STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2011-12 & thereafter)

SUBJECT CODE : 11MT/PE/TS24

M. Sc. DEGREE EXAMINATION, APRIL 2014
BRANCH I – MATHEMATICS
SECOND SEMESTER

COURSE : ELECTIVE
PAPER : TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION –A

Answer all the questions: **5×2=10**

1. Define Inner multiplication.
2. With usual notations prove that $g_{21}G(3,1) + g_{22}G(3,2) + g_{23}G(3,3) = 0$
3. Write Newton's Law in tensor form.
4. Write down the postulates of special theory of relativity.
5. Define world line of a particle.

SECTION –B

Answer any five questions: **5×6=30**

6. Show that the Contraction of the outer product of the tensors A^p and B_q is an invariance.
7. Find the value of g corresponding to
   $ds^2 = 5(dx^1)^2 + 3(dx^2)^2 + 4(dx^3)^2 - 6dx^1dx^2 + 4dx^2dx^3$.
8. Find the covariance derivative of $A_k^j B_n^{lm}$ with respect to x^q.
9. Find the physical components of the velocity in cylindrical coordinates.
10. State and prove Newtonian principle of relativity.
11. Obtain the effect of Lorentz Transformations with respect to the length of an object.
12. Derive the geodesic of the curve in tensor form.

SECTION –C

Answer any three questions: **3×20=60**

13. a) Define metric tensor in cylindrical and spherical coordinates.
    b) Show that $\left\{ {p \atop pq} \right\} = \frac{\partial}{\partial x^q} log\sqrt{g}$. (10+10)

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14. a) Obtain the law of transformation of Christoffel's symbols of first kind and second kind.

    b) If A^p is a tensor prove that $A^p, q = \frac{\partial A^p}{\partial x^q} + \left\{ {p \atop qs} \right\} A^s$ is also a tensor. (15+5)

15. a) Derive work and energy in tensor form.

    b) Derive the Lagrange's Equations for a force system to be conservative. (10+10)

16. Derive Lorenez Transformation Equations and obtain its inverse.

17. Define Quotient Law of tensor. Prove that $A(p.q.r)$ is a tensor where $A(p.q.r)B_r^{qs} = C_p^s$, where B_r^{qs} is an arbitrary tensor and C_p^s is a tensor.