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| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  FIFTH SEMESTER (S) B.TECH DEGREE EXAMINATION, MAY 2019 | | | |
| **Course Code: CE303** | | | |
| **Course Name: STRUCTURAL ANALYSIS -11** | | | |
| **Scheme of Valuation** | | | |
| (Scheme of evaluation (marks in brackets)and answers of problems/key) | | | |
| **PART A** | | | |
|  |  | ***Answer any two full questions, each carries 15 marks.*** | Marks |
| 1 | a) | Fig. showing three adjacent spans of a continuous beam indicating span length and MI considered in derivation. (1 mark)  Support and free BMD, deflected profile (3 marks)  Derivation (6 marks) | (10) |
|  | b) | Sway analysis procedure with explanatory Figs. and relevant shear equation | (5) |
| 2 |  | Degree of indeterminacy (1 mark)  Consider an imaginary span AˈA and apply three moments equation for AˈAB substitution and forming Eqn. (3 marks)  Apply three moments equation for ABC , substitution and forming Eqn. (2 marks)  Assume imaginary span CCˈ, apply three moments equation for BCCˈ, substitution and forming Eqn. (3 marks)  Solving for MA= -19.583 kNm, MB= -20.833kNm, MC= -8.33kNm (2 marks)  BMD (1mark)  Calculation of reactions ; SFA =+29.69 KN, SFB = 35.94KN, SFC = -13.75KN (2 marks) SFD (1 mark) | (15) |
| 3 | a) | Four steps (3 marks) | (3) |
|  | b) | Fixed end moments for spans AB, BC and CD (3 × 0. 5=1.5 marks)  Slope deflection equations for spans AB, BC and CD and substitutions (3×1=3 marks)  Equilibrium equations at support B, C and D (1+1+0.5=2.5 marks)  Solving for EIƟB(= -7.801), EIƟC(=-25.649) and EIƟD  (2 marks)  Substituting, MAB= -106.55 kNm, MBA= 10.77 kNm, MBC= -10.77 kNm, MCB= 78.56 kNm, MCD= -78.56 kNm (3 marks) | (12) |
| **PART B** | | | |
| ***Answer any two full questions, each carries 15 marks.*** | | | |
| 4 |  | Stiffness factors at joint B and C (2 × 0. 5=1mark)  Distribution factors of BA, BC, CB and CD (4× 0. 5=2 marks)  Fixed End Moments in BC (1 mark)  Non sway moment distribution and moments (2 marks)  Assuming initial sway moments (2 marks)  Sway moment distribution and moments (2 marks)  Final moment equations with proportionality factor.(1 mark)  Determining factor using horizontal shear equilibrium equation (2 marks)  Determining final moments (2 marks) | (15) |
| 5 |  | Fixed end moments for spans AB, BC and CD (3×1=3 marks)  Rotation factor B, C (2×1=2 marks)  Iteration table (3 marks)  Final moment equation (1 mark)  Substitution and calculations of moments, MAB= -106.55 kNm, MBA= 10.77 kNm, MBC= -10.77 kNm, MCB= 78.56 kNm, MCD= -78.56 kNm (2 marks), BMD (1 mark)  Calculation of reactions (2 marks ) and SFD (1 mark) | (15) |
| 6 | a) | Fixed end moments for span AB and BC (2×0.5=1 marks)  Rotation factor at B (1 mark)  Iteration table (2 marks)  Final moments MAB= -22.5 kNm, MBA= 45kNm, MBC= -45kNm, MCB= 67.5kNm (4×0.5=2 marks)  BMD (1 mark) | (7) |
|  | b) | Fixed end moments for span AB, BC and CD (3 ×0.5 =1.5 marks)  Stiffness of members at B and C. (1 mark)  Distribution factor at B, C (2×0.5= 1 marks)  Balancing at A and D (0.5 mark) Distribution table (2)  Final moments, MB= -84.582 kNm , MC= -55.873kNm (2×1=2 marks) | (8) |
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| **PART C** | | | |
| ***Answer any two full questions, each carries 20 marks.*** | | | |
| 7 | a) | Locating neutral axis =33.7mm (1 mark)  Moment of Inertia (2 marks) and Section modulus, Z =36.9×103mm3 (1 mark)  Locating equal area axis=9.583 from top (1 mark)  Plastic section modulus, Zp=66479.17mm3(3 marks)  Shape factor=1.8 (1 mark)  Plastic moment capacity (1 mark) | (10) |
|  | b) | Fig. (1 mark)  Expression for shear force, bending moment and twisting moment at any section (3 marks)  Strain energy Eqn. (1 mark)  Deflection = derivative of strain energy with applied load (1 mark)  Integration and final expression for deflection at free end (4 marks) | (10) |
| 8 |  | Fig. (1 mark)  Support reactions -shear (1 mark), moment (3 marks)  Bending moment at any section (6 marks) and twisting moment (9 marks) | (20) |
| 9 |  | Beam mechanism, Fig. (1 mark), Wc=4Mp/L (4 marks)  Panel mechanism, Fig. (1 mark), Wc=8Mp/L (4 marks)  Combined mechanism, Fig. (2 mark), Equilibrium equation Wc=8Mp/L (6 marks)  Actual collapse load, Wc=4Mp/L (2 marks) | (20) |