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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**Supplementary Examination – June – 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. | Design a Post-tensioned slab of 12m for a live load of 12kN per metre run. Adopt concrete grade of M45 and 7mm diameter steel wires of characteristic strength 1520MPa. Design the beam as type 1 structure. Assume that the strength of concrete at transfer is 45MPa and the wires can be initially stretched to 1100MPa. | CO2 | 15 |
| b. | List out the various short term losses. | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | Investigate the losses due to elastic shortening for a post tensioned concrete beam, 100mm wide and 300mm deep, is prestressed by three cables, each with a cross-sectional area of 50mm2 and with an initial stress of 1200N/mm2. All the three cables are straight and located 100mm from the soffit of the beam if the modular ratio is 6. | CO3 | 15 |
| b. | Sketch the cross section recommended by Military Engineering Hand book for MD/ML ratio of 0.7 for preliminary design of prestressed concrete girders. | CO1 | 5 |
| 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 300mm wide and 400mm deep prestressed with wires (area 640mm2) located at a constant eccentricity of 100mm and carrying an initial stress of 1000N/mm2. The span of the beam is 10m. 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. | A rectangular concrete beam of 200 mm width and 400mm depth is simply supported over a span of 10 metres and carries a central concentrated load of 15kN. The prestressing cable with a sharp bend at the mid span section with an eccentricity of 66mm. The magnitude of the prestressing force is 400kN. If modulus of elasticity of concrete is 40kN/mm2, find the maximum deflection when the central concentrated load is applied. | CO3 | 8 |
|  | b. | A prestressed concrete beam of 300mmx650mm rectangular section is prestressed by means of 2 cables, each consisting of 12 numbers of 5mm dia. HTS wires with an uniform eccentricity 175mm throughout its span of 10 meters. If the beam is made of M40 concrete,   1. Calculate the deflection at mid span at the time of transfer of prestress, if the initial prestress in the HTS wies is 1150Mpa. 2. Calculate the uniformly distributed super imposed load that should act on the beam if a maximum downward deflection = span/300 is to be produced at mid span. Assume losses to be 20% | CO3 | 12 |
| 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 20m for a live load of 15 kN/m. Adopt concrete of grade M40 and 5mm dia steel wires of charactersistics strength 1600Mpa. Assume that the strength of concrete at transfer is 35.6Mpa and the wires can be initially stretched to 1200Mpa and check whether this section is safe with respect to the limit state of collapse. | CO3 | 15 |
| (OR) | | | | |
| 6. | a. | Breifly outline the method of estimating the deflection of composite members in cases of (a) Unpropped construction (b) Propped construction | CO3 | 5 |
|  | b. | For a state highway, a slab culvert is to be constructed for a span of 10m. As a prestressed concrete designer and consultant how you will design a post tensioned prestressed concrete slab to carry an equivalent live load of 15kN/m adopting M45 grade of concrete and 7mm diameter high tensile wires of ultimate strength 1520 MPa. The cube strength of concrete at transfer is 35.6N/mm2 | CO2 | 15 |
| 7. | a. | A continuous prestressed concrete beam of uniform section has cable profile as shown in Fig.1. The magnitude of the prestressing force is 1500kN  i) Locate the line of pressure (C-line) in the concrete due to prestress alone not considering the dead load of the beam  ii) What is the secondary moment at section B  iii) Determine the maximum stress at the mid span section of BC due to dead load and prestressing force if cross section is a rectangle of breadth 300mm and depth 800mm | CO2 | 15 |
|  | b. | Write short notes on ‘Partial Prestressing’ – methods of achieving, advantages and disadvantages | CO3 | 5 |
| (OR) | | | | |
| 8. |  | Design a composite T beam using the following data:  Breadth of top flange = 1000mm; Depth of top flange = 100mm  Breadth of bottom flange = 300mm; Depth of bottom flange = 150mm  Thickness of the web = 150mm; Overall depth = 800mm; Span = 8m; spacing of beams = 1m; Expected loss of prestress = 20%; Live load = 40kN/m2; grade of concrete = M40; Take fci = fck | CO2 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | A prestressed concrete cylindrical water tank has to store 26500  million litres of water with a storage depth of 9m. 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.  a. Residual compressive stress of 0.6N/mm2 under working conditions.  b. Cracking load factor of 1.4 and ultimate load factor of 2.  c. M45 grade concrete with compressive stress of 13N/mm2 and tensile stress of 1.7N/mm2.  d. Ultimate tensile stress of wires is 1400N/mm2 and initially stressed to 1100N/mm2  e. Loss of prestress=20% | CO3 | 20 |

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