SET A

M.SC. MATHEMATICS
SECOND SEMESTER
MECHANICS & TENSOR
MSM – 204

[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

(Objective)

Time: 15 mins. **Marks: 10**

Choose the correct answer from the following: ***1×10=10***

1. $\Gamma_{ab,c} = ?$

   a. $\frac{1}{2}\left\{\frac{\partial g_{bc}}{\partial x^a} + \frac{\partial g_{ab}}{\partial x^c} - \frac{\partial g_{ac}}{\partial x^b}\right\}$ b. $\frac{1}{2}\left\{\frac{\partial g_{ac}}{\partial x^b} + \frac{\partial g_{bc}}{\partial x^a} - \frac{\partial g_{ab}}{\partial x^c}\right\}$

   c. $g^{ch}[ab,h]$ d. $g_{ch}[ab,h]$

2. $\partial^t_p = ?$

   a. $g_{pm}g^{mt}$ b. 0

   c. 1 d. N

3. $\partial^t_t = ?$

   a. 1 b. N

   c. -1 d. 0

4. Transformation law for the tensor $D^a{}_{bc}$ Is given by

   a. $\overline{D}^a{}_{bc} = \frac{\partial \overline{x}^a}{\partial x^r}\frac{\partial x^b}{\partial \overline{x}^s}\frac{\partial x^c}{\partial \overline{x}^t} D^r{}_{st}$ b. $\overline{D}^a{}_{bc} = \frac{\partial \overline{x}^a}{\partial x^r}\frac{\partial x^s}{\partial \overline{x}^b}\frac{\partial x^t}{\partial \overline{x}^c} D^a{}_{bc}$

   c. $\overline{D}^a{}_{bc} = \frac{\partial \overline{x}^a}{\partial x^r}\frac{\partial x^s}{\partial \overline{x}^b}\frac{\partial x^t}{\partial \overline{x}^c} D^r{}_{st}$ d. None of the above

5. Inertia $I = ?$

   a. $-mr^2$ b. mr^2

   c. MR^2 d. $-MR^2$

6. Impulse can be expressed as

a. $I = -Ft$ b. $I = mFt$

c. $I = Ft$ d. $I = mv - mu$

7. In the expression $A_{pq}A^{qr}$,the Dummy suffix is

a. p b. q

c. r d. a

8. Action Integral defined by

a. $I = \int_{t_1}^{t_2} Ldt$ b. $I = \int_{t_1}^{t_2} Lmdt$

c. $I = \int_{t_1}^{t_2} -Ldt$ d. $I = \int_{t_1}^{t_2} -Lmdt$

9. If there are N particles and k constraints are given,then the generalized coordinates is

a. $3N$ b. $3N + k$

c. $N - k$ d. $3N - k$

10. For derivation of Euler-Lagrange equation ,D'Alembert's principle is

a. $\sum_i \left(\vec{F}_i^a - \dot{\vec{p}}_i\right) \times \partial \vec{r}_i = 0$ b. $\sum_i \left(\vec{F}_i^a - \dot{\vec{p}}_i\right) = 0$

c. $\sum_i \left(\vec{F}_i^a - \dot{\vec{p}}_i\right) \times \partial \vec{r} = 0$ d. None of the above

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Descriptive

Time : 1 hr. 15 mins. **Marks : 25**

[Answer question no.1 & any two (2) from the rest]

1. What do you mean by D'Alembert's Principle.Prove that $\frac{d\vec{J}}{dt} = \vec{w}$ **5**

2. Prove that fundamental metric tensor g_{ij} is a covariant and symmetric tensor of rank two. **10**

3. Write the velocity expression in plane polar coordinate.Find the velocity in spherical coordinate. **10**

4. State and proof Euler-Lagrange's Equation from D'Alemberts Principle. **2+8=10**

5. What do you mean by Hamilton's Principle. Write the difference between Monogenic system and conservative system. Give one real life example where Hamilton's Principle can be applied. **2+2+6 =10**

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