the various methods of mixing of concrete.
4. (a) Explain the various factors influencing the strength of concrete.
(b) Explain the significance of curing of concrete and describe the various methods of curing of concrete.
5. (a) Explain the method of obtaining the flexural strength of concrete.
(b) Explain the ultrasonic pulse velocity test for the evaluation of concrete.
6. (a) Explain the factors influencing the creep and shrinkage of concrete.
(b) Explain the static and dynamic moduli of elasticity of concrete.
(c) Explain the method of obtaining the dynamic modulus of elasticity of concrete.
7. (a) Explain the factors influencing the mix proportions of concrete.
(b) Explain the quality control of concrete and the acceptance criteria.
8. (a) Explain the various types of fibres used in concrete and also the factors affecting properties of fibre reinforced concrete.
(b) Explain the following:
(i) Light weight aggregate concrete (ii) Types of Polymer concrete



Code No: R31013

R10

Set No: 3

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

CONCRETE TECHNOLOGY
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the chemical composition of Portland cement.
(b) Explain the importance of fineness of cement and describe the various tests to obtain the soundness of cement.
2. (a) Explain the significance of sieve analysis in determining the particle size distribution.
(b) Explain the various tests on aggregates.
3. (a) Explain the influence of temperature and time on workability of concrete.
(b) Explain the various methods of vibration of concrete.
4. (a) Explain the influence of gel-space ratio on the strength of concrete.
(b) Explain the maturity of concrete. Also describe its importance in the concrete construction industry.
5. (a) Explain the factors influencing the compressive strength of concrete.
(b) Explain the various code provisions for Non-destructive testing methods of concrete.
6. (a) Draw the stress-strain curve for concrete and explain the method of determination the various elastic moduli of concrete.
(b) Explain creep and shrinkage of concrete and the factors influencing the creep of concrete.
7. (a) Explain the statistical quality control of concrete.
(b) Explain the various methods of proportioning of concrete mixes.
8. (a) Explain the different types of polymer concrete and also the properties of polymer concrete.
(b) Explain the following:
(i) High performance concrete (ii) No-fines concrete



Code No: R31013

R10

Set No: 4

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

CONCRETE TECHNOLOGY
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the application of different types of admixtures.
(b) Explain the soundness of cement and also the procedure to determine the soundness of cement.
2. (a) Define the fineness modulus and explain the procedure to obtain the same. Also indicate the range of fineness modulus values for fine and coarse aggregates.
(b) Explain the importance of grading of aggregates and distinguish between the well graded and gap graded aggregates.
3. (a) Explain the Setting times of concrete.
(b) Explain the various steps in manufacturing of concrete.
4. (a) Explain the maturity of concrete. Also describe its practical relevance in the concrete construction industry.
(b) Explain the relation between the compression and tensile strength of concrete.
5. (a) Explain the method of obtaining the split tensile strength of concrete.
(b) Explain the rebound hammer test for the evaluation of concrete.
6. (a) Explain the factors affecting the modulus of elasticity of concrete.
(b) Define creep and shrinkage of concrete and explain the classification of shrinkage of concrete.
7. (a) Explain the factors affecting the durability of concrete.
(b) Explain the step-by-step procedure for the mix design of M20 grade of concrete as per the Bureau of Indian standards method.
8. (a) Explain the different types of fibres used in concrete and the factors affecting properties of fibre reinforced concrete.
(b) Explain the following:
(i) Self-consolidating concrete (ii) High density concrete.



Code No: R31011

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Design and Drawing of Concrete Structures - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

Note: Answer any ONE question from PART-A and THREE questions from PART-B
Use of IS: 456-2000 and design charts from SP-16 is allowed.

PART-A

1. Design a square footing for a rectangular column $350 \text{ mm} \times 500 \text{ mm}$, reinforced with 6- $25 \text{ } \emptyset$ bars and carrying a service load of 1400 kN. Assume soil with an allowable pressure of 200 kN/m^2 at a depth of 1.25 m below ground. Assume Fe 415 grade steel for both column and footing and M 20 grade concrete for the footing and M 25 grade concrete for the column.

[30]

(OR)

2. Determine the reinforcement required for a short column subjected to biaxial bending, using the following data:

Cross section of the column: $400 \text{ mm} \times 600 \text{ mm}$

Concrete Mix: M 20

Steel: Fe 415

Factored load $P_u = 2000 \text{ kN}$

Factored moment acting parallel to the larger dimension $M_{ux} = 175 \text{ kN-m}$

Factored moment acting parallel to the shorter dimension $M_{uy} = 125 \text{ kN-m}$.

Use of SP -16 permitted.

[30]



PART-B

3. (a) What is meant by limit state? Discuss the different 'limit states' to be considered in reinforced concrete design.
- (b) Explain the basis for the selection of partial safety factors (for loads and materials) by the Code for 'serviceability limit states'.
- [7+8]
4. A T-beam slab floor of R.C.C. has 150 mm thick slab forming part of T-beam which are of 10m clear span. The end bearings are 450 mm thick. Spacing of T-beam is 3.5 m. The live load on the floor is 5 kN/m^2 . Design one of the T-beams using limit state method. Use M20 concrete and Fe 415 steel.
- [15]
5. Design a one way continuous slab of spans 4 m, if imposed load is 3.5 kN/m^2 and finishing load is 1.5 kN/m^2 . Assume width of beams as 250 mm. Use M20 concrete and Fe 415 steel.
- [15]
6. A R.C. beam $250 \times 550 \text{ mm}$ reinforced with 4 bars of 25mm diameter bars of Fe 415 grade steel. Effective cover is 50mm and M20 concrete is used. It is provide with 2 legged 8mm stirrups at spacing of 150mm. Determine ultimate strength of the section.
- [15]
7. A beam of cross section $250 \times 450 \text{ mm}$ is reinforced with 4 bars of 20 mm with an effective cover of 50 mm. The effective span of the simply supported beam is 8m. Using empirical formula, check whether depth provided is satisfactory from the criteria of deflection control? Take grade of concrete as M20 and grade of steel as Fe 415. Assume that exactly required amount of steel is used.

[15]



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Set No: 2

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III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Design and Drawing of Concrete Structures - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

Note: Answer any ONE question from PART-A and THREE questions from PART-B
Use of IS: 456-2000 and design charts from SP-16 is allowed.

PART-A

1. Design a square footing for a circular column, 500 mm in diameter, reinforced with 8-25 \emptyset bars, and carrying an axial load of 2,500 kN. Assume soil with a safe bearing capacity of 350 kN/m² at a depth of 1.5 m below ground. Assume Fe 415 grade steel for both column and footing, and M 20 grade concrete for the footing and M 20 grade concrete for the column.

[30]

(OR)

2. Design a reinforced concrete slab for a room of size 5.5 \times 4 m clear in size, if the superimposed load is 5.5 kN/m². Use M20 concrete and Fe 415 steel. The edges are simply supported and corners are held down.

[30]

PART-B

3. (a) Why is the partial safety factor for concrete (γ_c) greater than that for reinforcing steel (γ_s) in the consideration of ultimate limit states?

(b) What is the fundamental assumption in flexural theory? Is it valid at the ultimate state?

[8+7]

4. The overall cross section of a R.C. beam is 300 mm \times 600 mm. The factored design moment at a particular Section of the beam is 350kN-m. Design the necessary reinforcement by limit state method, if the effective cover to the reinforcement is 35 mm. Adopt M25 concrete and Fe 415 steel.

[15]



5. A corner column 400×400 mm, is subjected to the factored loads $P_u = 1350$ kN, $M_{ux} = 200$ kN-m and $M_{uy} = 120$ kN-m. Design the reinforcement in the column, assuming M25 concrete and Fe 415 steel and effective cover of 60 mm. Assume it is a short column.

[15]

6. A.R.C. beam of size 300 mm \times 500 mm is subjected to the following factored loads:

$$M_u = 120 \text{ kN-m}$$

$$T_u = 45 \text{ kN-m}$$

$$V_u = 80 \text{ kN-m}$$

and Determine the equivalent bending moment and shear force for which the section is to be designed.

[15]

7. A rectangular beam of size 300 mm \times 600 mm is reinforced with 6 bars of 20 mm diameters on tension side and 6 bars of 16 mm diameter on compression side with Fe 415 steel. The effective cover on both sides is 50mm and the effective span of the simply supported beam is 8m. Check whether depth provided is sufficient from the deflection consideration. Assume, exactly the required amount of steel is provided.

[15]



Code No: R31011

R10

Set No: 3

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Design and Drawing of Concrete Structures - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

Note: Answer any ONE question from PART-A and THREE questions from PART-B
Use of IS: 456-2000 and design charts from SP-16 is allowed.

PART-A

1. Design a footing for a 250-mm thick reinforced concrete wall which supports a load (inclusive of self – weight) of 250 kN/m under service loads. Assume a safe soil bearing capacity of 200 kN/m² at a depth of 1.5 m below ground. Assume M 20 grade concrete and Fe 415 grade steel for both wall and footing. Assume the longitudinal reinforcement of the wall to comprise 0.25 percent of the gross cross-sectional area.

[30]

(OR)

2. Design a reinforced concrete slab of size 6m × 4 m whose one short edge is discontinuous and corners are restrained at supports. The slab has to carry a live load of 4 kN/ m² and a floor finish of 1.5 kN/ m². Use M20 concrete and Fe 415 steel. Sketch the details of reinforcements.

[30]

PART-B

3. (a) Why does the code specify an effectively higher modular ratio for compression reinforcement, as compared to tension reinforcement?

(b) The term ‘balanced section’ is used in both working stress method (WSM) and limit state method (LSM). Discuss the difference in meaning.

[7+8]



4. A reinforced concrete T-beam has a flange width of 1000 mm and thickness 120 mm. The web is 250 mm wide and 600 mm deep. Design the T-beam to carry a live load of 25 kN/m over a span of 8m. Use M20 concrete and Fe 415 steel. Sketch the reinforcement details.

[15]

5. A column of size 300 mm × 400 mm has effective length of 4 m and is subjected to $P_u = 1100$ kN and $M_u = 160$ kN-m about the major axis. Design the column using M25 concrete and Fe 415 steel, providing the steel

(i) On two sides

(ii) on four sides.

Assume cover of 60 mm.

[15]

6. A column of size 250 × 500 mm supports a cantilever beam of span 3 m. the cross section of the beam is 230 × 500 mm and is reinforced with 4 bars of 20 mm Fe 415 steel. Concrete used is of grade M20. Assuming effective cover as 50 mm. calculate the anchorage length required and sketch how it is provided.

[15]

7. A rectangular simply supported beam of clear span 5 m is 300 × 500mm in cross section. It is reinforced with 4 bars of 20mm diameter. M20 concrete and Fe 415 steel are used. The effective cover is 40mm. Taking super imposed live load as 25 kN/m and dead load as 18 kN/m, calculate the short term and long term deflections of the beam.

[15]



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Design and Drawing of Concrete Structures - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

Note: Answer any ONE question from PART-A and THREE questions from PART-B
Use of IS: 456-2000 and design charts from SP-16 is allowed.

PART-A

1. The footing of uniform thickness is to be designed for a column of size 300× 450 mm carrying an axial load of 950 kN. Due to site condition one side of the footing is to be restricted to 2.5 m only. Design the rectangular footing using M20 concrete and Fe 415 steel.

[30]

(OR)

2. Determine the reinforcement to be provided in a square column 300 mm × 300 mm subject to uniaxial bending with bending with the following data:

Factored load = 1100 kN
Factored bending moment = 125 kN-m
Grade of concrete = M20
Grade of steel = Fe-415

The reinforcement is to be provided on four faces equally. Use SP – 16.

[30]

PART-B

3. (a) Why is it undesirable to design over-reinforced sections in (i) working stress method (WSM), (ii) limit state method (LSM)?
(b) Justify the code specification for the limiting neutral axis depth in limit state method (LSM).

[7+8]



4. At a particular cross section of R.C. Beam $300\text{mm} \times 600\text{mm}$ in size, a factored bending moment of 120 kN-m , a factored shear force of 120 kN and a factored torsion moment of 65 kN-m are acting. Design the necessary reinforcements using M25 concrete and Fe 415 HYSD bars.

[15]

5. Design a cantilever slab of span 2.5m to carry a imposed load of 3 kN/m^2 over its entire span. Take finishing load as 0.75 kN/m^2 . Use M20 concrete and Fe 415 steel. Sketch the details of reinforcement, if the slab is supported by a beam of size $300\text{ mm} \times 500\text{ mm}$.

[15]

6. A 250 mm wide and 600 mm deep R.C. beam is reinforced with 2 legged 10 mm inclined stirrups at 250 mm c/c with $\alpha = 60^\circ$. Longitudinal steel consists of 4 bars of 20 mm with a cover of 40 mm . If concrete grade is M25 and grade of steel is Fe 415, determine the strength of the section in shear.

[15]

7. A cantilever beam of span 3.5 m has a cross section of $250\text{ mm} \times 500\text{ mm}$. It is reinforced with 4 bars of 20 mm diameter on tension side and 2 bars of 20 mm on compression side, with effective cover of 50 mm on both sides. Determine the deflection at free end, if it is subjected to a total service load (including self weight) of 35kN/m . Grades of concrete and steel used are M 25 and Fe 415.

[15]



Code No: R31015

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

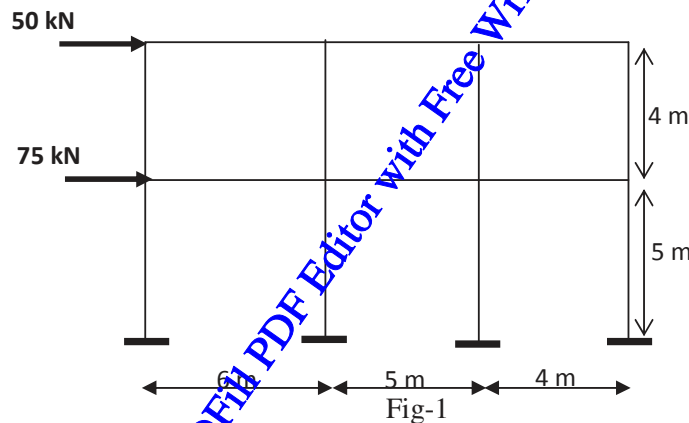
STRUCTURAL ANALYSIS-II
(Civil Engineering)

Time: 3 Hours

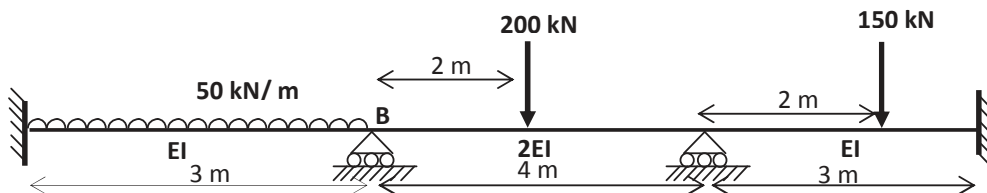
Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. A three-hinged parabolic arch of span 36 m and a central rise of 7 m is subjected to two concentrated loads 150 kN and 100 kN at a distance of 8 m and 15 m from the right hinge and an uniformly distributed load of 40 kN/m on the left half of the span. Find the resultant support reactions and the horizontal thrust, bending moment and the radial shear at a section 8 m from the left support.
2. A two hinged parabolic arch has 30 m span and 6 m central rise. The arch is subjected to a concentrated load of 75 kN from the left hinge. The second moment of inertia of the arch rib varies as the secant of the slope of the rib axis. Determine the horizontal thrust and the support reactions.
3. Analyse the frame shown in Fig.1, using portal method.



4. A cable of a suspension bridge of span 120 m and central dip of 12 m is subjected to a rise of temperature of 25°C . The cable is subjected to a uniformly distributed load of 35 kN/m run of the horizontal span. Find the increase in the dip of the cable and change in the tension due to the rise of temperature. Adopt the coefficient of thermal expansion is $12 \times 10^{-6}/^{\circ}\text{C}$
5. Analyse the continuous beam shown in Fig.2, by moment distribution method.



6. Analyse the frame shown in Fig.3 by Kani's method.

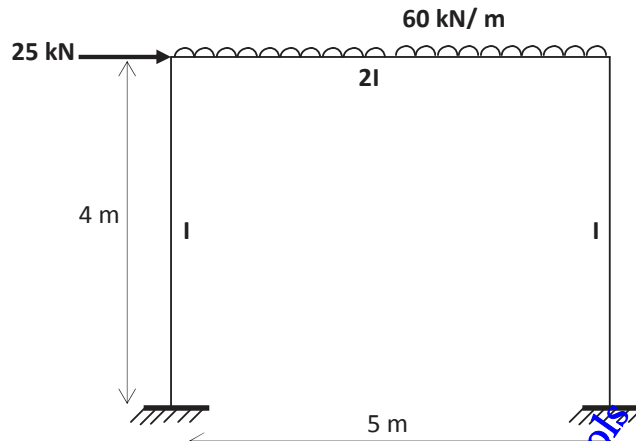


Fig-3

7. Analyse the beam shown in Fig.4, using flexibility method.

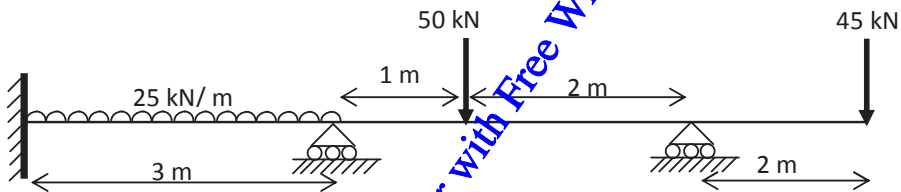


Fig-4

8. Analyse the beam shown in Fig.5, using stiffness method. Also draw the bending moment and shear force diagrams.

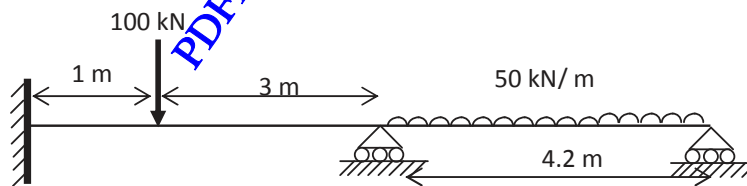


Fig-5



Code No: R31015

R10

Set No: 2

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

STRUCTURAL ANALYSIS-II
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. A three-hinged circular arch of span 25 m and a central rise of 5 m is subjected to two concentrated loads 125 kN and 75 kN at a distance of 5 m and 15 m from the left hinge respectively. Find the resultant support reactions and the horizontal thrust, bending moment and the radial shear at a section 8 m from the right support.
2. A two hinged semi-circular arch of span 20 m is subjected to a vertical concentrated load of 30 kN at the crown. Determine the horizontal thrust at the supports and the bending moment, the normal thrust, and radial shear at a section 6 m from the left hinge.
3. Analyse the frame shown in Fig.1, using cantilever method.

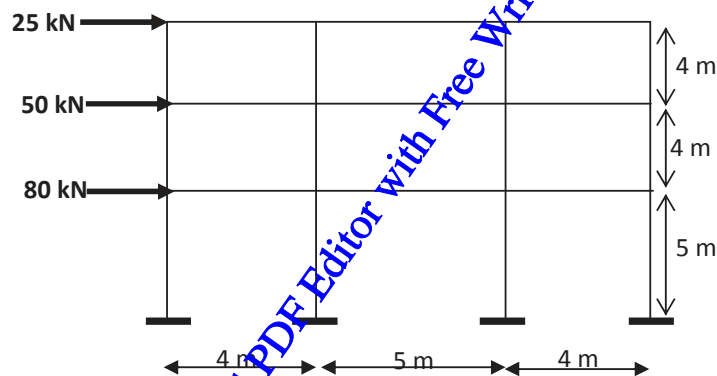


Fig-1

4. The three-hinged stiffening girder of a suspension bridge of span 125 m is subjected to two concentrated loads of 25 kN and 60 kN located at 30 m and 50 m respectively from the left hinge. The central dip of the suspension bridge is 12 m. Determine the bending moment and shear force at a section 40 m from right hinge. Also find the maximum tension in the cable.



5. Analyse the frame shown in Fig.2 ,by moment distribution method.

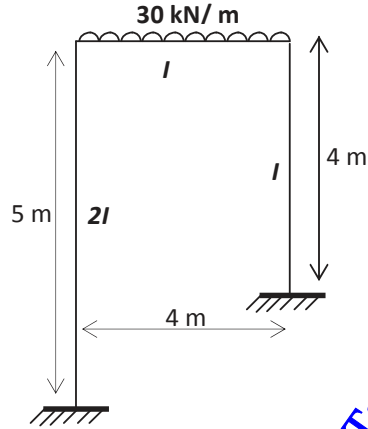


Fig-2

6. Using Kani's method, analyse the beam shown in Fig.3

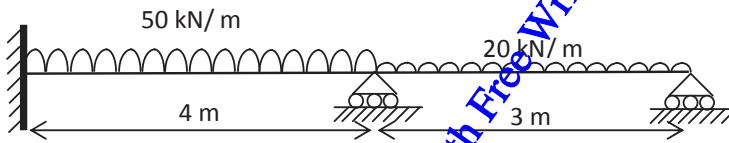


Fig-3

7. Analyse the beam shown in Fig.4 using flexibility method

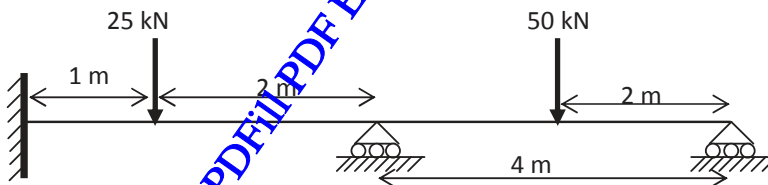


Fig-4

8. Using stiffness method, analyse the continuous beam shown in Fig.5. Also draw the bending moment and shear force diagrams.

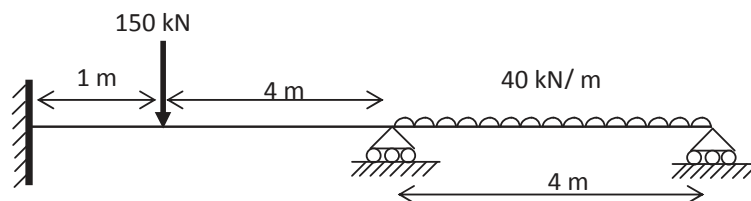


Fig-5

2 of 2



JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

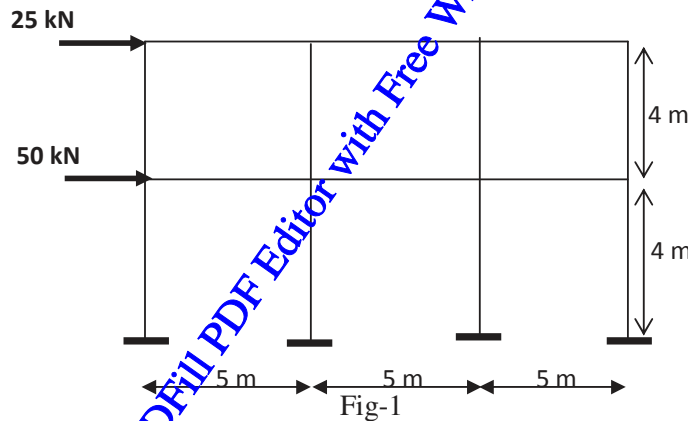
STRUCTURAL ANALYSIS-II
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. A three-hinged parabolic arch of span 24 m and a central rise of 6 m is subjected to two concentrated loads 50 kN and 25 kN at a distance of 6 m and 10 m from right hinge and an uniformly distributed load of 240 kN/m on the left half of the span. Find the horizontal thrust, bending moment and the radial shear at a section 8 m from the left support. Also determine the maximum bending moment.
2. A two hinged parabolic arch has 45 m span and 8 m central rise. The arch is subjected to an uniformly distributed load of 50 kN/m over the left half of the span. The second moment of inertia of the arch rib varies as the secant of the slope of the rib axis. Determine the horizontal thrust and bending moment at a section 15 m from the right support.
3. Analyse the frame shown in Fig.1, using cantilever method.



4. The suspension bridge of span 240 m has two three-hinged stiffening girders supported by a cable with a central dip of 24 m. the width of the road way is 8 m. The roadway carries a dead load of 1 kN/m^2 over the whole span and a live load of 2 kN/m^2 over the right half of the span. Find the bending moment and shear force at a point 75 m from the right hinge. Also find the maximum tension in the cable
5. Using moment distribution method, analyse the continuous beam shown in Fig.2.

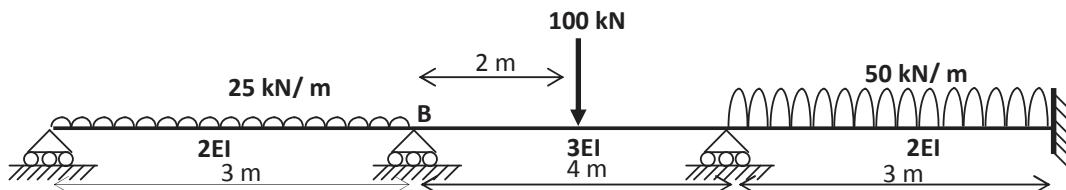


Fig-2
1 of 2



6. Analyse the frame shown in Fig.3, by Kani's method

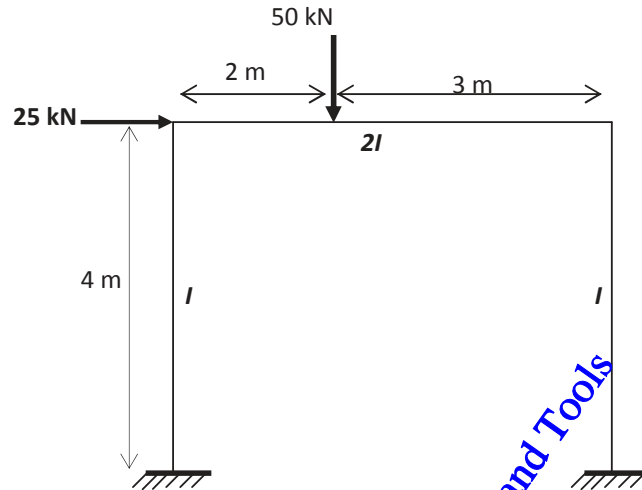


Fig-3

7. Using flexibility method, analyse the beam shown in Fig.4.

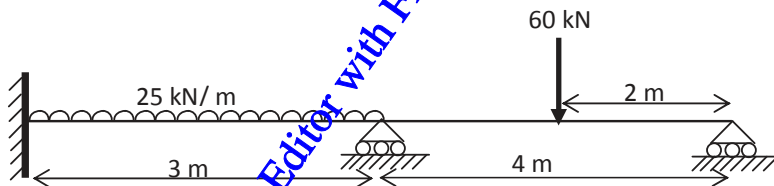


Fig-4

8. Analyse the continuous beam shown in Fig.5, using stiffness method. And draw the bending moment and shear force diagrams

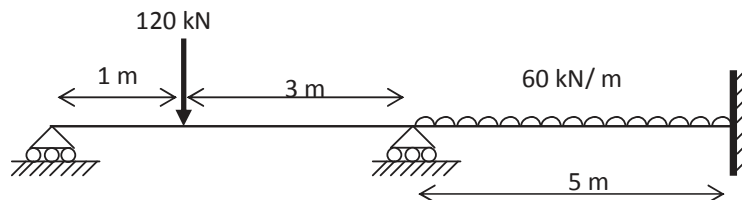


Fig-5



JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

STRUCTURAL ANALYSIS-II
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. A three-hinged parabolic arch of span 32 m has its supports at 5 m and 15 m below the crown. The arch is subjected to two concentrated loads 75 kN and 50 kN at a distance of 6 m and 20 m from right hinge. Determine the resultant support reactions and the bending moment under the loads.
2. A two hinged parabolic arch of span 50 m and central rise 8 m is subjected to a vertical concentrated load of 30 kN at the crown and an uniformly distributed load of 50 kN/m over the left half of the span. Determine the horizontal and radial shear at a section 15 m from the left hinge.
3. Analyse the frame shown in Fig.1, using portal method.

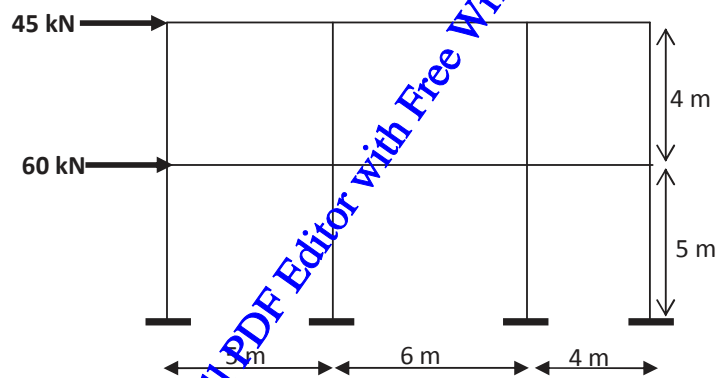


Fig-1

4. The suspension bridge of span 180 m has two two-hinged stiffening girders supported by a cable with a central dip of 18 m. the width of the road way is 8 m. The roadway carries a dead load of 0.5 kN/m^2 over the whole span and a live load of 1.5 kN/m^2 over the right half of the span. Find the bending moment and shear force at a point 75m from the right hinge. Also find the maximum tension in the cable.



5. Using moment distribution method, analyse the frame shown in Fig.2, Assume the flexural rigidity is constant

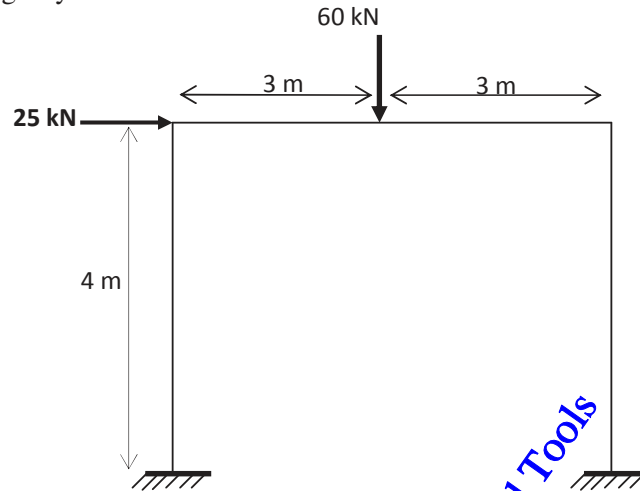


Fig-2

6. Using Kani's method, analyse the beam shown in Fig.3

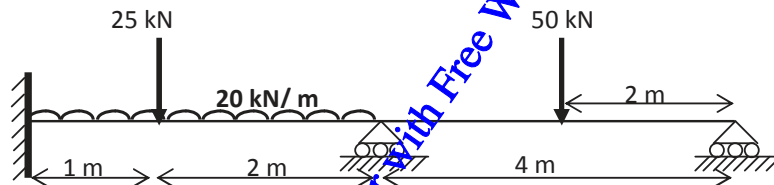


Fig-3

7. Analyse the beam shown in Fig.4, using flexibility method.

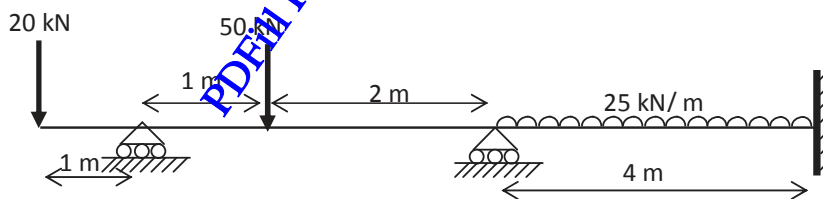


Fig-4

8. Using stiffness method, analyse the continuous beam shown in Fig.5, Also draw the bending moment and shear force diagrams.

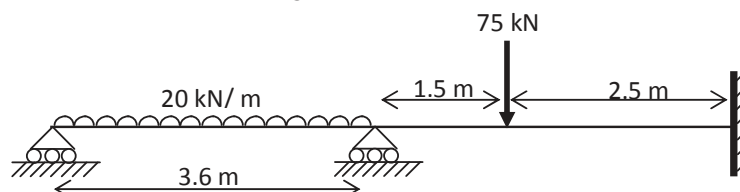


Fig-5

2 of 2



Code No: R31016

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Transportation Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the necessity and objects of highway planning.
(b) Briefly explain the engineering surveys needed for locating a new highway.
2. (a) Derive an expression for calculating the overtaking sight distance on a highway.
(b) Calculate the length of transition curve and the shift using the following data.
Design speed = 65 kmph; Radius of circular curve = 220 m; Allowable rate of introduction of superelevation (pavement rotated about the centre line) = 1 in 150; pavement width including extra widening = 7.5 m.
3. Explain how the speed and delay studies are carried out. What are the various uses of speed and delay studies.
4. (a) Explain IRC method for the design of fixed time traffic signals at cross roads.
(b) Explain Grade separated intersections, the advantages and limitations.
5. Explain CBR and the test procedure for laboratory and field tests. How the results of the test obtained and interpreted?
6. (a) Explain flexible and rigid pavements and bring out the point of difference.
(b) Discuss the effects of repeated applications of loads on pavements. Explain equivalent wheel load factors for load repetitions.
7. (a) Explain the terms 'modulus of subgrade reaction', 'radius of relative stiffness' and 'radius of resisting section'.
(b) Explain the critical locations of loading as regards wheel load stresses in cement concrete pavement. Discuss the Westergaard's concept and assumptions.
8. (a) Enumerate the steps for the preparation of subgrade.
(b) Write down the construction steps for water bound macadam road.



Code No: R31016

R10

Set No: 2

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Transportation Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Briefly outline the highway development in India.
(b) What are the various objectives of preliminary survey for highway alignment? Enumerate the details to be collected and the various steps in the conventional method.
2. (a) Derive an expression for finding length of transition curve on horizontal alignment of highways.
(b) The speed of overtaking and overtaken vehicles are 70 and 40 kmph, respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.99 m/s^2 , calculate the safe overtaking sight distance.
3. What are the objects of carrying out traffic volume studies? Explain the different methods of carrying out traffic volume studies.
4. (a) What are the objects of providing channelized intersections?
(b) Explain the Webster's method for the design of traffic signal cycles for fixed time traffic signals at cross roads.
5. Explain briefly the Marshall method of bituminous mix design.
6. (a) Explain ESWL and the concept in the determination of equivalent wheel load.
(b) Explain how climatic variation affects pavement design and performance.
7. (a) Discuss Westergaard's concept of temperature stresses in cement concrete pavements.
(b) Calculate the stresses at interior, edge and corner of a cement concrete pavement by Westergaard's stress equations using the following data.
Modulus of elasticity of concrete = $3.0 \times 10^5 \text{ kg/cm}^2$; Poisson's ratio of concrete = 0.15;
Modulus of subgrade reaction = 8.5 kg/cm^2 ; Thickness of concrete slab = 18 cm;
Wheel load = 5100 kg; Radius of loaded area = 15 cm.
8. (a) Briefly discuss about the method of construction of gravel roads.
(b) Specify the materials required for construction of WBM roads. What are the uses and limitations of this type of road?



Code No: R31016

R10

Set No: 3

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Transportation Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) what are the significant recommendations of Jayakar Committee Report? Mention how this helped in road development in India.
(b) Explain with sketches the various factors controlling the alignment of roads.
2. (a) Enumerate the steps for practical design of superelevation.
(b) A vertical summit curve is formed at the intersection of two gradients, +3.0 and -5.0 percent. Design the length of summit curve to provide a stopping sight distance for a design speed of 80 kmph. Take $t = 2.5$ sec and $f = 0.35$.
3. Explain spot speed, running speed, space mean speed, time mean speed and average speed. How are spot speed studies carried out?
4. (a) Explain the various types of Road markings commonly used?
(b) What are the advantages and limitations of a rotary intersection?
5. What are the various tests for judging the suitability of road stones? Discuss the objects of carrying out each of these tests and their advantages and limitations.



6. (a) Discuss the application of Burmister's two layer theory in pavement design.
 (b) Soil subgrade sample was obtained from the project site and the CBR test was conducted at field density. The following were the results.

Penetration (mm)	Load (kg)	Penetration (mm)	Load (kg)
0.0	0.0	3.0	56.5
0.5	5.0	4.0	67.5
1.0	16.2	5.0	75.2
1.5	28.1	7.5	89.0
2.0	40.0	10.0	99.5
2.5	48.5	12.5	106.5

It is desired to use the following materials for different pavement layers.

- (i) Compacted sandy soil with 7 percent CBR
 (ii) Poorly graded gravel with 20 percent CBR
 (iii) Well graded gravel with 95 percent CBR
 (iv) Minimum thickness of bituminous concrete surfacing may be taken as 5cm.
 The traffic survey revealed the present AADT of commercial vehicle as 1200. The annual rate of growth of traffic is found to be 8 percent. The pavement construction is to be completed in 3 years after the last traffic count.
 Design the pavement section by CBR method as recommended by IRC using all the four pavement materials.
7. (a) Briefly outline the I.R.C. recommendations for determining the thickness of cement concrete pavement.
 (b) Design the size and spacing of dowel bars at the expansion joints of a cement concrete pavement of thickness 25 cm with radius of relative stiffness 80 cm, for a design wheel load of 5000 kg. Assume load capacity of the dowel system as 40% of the design wheel load. Joint width is 2 cm, permissible shear and flexural stresses in dowel bar are 1000 and 1400 kg/cm² respectively and permissible bearing stress in CC is 100 kg/cm².
8. (a) what are the materials required, plants and equipment and construction steps for the surface dressing bituminous construction.
 (b) What are the advantages and drawbacks of cement concrete roads? Explain cement grouted and rolled concrete layers and their uses.



Code No: R31016

R10

Set No: 4

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015

Transportation Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain briefly the modified classification of road system in India as per the Third Twenty Year Road Development Plan, 1981-2001.
(b) What are the various requirements of an ideal alignment? Discuss briefly.
2. (a) Derive an expression for finding the stopping sight distance at level and at grades.
(b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on a certain locality. Calculate the superelevation needed to maintain this speed. If the maximum superelevation of 0.07 is not to be exceeded, calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius. Safe limit of transverse coefficient of friction is 0.15.
3. What are the different causes of traffic accidents? Explain various measures that may be taken to prevent accidents.
4. (a) Explain the various types of traffic signs with neat sketches.
(b) What are the advantages and disadvantages of traffic signals?
5. What are the various tests carried out on bitumen? Briefly mention the principle and uses of each test.
6. (a) Discuss the advantages and limitations of CBR method of design.
(b) The CBR value of subgrade soil is 8 percent. Calculate the total thickness of flexible pavement using (i) design curve developed by California State Highway Department (ii) design chart recommended by I.R.C. (iii) design formula developed by the U.S. Corps of Engineers.
Assume light traffic or 3175kg wheel load and tyre pressure of 5 kg/cm^2
7. (a) Explain how the dimensions and spacing of tie bars are designed.
(b) Find the spacing between contraction joints for a 3.5 m slab width having a thickness of 22 cm for (i) Plain concrete slab (ii) R.C.C. slab.
The allowable tensile stress values in concrete and steel are 0.8 and 1400 kg/m^2 , coefficient of friction is 1.5.
8. (a) Explain briefly the construction of earth roads. Discuss the advantages and limitations of earth roads.
(b) Enumerate the steps in the construction of cement concrete pavement.



Code No: R31014

R10

Set No: 1

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Water Resources Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

- (a) What is hydrologic cycle and what is its importance?
(b) In a certain river basin, there are four rain gauge stations, with their normal annual precipitations amounting to 800,520,440 and 400 mm, respectively. Determine the optimum number of rain gauges in the catchment, if it is desired to limit the error in the mean value of rainfall in the catchment to 12%.
- (a) Explain the following: (i) Evaporation (ii) Transpiration
(iii) Infiltration (iv) consumptive use
(b) Explain Φ -index method and W-index method for calculating net storm rainfall.
- (a) Explain the procedure for derivation of synthetic unit hydrograph for an ungaged catchment.
(b) Compute and plot the ordinates of a storm hydrograph resulting from a 4 hr storm with rainfall of 40 mm. The ordinates of 1 hr unit hydrograph are given below:

hours	03	06	09	12	15	18	21	24	03	06
Ordinates of unit hydrograph (cumec)	0	115	370	505	395	315	255	240	180	135
hours	09	12	15	18	21	24				
Ordinates of unit hydrograph (cumec)	100	70	45	25	15	0				

- (a) Enumerate the different methods of measuring discharge. How will you measure the discharge of (i) a river (ii) a small stream and (iii) canal?
(b) What is flood routing? Explain in detail any one method of flood routing.



5. (a) Derive the equilibrium flow equations for (i) confined aquifer (ii) unconfined aquifer.
(b) A well of 25 cm diameter is located in a confined aquifer of transmissibility $500 \text{ m}^2/\text{day}$ and storage coefficient of 0.005. What pumping rate will have to be adopted, if the drawdown at the well is not to exceed 1m in 3 days?
6. (a) Explain the following: (i) flow irrigation (ii) lift irrigation (iii) perennial irrigation
(b) What is meant by C2-S2 water? Discuss its usefulness for irrigating fine textured soils.
7. (a) Describe briefly the factors affecting duty.
(b) Compute the depth and frequency of Irrigation required for a certain crop with data given below: Root zone depth = 100cm; wilting point = 12%; Field capacity = 22%; consumptive use = 25 mm/day; Apparent specific gravity of soil = 1.5; Efficiency of Irrigation = 50%. Assume 50% depletion on available moisture before application of irrigation water at field capacity.
8. (a) What is balancing depth in a canal? Derive an expression for the same.
(b) Design a concrete lined channel to carry a discharge of 400 cumec at a slope of 1 in 10000. The side slopes of the channel are 1.25:1 and Manning's N may be taken as 0.014. The depth is limited to 5 m.



Code No: R31014

R10

Set No: 2

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Water Resources Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is an intensity duration curve and how will you proceed to derive such a curve for a given frequency at a rain gauge station from the available data of worst storms of different durations kept for a sufficient number of years.
(b) Differentiate between recording and non-recording type rain gauges. Which type of gauge is used for remote recording of rainfall?
2. (a) Explain the difference between evaporation, interception and transpiration ratio.
(b) Briefly describe any method by which you can measure the evaporation loss from a free water surface.
3. (a) What is unit hydrograph? Describe how you can obtain the unit hydrograph from a flood hydrograph resulting from a storm of certain duration.
(b) What is meant by ground water depletion curve and how it is derived?
4. (a) What are the various methods of estimating the design flood of a catchment?
(b) Distinguish between channel routing and reservoir routing.
5. (a) Briefly explain the terms: (i) radius of influence (ii) drawdown (iii) cone of depression (iv) specific yield.
(b) An observation well 25 m away from the pumping well records a drawdown of 2 m after 30 minutes of pumping. Find the time when another well 50 m away will record the same drawdown.



6. (a) What are the different types of irrigation systems? Discuss each of these systems briefly.
- (b) Write short note on: (i) mixed cropping (ii) ill effects of irrigation (iii) sodium hazards of irrigation water.
7. (a) Explain the following terms: (i) base period (ii) cash crops (ii) intensity of irrigation (iv) kor water depth.
- (b) The discharge at an outlet is $0.2 \text{ m}^3/\text{s}$. Average losses from outlet to field are 10% of water flowing through the outlet. If kor period and kor depth for wheat and rice are 3 weeks, 120 mm and 2 weeks, 250mm, calculate how much area can be irrigated for each crop.
8. (a) What are the causes of water logging? What are the ill-effects of water logging?
- (b) Design a concrete lined channel to carry a discharge of 20 cumec at a slope of 1 in 10000. The side slopes of the channel are 1.25:1 and Manning's N may be taken as 0.014.



Code No: R31014

R10

Set No: 3

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Water Resources Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Write down the general expression for intensity duration relationship of rainfall. Explain the necessity for frequency analysis.
(b) How do you determine statistically the optimum number of rain gauges required to be installed in a given catchment.

2. (a) What is evaporation? Mention the factors controlling the evaporation process.
(b) Compute the infiltration index Φ for the following data: total rainfall during storm = $76.25 \times 10^6 \text{ m}^3$, estimated groundwater contribution in total runoff = $1.25 \times 10^6 \text{ m}^3$, area of the basin = 250 km^2 , rainfall distribution is as follows

hours	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16
mm/hour	25	50	50	35	20	20	15	12.5

3. (a) Determine the unit hydrograph of an effective duration of 3 hours. The flood hydrograph due to an isohyetal storm of 3 hours duration has 6 hours ordinates as under in cumecs: 2; 4; 33; 116; 86; 64; 46; 32; 18; 15; 9; 7; 5; and 3. Assume a base flow of 2 cumec. The catchment area of the basin is 200 km^2 .
(b) Define unit hydrograph and state its uses.

4. (a) Write short notes on flood frequency analysis of Gumbels method and Log-Pearson type III method.
(b) Describe the various methods adopted for control of floods?



5. (a) A well penetrates 25 m into a saturated free aquifer. The discharge is 250lpm at 5m drawdown in the pumping well. Assuming equilibrium conditions and a homogeneous aquifer, what is the discharge at 7 m drawdown?
(b) Define water table, storage coefficient and transmissibility of an aquifer.
6. (a) Discuss the various sub-surface irrigation methods. Indicate their limitations.
(b) Discuss the quality standards required for irrigation water.
7. (a) write short notes on: (i) Irrigation efficiencies (ii) optimum utilization of irrigation water (iii) crop seasons in India
(b) A water course has a culturable commended area of 1000 hectares. The intensity of irrigation for crop A is 40% and for crop B is 45%, both the crops being rabi crops. Crop A has kor depth of 150mm and kor period 3 weeks; and crop B has a kor depth of 100mm and kor period 2 weeks. Calculate the discharge of the water course.
8. (a) What is canal lining? Discuss the advantages and disadvantages of canal lining.
(b) A canal has a bed width of 6 m, full supply depths 1.6 m, bank width 2.5 m, cutting slope 1:1, filling slope 1.5:1 and free board 0.4 m. calculate balancing depth.



Code No: R31014

R10

Set No: 4

JNT University Kakinada
III B.Tech. I Semester Regular/Supplementary Examinations, Dec - 2014/Jan -2015
Water Resources Engineering - I
(Civil Engineering)

Time: 3 Hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is meant by rain gauge density? What are the standards prescribed for it for different regions?
(b) Discuss briefly the three important methods which are used for determining the mean rainfall over a drainage basin.
2. (a) Explain any two methods of reducing the evaporation loss from a free water surface.
(b) Write short notes on transpiration and transpiration ratio and Φ -index and W-index.
3. (a) What are the factors that are affecting runoff.
(b) Describe the method of computing the ordinates of a unit hydrograph from the data of a flood hydrograph.
4. (a) Describe the Muskingum method of routing an inflow hydrograph through a channel reach.
(b) Explain briefly the following terms: (i) design flood (ii) probable maximum flood (iii) probability of exceedence.
5. (a) A 25cm well penetrates 50 m below the water table. After a long period of pumping at a rate of 1000 lpm, the drawdown in the wells 20 m and 40 m from the pumped well is found to be 4 m and 2.5 m respectively. Determine the transmissibility of the aquifer. What is the draw down in the pumped well?
(b) Derive the expression for yield of a open well by recuperation test method.



6. (a) Discuss briefly the factors affecting the choice of the method of irrigation.
(b) Explain the following: (i) crop seasons (ii) mixed cropping (iii) Salt concentration of irrigation waters and their utility in irrigation.
7. (a) Define duty and delta. How can the duty are improved.
(b) After how many days will you supply water to soil in order to ensure sufficient irrigation of the given crop, if: field capacity of the soil = 28%; permanent wilting point = 13%; dry density of soil = 1.3 gm/cc; effective depth of root zone = 70 cm; daily consumptive use of water for the given crop = 12 mm. Assume any other data required.
8. (a) Explain the method of design of a lined canal.
(b) Using Lacey's theory design an irrigation channel to carry 28 cumecs, side slopes of the channel are $\frac{1}{2}$:1 and silt factor $f = 1.25$.

