REV-01
MSM/24/29

2023/06

SET A

M.Sc. MATHEMATICS
SECOND SEMESTER
MECHANICS & TENSOR
MSM – 204
[USE OMR FOR OBJECTIVE PART]

Duration: 1.30hrs **Full Marks: 35**

(Objective)

Time: 10 min. **Marks: 10**

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

1. In the expression $a_{ij}x^j$, i is called
   a. Real suffix
   b. Dummy suffix
   c. Kronecker delta
   d. None of the above

2. The statement "The minimum number of coordinate required to explain the state of a system completely "are called
   a. Generalized coordinates
   b Certasian coordinates
   c. Polar coordinates
   d Spherical coordinates

3. Hamiltonian Principle for a monogenic system can be stated as the motion of a system from time t_1 to time t_2 is such that the line integral
   a. $I=\int_{t_1}^{t_2} Ldt$, has a value
   b $I=\int_{t_1}^{t_2} Edt$ has a stationary value
   c. $I=\int_{t_1}^{t_2} Edt$ has a value
   d $I=\int_{t_1}^{t_2} Ldt$ has a stationary value

4. $A^i\partial^i{}_j = ?$
   a. A^j
   b $A^i A_j$
   c. A^i
   d $A^i{}_j$

5 In case of a simple pendulum,the Lagrangian
   a $L=\frac{1}{2}m^2l^2\dot{\theta}^2+mgl(1-\cos\theta)$
   b $L=\frac{1}{2}m^2l^2\dot{\theta}^2-mgl(1+\cos\theta)$
   c $L=\frac{1}{2}m^2l^2\dot{\theta}^2-mgl(1-\cos\theta)$
   d $L=\frac{1}{2}m^2l^2\dot{\theta}^2+mgl(1+\cos\theta)$

6. For the metric $ds^2 = 5(dx^1)^2 + 3(dx^2)^2 + 4(dx^3)^2 - 6dx^1dx^2 + 4dx^2dx^3$, $g = ?$

a. -4 b 4

c. 2 d -2

7. $[ij,k]+[jk,i]=?$

a. $\partial_j g_{ik}$ b. $\partial_i g_{jk}$

c. $\partial_k g_{ij}$ d. $\partial_j g_{kk}$

8. Velovity expression in plane polar coordinate system

a. $\vec{V} = \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta$ b $\vec{V} = \dot{r}\hat{e}_r - r\dot{\theta}\hat{e}_\theta$

c. $\vec{V} = \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta$ d $\vec{V} = \dot{r}\hat{e}_r - r\dot{\theta}\hat{e}_\theta$

9. For a rotating rigid body $KE = ?$

a. $\frac{1}{2}Iw^2$ b $\frac{1}{2}mv^2$

c. $\frac{1}{2}mw^2$ d none of above

10. $\frac{d\vec{J}}{dt} = ?$

a. $\sum \vec{r}_j \times \vec{F}_i$ b $\vec{r}_i \times \vec{F}$

c. $\sum \vec{r}_j \times \vec{F}_j$ d $\sum \vec{r}_i \times \vec{F}_i$

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Descriptive

Time : 1 hr. 15 mins. Marks : 25

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

1. Prove That Fundamental metric tensor g_{ij} is a covariant second rank tensor — 5

2. Find the velocity and acceleration of a moving particle in Cylindrical coordinate system — 4+6=10

3. State and Prove Euler-Lagrange Equation from D'Alembert's Principle — 2+8=10

4. What is the definition of contraction?If a mixed tensor, contravariant of rank p and covariant of rank q ,we equate a contravariant and covariant index and sum with regard to that index ,then the resulting set of N^{p+q-2} sums is a mixed tensor ,contravariant of rank $p-1$ and covariant of rank $q-1$ — 1+9=10

5. What do you mean by Impulse and Impulsive force?State and Proof Carnot's Theorem — 2+2+6 =10

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