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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code : 17MA3041** |  | **Duration :** | **3hrs** |
| **Sub. Name : MATHEMATICAL THEORY OF ELASTICITY** |  | **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. | Determine the strain and rotation tensors eij and ωij for the following displacement field:  where A, B and C are constants. | CO1 | 10 |
| b. | Derive the equations of Equilibrium in 2D case. | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | Explain plane state of stress with its mathematical expressions. | CO1 | 16 |
| b. | Discuss the interpretation of the shear strain components. | CO1 | 4 |
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| 3. |  | Derive the mathematical expression for the torsion of general prismatic bars of solid cross sections. | CO1 | 20 |
| (OR) | | | | |
| 4. | a. | Derive the expression for stresses due to gravitation. | CO2 | 10 |
| b. | A steel shaft of 10 cm diameter is shrunk inside a bronze cylinder of 25 cm outer diameter. The shrunk allowance is 1 part per 1000 (i.e., 0.005 cm difference between the radii). Find the tangential stress in the bronze cylinder at the inside and outer radii and the stress in the shaft. Adopt Esteel = 214 x 106 kPa, Ebronze = 107 x 106 kPa and υ = 0.3 for both metals. | CO2 | 10 |
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| 5. | a. | Derive the mathematical expression for the rotating disks of uniform thickness. | CO3 | 10 |
| b. | The inner surface of the hollow tube is at temperature Ti and the outer surface at zero temperature. Assuming the steady state conditions, calculate the stresses. What are the values of the and  near the inner and outer surfaces. | CO3 | 10 |
| (OR) | | | | |
| 6. |  | A flat steel disk of 75 cm outside diameter with a 15 cm diameter hole is shrunk around a solid steel shaft. The shrink-fit allowance is 1 part in 1000 (i.e., an allowance of 0.0075 cm in radius). E = 214 x 106 kPa.   1. What are the stresses due to shrink-fit? 2. At what rpm will the shrink-fit lossen up as a result of rotation? 3. What is the circumferential stress in the disk when spinning at the above speed?Assume that the same equations as for the disk are applicable to the solid rotating shaft also. | CO4 | 20 |
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| 7. |  | Discuss the laminates and derive the mathematical expressions. | CO5 | 20 |
| (OR) | | | | |
| 8. |  | If an isotropic solid is heated non uniformly to a temperature distribution T(x, y, z) and the material has unrestricted thermal expansion, the resulting strain will be eij = αTδij. Show that this case can only occur if the temperature is a linear function of the coordinates; that is,  T = ax + by +cz +d. | CO5 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Discuss the stress analysis in pressure vessel. | CO6 | 10 |
| b. | Obtain the expression for various elastic constants for the Transversely isotropic material. | CO6 | 10 |