Q. No. CEC - 401 084

ND/B.Tech./Even

Reg/2022-23

2022-23

STRUCTURAL ANALYSIS - I

CEC - 401

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Solve *all* questions of in Part - A and Part - B :

Part - A

A1. A cantilever beam AB of uniform section fixed at A carries a uniformly distributed load of 'ω' / m run over entire span L. If a vertical concentrated upward load 'P' is applied at 3L/4 from fixed end, find the values of P in terms of 'ω and L'. The point of application of 'P' is at the same level as that of cantilever beam before bending. Use either Elastic beam theory or Moment area method. 10 [CO3]

A2. A simply supported beam AB of span 'L' and flexural rigidity EI carries two point loads 'P' at one-third point from each end. Find the deflection at mid-point of the beam using Conjugate beam method. 5 [CO3]

P.T.O.

Part - B

B1. Using the Virtual work method, calculate horizontal or vertical deflection of joint C of the truss shown in Fig QB1. The cross sectional areas of all the members are of 1500 sq. mm. E = 200 GPa. 5 [CO4]

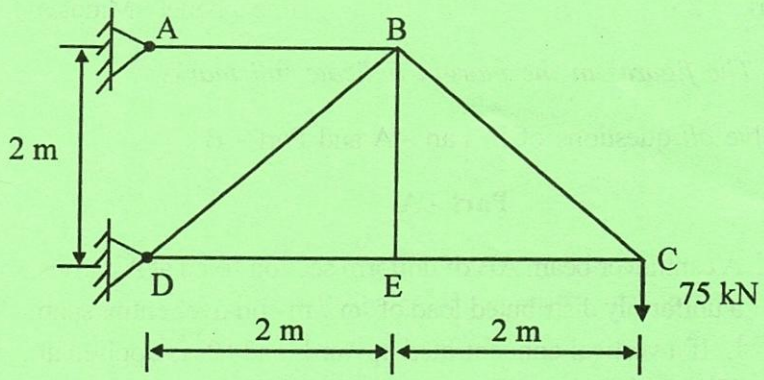

Fig. QB1

B2. Using the Virtual work method, determine the Bending moment at the point D of the simply supported beam due to the load system shown in Fig QB2. 5 [CO4]

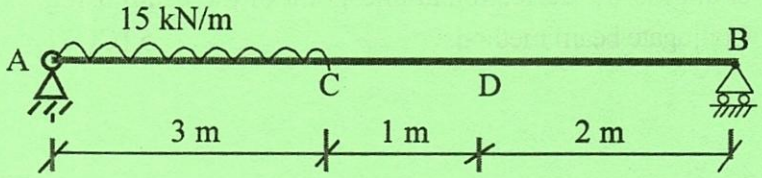

Fig. QB2

Course Outcomes :

- CO1 : Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy
- CO2 : Able to compute the internal forces in cable, arch, trusses, beams and frames
- CO3 : Achieved the idea to apply geometric methods to obtain slope and deflections
- CO4 : Gain the idea to apply Energy methods to obtain slope and deflections
- CO5 : Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load

Q. No. CEC - 402 0087 ND/B.Tech./Even

Reg./2022-23

2022-23

DESIGN OF CONCRETE STRUCTURES

CEC - 402

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answer to the point and brief. 2 marks allotted for neatness.
Use of IS:456-2000 is permitted
Use combination of M25 and Fe415
Show details/sections compulsorily
Assume any suitable data. if not supplied.

1. (a) State the assumptions of working stress and limit state method of design. 2+2 [CO1]

   (b) Derive the factors 'k', 'j' and 'Q' in a reinforced concrete section following working stress method. 2+1+1 [CO2]

   (c) Why over-reinforced section is not desirable ? What are the possible alternatives ? 2+1 [CO3]

2. (a) A beam with overhang is simply supported at 'A' and 'B' with its free end at 'C'. The length of AB is 5m and BC is 2m. AB carries a uniformly distributed load of 20 kN/m over the entire span and BC is carrying a point load of 25 kN at its free end. Draw BMD & SFD. 2+2 [CO3]

P.T.O.

(b) (i) Design the beam section at midspan (of AB) as rectangular section against flexure from the first principle assuming both under-reinforced as well as doubly reinforced section following WSM. 4+4 [CO3]

Or,

(ii) Design the beam section at support (B) as rectangular section against flexure from the first principle assuming both under-reinforced as well as doubly reinforced section following LSM. 4+4

Course Outcomes :

CO1 : Apply knowledge of solid mechanics for design solutions.

CO2 : Understand basic design philosophies applicable to Concrete structures

CO3 : Formulate, analyze, and design basic components of Reinforced Concrete structures.

Q. No. CEC - 403 0084 ND/B.Tech./Even

Reg./2022-23

2022-23

SURVEYING

CEC - 403

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answer *all* the questions.

Programmable scientific calculators are not allowed

1. In running fly level from a Bench Mark of RL 120.75 M, Following readings were taken (Back sight : 0.85, 1.285, 1.182, 0.965, 0.49) and corresponding Fore sights were : 0.555, 1.150, 1.945, 1.756 5 respectively. From the last position of the instrument, seven pegs are set at 10m interval on a falling gradient of 1 in 50. RL of 1st peg is 120.0 m. Work out the RL for all stations and pegs. Fill the level book and apply necessary arithmetic checks. 10 [CO3]

2. What is curvature correction ? Explain with a neat illustration. Establish an empirical relationship between curvature correction and horizontal distance. Make necessary assumptions. 5 [CO1]

3. A line was measured with a steel tape which was exactly 30m at a pull of 5kg and the measured length was 157.31m. The pull applied during measurement was 10 kg and the tape

P.T.O.

was uniformly supported at the temperature of 30 degree Celsius. Find the true length of line if the cross-sectional area of tape was 0.02 cm^2 and modulus of elasticity of tape material = 2.1×106 kg/cm^2. Assume Standard Temperature as 20 degree Celsius and standard pull applied is 15 kg. 5 [CO1]

4. (a) What is a well-conditioned triangle ? Explain its significance in surveying.

   (b) Classify the survey based on nature of the field and state their objectives. 5 [CO2]

Course Outcomes :

CO1 : Learn basic principles of surveying and handling of various surveying instruments.

CO2 : Learn to conduct engineering surveys.

CO3 : Data entry in field books and level books.

CO4 : Make and interpret maps.

CO5 : Compute area and volumes

Q. No. CEC 601/ 077

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

WATER RESOURCE ENGINEERING

CEC 601

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Answer any *five* questions.

Question No.	Body of the Question	Marks	Mapped CO

1. (i) List the different types of precipitation according to the factors responsible for lifting of air mass. Explain briefly anyone.

   (ii) There are four rain gauge stations existing in the catchment. The average annual rainfall values at these stations are 750, 600, 420 and 500 mm respectively. Determine the optimum number of a rain gauges in the catchment if it is desired to limit the error in the mean value of a rainfall in the catchment to 10%. Is the number of rain-gauge in that catchment sufficient to record the amount of rainfall? If not, how many more gauges are required to be installed? 2+3 CO1

2. (i) Explain the various steps involved in watershed delineation.

   (ii) Differentiate between D8 and D Infinity models. 3+2 CO2

3. (i) The weather conditions recorded at a weather station are: Incident radiation 978 W/ m^2- Water temperature 26°C, Air temperature 28.5°C. Relative humidity 75 %,

wind speed 1.7 m/s at 2 meters. If a lake near the weather station has surface area of 1.5 km^2, determine the evaporation rate in mm/day and volume of water loss (m^3) using the energy balance method. (Take Albedo =0.35, relative emissivity of water= 0.995, Stefan-Boltzman-Constant= 5.67 $E^{-8}W/m^2K^4$, density of water = 997 kg/m^3) 5 CO2

4. (i) The infiltration capacity of soil in a small watershed was found to be 6cm/h before a rainfall event. It was found to be 1.2 cm/h at the end of 8 hours of storm. If the total infiltration during the 8 hours period of storm was 15 cm, estimate the value of decay coefficient K_h in Horton's infiltration capacity equation 5 CO1

5. (i) Explain Thiessen Polygon method and write down its formula.

   (ii) A lake had a water surface elevation of 103.200 m above datum at the beginning of a certain month. In that month, the lake received an average inflow of 6.0 m3/s from surface runoff sources. In the same period, the outflow from the lake had an average value of 6.5 m3/s. Further, in that month, the lake received a rainfall of 145 mm and the evaporation from the lake surface was estimated as 6.10 cm. Write the water-budget equation for the lake and calculate the water surface elevation of the lake at the end of the month. The average lake-surface area can be taken as 5000 ha. Assume that there is no contribution to or from the groundwater storage. 2+3 CO2

6. (i) For the storm commence at 7:00 hours. The ordinates of the rainfall mass-curve of the storm in mm as recorded by the recording rain gauge at every 15 minutes time intervals are: 0, 9.5, 17, 27, 40.5, 49, 63, 84,

95, 102, 110, 112, 112. Calculate the maximum rainfall intensities for the durations of 30, 60 and 180 min.

(ii) Write down the recommended rain gauge density guidelines as per IS: 4987-1968 3+2 CO1

7. (i) Distinguish between a) Infiltration capacity and infiltration rate b) Actual and Potential Evapotranspiration c) Mass curve and Double mass curve

(ii) A 6-hour rainstorm with hourly intensities of 7, 18, 25, 17, 11 and 3mm/hour produced a runoff of 39 mm. Determine the value of Phi (Φ) index. 3+2 CO1

COURSE OUTCOMES

CO1: Understanding of occurrence, distribution, storage & transmission of water in different form in the space, on the surface and below the surface of the earth

CO2: Understanding of tempo-spatial collection of data and preparation of hydrometeorological information system

CO3: learning importance, requirement, method & infrastructure for imparting irrigation water to crop, development & conservation of water for its economic & efficient use

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Q. No. CEC 602/ 092

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

FOUNDATION ENGINEERING

CEC 602

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Graph paper shall be supplied, if required.

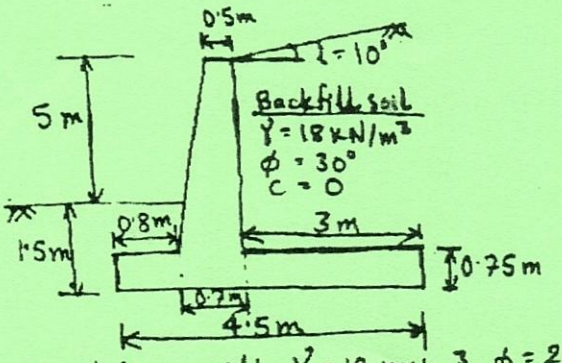
Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO

1. A retaining wall of 4 m height has a smooth vertical back retaining a cohesionless fill with horizontal backfill surface in level with the top of the wall. There is a uniformly distributed surcharge load of 36 kN/m^2 acting over the backfill surface. The water table is at 1.5 m depth from the backfill surface. The backfill soil has the following properties: bulk unit weight = 18 kN/m^3, angle of internal friction = 30°, saturated unit weight =19 kN/m^3. Assume that there is no change in the angle of internal friction due to submergence. Draw the variation in active earth pressure along the height of the wall. Determine the magnitude and point of application of the active earth pressure force per meter length of the wall. 8 CO2

2. Check the stability of the retaining wall as shown in Figure below.

   Consider unit weight of concrete = 24 kN/m^3. 8 CO2



Foundation soil: $\gamma = 19\ kN/m^3$, $\phi = 20°$, $C_a = 40\ kPa$, $\delta = 19°$, safe bearing capacity = 500 kPa

3. Derive the relationship between major principal stress (σ_1) and minor principal stress (σ_3) at failure for a cohesive ($c - \phi$) soil from Mohr-Coulomb failure criteria. 4 CO1

4. A cylindrical sample of dry sand was tested in a triaxial test. Failure occurred under a cell pressure of 1.2 kg/cm^2 and deviator stress of 4 kg/cm^2. Find out the angle of internal friction of the soil. Also estimate the normal and shear stresses on the failure plane and orientation of the failure plane with the major principal plane. 5 CO1

COURSE OUTCOMES

CO1: Calculate shear strength of soil

CO2: Determine the earth pressures on foundations and retaining structures

CO3: Analyse stability of finite and infinite soil & rock slopes

CO4: Calculate the bearing capacity of soils and foundation settlements

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