Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **14CE3021** | **Duration :** | **3hrs** |
| **Sub. Name :** | **PRESTRESSED CONCRETE STRUCTURES** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Derive the fundamental equations of analyzing prestressed concrete flexural element. | CO2 | 14 |
| b. | Depict the ‘at transfer’ stage in prestressed concrete. | CO1 | 2 |
| c. | Can you identify the concrete grades that can be applied in practice as suggested by IS code. | CO1 | 2 |
| d. | What do you mean by concentric tendons? | CO1 | 1 |
| e. | Distinguish between low, medium and high strength concrete. | CO1 | 1 |
| (OR) | | | | |
| 2. | a. | Demonstrate what you learnt to analyse and design a post tensioned beam of span 15 m for a live load of 12kN/m. Strength of concrete at transfer is 35 N/mm2. The wires are initially stretched to 1100 MPa. M40 grade concrete and 5mm diameter HTS wires of tensile strength 1600 N/mm2 are to be used. | CO3 | 1 |
| b. | What approach would you use to avoid elastic shortening in Post Tensioned prestressed concrete beams. | CO1 | 1 |
| c. | Highlight the time dependant losses which you would take into account in the design of prestressed concrete beams. | CO1 | 2 |
| d. | Relate high yield strength deformed steel with high tensile steel. | CO1 | 2 |
| e. | Can you identify the minimum concrete strength requirements prescribed for prestressed concrete members in IS:1343 code? | CO3 | 14 |
| 3. | a. | What is strain compatibility method? Outline the various steps followed in computing the flexural strength of prestressed concrete sections. | CO3 | 5 |
|  | b. | In order to design a prestressed concrete beam, we need to calculate the losses so that we can apply the correct loss factor in the design. Can you work out how would you determine the losses in a post tensioned prestressed concrete beam 350mm wide and 450mm deep prestressed with wires (area 640mm2) located at a constant eccentricity of 150mm and carrying an initial stress of 1100N/mm2. The span of the beam is 12m. Calculate the percentage loss of stress in wires for the following data:  Relaxation of steel stress = 3 percent of the initial stress  Shrinkage of concrete = 300 x 10-6 for pretensioning and 200 x 10-6 for post tensioning  Creep coefficient = 1.6  Slip at anchorage = 1mm  Frictional coefficient for wave effect = 0.0015 per m | CO3 | 15 |
| (OR) | | | | |
| 4. | a. | Discuss the various methods of predicting long – term deflections of uncracked prestressed concrete members | CO3 | 5 |
|  | b. | A simply supported beam of span 20m and live load of 30kN/m, an unsymmetrical section having the following  dimensions is designed adopting M40 grade concrete.  Breadth of the top flange = 800mm  Thickness of top flange = 140mm  Thickness of web = 120mm  Breadth of bottom flange = 420mm  Thickness of bottom flange = 210mm  Depth of the section = 990mm  Eccentricity of prestressing wire = 432mm below the centroidal axis  Eccentricity of the cable at the end sections = 0  Area of prestressing steel = 1630 mm2  Initial Prestressing force = 1957069N  fck = 40MPa and 5mm HTS wires with ultimate stress of 1600N/mm2  Expected loss of prestress = 20%  Design the shear reinforcement for the section which is at span/6 from the support. | CO3 | 15 |
| 5. | a. | Where do you adopt circular prestressing? | CO2 | 5 |
|  | b. | Calculate the ultimate moment of resistance of the flanged section designed for a post tensioned concrete beam of span 15m is obtained as shown in figure given below. Check whether the section is safe with respect to the Limit state of collapse. The live load on the beam is 15kN/m. The eccentricity of the cable is 278.30mm and the Prestressing force is 1446588N. 5 Nos of freyssinet cables of 5mm diameter wires are provided as prestressing steel. | CO3 | 15 |
| (OR) | | | | |
| 6. | a. | Briefly outline the method of estimating the deflection of composite members in cases of i) Unpropped construction ii) Propped construction | CO3 | 5 |
|  | b. | Design a composite T beam for a span of 20m with a beam spacing of 1m c/c. The expected loss of prestress is 15%. The live load on the beam is 42kN/m. The grade of concrete adopted is M40 and HTS wires of 5mm diameter are used. | CO2 | 15 |
| 7. | a. | Design a continuous prestressed beam of two spans (AB = BC = 12m) to support a uniformly distributed live load of 10 kN/m. Tensile stresses are not permitted in concrete and the compressive stress in concrete is not exceed 13 kN/mm2. Sketch the details of the cable profile and the check for stress developed at the support and span sections. | CO2 | 15 |
|  | b. | Explain the terms i) Primary moment ii) Secondary moment iii) Resultant moment iv) Redundant reaction with respect to continuous prestressed concrete beams. | CO3 | 5 |
| (OR) | | | | |
| 8. | a. | State the advantages and disadvantages of partial prestressing | CO2 | 5 |
|  | b. | Design a composite slab for the bridge deck using a standard inverted T section. The top flange is 300mm wide and 150mm thick. The bottom flange is 500mm wide and 350mm thick. The web thickness is 100mm and the overall depth of the inverted T- section is 700mm. The bridge deck has to support a characteristic imposed load of 50 kN/m2 over an effective span of 12m. Grade 40 concrete is specified for the precast pretensioned T with a compressive strength at concrete at transfer of 36 N/mm2. Concrete of grade 30 is used for the in situ part. Determine the minimum prestress necessary and check for safety under serviceability limit state. | CO2 | 15 |
|  | | **Compulsory:** |  |  |
| 9. | a. | What minimum load factors are provided against cracking and ultimate collapse for circular water tanks in the relevant Indian codes. | CO1 | 5 |
|  | b. | A prestressed concrete cylindrical water tank has to store 24500 million litres of water with a storage depth of 8m. Assuming a flexible base, design the wall thickness and the spacing of 7mm dia  HTS wires for prestressing. The design should satisfy the following  conditions.   1. Residual compressive stress of 0.7N/mm2 under working conditions. 2. Cracking load factor of 1.4 and ultimate load factor of 2. 3. M45 grade concrete with compressive stress of 13N/mm2 and tensile stress of 1.7N/mm2. 4. Ultimate tensile stress of wires is 1400N/mm2 and initially stressed to 1100N/mm2 5. Loss of prestress=20% | CO3 | 15 |

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