BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS:M.Tech. **SEMESTER : 2nd**
BRANCH:Mechanical **SESSION : SP/22**

SUBJECT: ME531 THEORY OF ELASTICITY

TIME:2Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**

Q.1(a) Explain the material and spatial description of a continuous body. [5]

Q.1(b) A uniform deformation of a square block of side two units and initially centered at $\mathbf{X} = (0, 0)$ is given. The deformation is defined by the mapping [5]
$\mathbf{x}(\mathbf{X}) = (3.5 + X_1 + 0.5X_2)\ \hat{}\mathbf{e}_1 + (4 + X_2)\ \hat{}\mathbf{e}_2 + X_3\ \hat{}\mathbf{e}_3$.
Determine deformation gradient tensor **F.**

Q.2(a) Derive an expression of Generalized Hooke's Law. [5]

Q.2(b) Explain the monoclinic materials, orthotropic materials and Isotropic materials. [5]

Q.3(a) Derive an expression for Papkovich Representation in terms of displacement field. [5]

Q.3(b) State the difference between Kelvin's and Mindlin's Problem. [5]

Q.4(a) In the xy-plane, consider a field $F(x, y)$ and a line defined by $f(x, y) = 0$. Find the points on the line $f(x, y) = 0$ where $F(x, y)$ is a minimum or maximum; that is, find the extrema of $F(x, y)$ subject to the constrain $F(x, y) = 0$. [5]

Q.4(b) Explain the Rayleigh-Ritz method for approximate solutions. [5]

Q.5(a) Sketch the range of the function $w = z^{-1/n}$ if the argument of $z = re^{i\theta}$ restricted to the interval $\theta_0 \le \theta \le \theta_0 + 2\Pi$. The domain δ is the finite z-plane with the origin deleted. [5]

Q.5(b) Explain the plane and half-plane problems of complex variable method. [5]

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