STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2015 – 16 & thereafter)

SUBJECT CODE : 15MT/PC/CM14

M. Sc. DEGREE EXAMINATION, NOVEMBER 2018
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE : CORE
PAPER : CONTINUUM MECHANICS
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A **(5 X 2 = 10)**

ANSWER ALL THE QUESTIONS

1. Define body forces and surface forces.
2. What is continuum configuration.
3. Define path lines and stream lines.
4. State angular momentum principle.
5. Define isotropy and anisotropy in elasticity.

SECTION – B **(5 X 6 = 30)**

ANSWER ANY FIVE QUESTIONS

6. Obtain the stress quadric of Cauchy.
7. Split the stress tensor $\begin{bmatrix} 12 & 4 & 0 \\ 4 & 9 & -2 \\ 0 & -2 & 3 \end{bmatrix}$ into spherical and deviator parts and show that the first invariant of the deviator is zero.
8. The Lagrangian description of a deformation is given by
   $x_1 = X_1 + X_3(e^2 - 1),\ x_2 = X_2 + X_3(e^2 - e^{-2})\ , x_3 = e^2 X_3$ where e is a constant. Show that the Jacobian J does not vanish and determine the Eulerian equations describing this motion.
9. Obtain the first, second and third Lagrangian strain invariants.
10. Obtain the Lagrangian differential form of the continuity equations.
11. Express the engineering constants υ and E interms of the Lame' constants λ and μ.
12. Derive Cauchy's deformation tensor and Green's deformation tensor.

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SECTION – C (3 X 20 = 60)

ANSWER ANY THREE QUESTIONS

13. Explain Cauchy's stress principle, principal stresses, stress invariants and stress ellipsoid.
14. Explain deformation gradient and displacement gradient.
15. (i) Explain the small deformation theory.
    (ii) Obtain the material derivative.
16. State the linear momentum principle. Obtain the equations of motion and equilibrium equations.
17. Write elastic constant matrix for anisotropic body. Obtain it for the plane of symmetry and orthotropic material. When are the plane and axial symmetry equivalent?