Question 1

Write the following expression in Einstein convention:

$$d\bar{x}^i = \sum_{j=1}^{n} \frac{\partial \bar{x}_i}{\partial x_j} dx^j$$

Question 2

What is Kronecker Delta ?

Question 3

Simplify the following expression $\delta_j^i A^j$.

Question 4

Suppose the components of a contravariant tensor in the n-coordinate systems $(x^1, x^2, \dots, x^n)$ and $(\bar{x}^1, \bar{x}^2, \dots, \bar{x}^n)$ are A^i and $\bar{A}^i$ respectively. Then write down the transformation formula of their components.

Question 5

Suppose the components of a covariant tensor in the n-coordinate systems $(x^1, x^2, \dots, x^n)$ and $(\bar{x}^1, \bar{x}^2, \dots, \bar{x}^n)$ are A_i and $\bar{A}_i$ respectively. Then write down the transformation formula of their components.

Question 6

What is the order of the mixed tensor Kronecker Delta ?

Question 7

If A_{jk}^i is a mixed tensor of order $(1,2)$, then what is the order of the contracted tensor of A_{jk}^i?

Question 8

Let A_{ij} be a tensor and A^{ij} be its conjugate symmetric tensor. Then what is the value of $A_{ij}A^{ij}$?

Question 9

What is the order of fundamental metric tensor?

Question 10

What is the necessary and sufficient condition for two tensors A^i and B^i to be orthogonal?

Question 11

What is the necessary and sufficient condition for a surface to be a developable?

Question 12

What is the geodesic curvature of a geodesic on a surface?

Question 13

What is the Gaussian curvature of a hyperbolic surface?

Question 14

Is the length of a vector invariant?

Question 15

If A^{ijl} and B^{abc} are components of two tensors of type $(3,0)$, the what is the type of the outer multiplication $A^{ijl}.B^{abc}$?

Question 16

Simplify the following expression
$$\frac{\partial x^k}{\partial y^i}\frac{\partial y^i}{\partial x^j}$$

Question 17

What is the value of
$\delta_i^i \ in \ n-coordinate \ system?$

Question 18

Simplify the following expression
$\delta^i_j A_i$.

Question 19

Suppose the components of a $(2,0)$ contravariant tensor in the n-coordinate systems
$(x^1, x^2, \ldots, x^n)$ and $(\bar{x}^1, \bar{x}^2, \ldots, \bar{x}^n)$
are A^{ij} and $\bar{A}^{ij}$ respectively. Then write down the transformation formula of their components.

Question 20

Suppose the components of a $(0,2)$ covariant tensor in the n-coordinate systems $(x^1, x^2, \ldots, x^n)$ and $(\bar{x}^1, \bar{x}^2, \ldots, \bar{x}^n)$ are A_{ij} and $\bar{A}_{ij}$ respectively. Then write down the transformation formula of their components.

Question 21

If λ_i and μ^i are the components of a covariant and contravariant tensor, then find out the tensor type of the quantity $\lambda_i \mu^i$?

Question 22

If $A^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_q}$ is a mixed tensor of order (p, q), then what is the order of the contracted tensor of $A^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_q}$?

Question 23

What is the contraction of the mixed tensor δ^i_j ?

Question 24

Is fundamental metric tensor symmetric or anti(skew)-symmetric?

Question 25

What is the magnitude of a null vector?

Question 26

If R_{ij} is the Ricci tensor, then write down the scalar curvature.

Question 27

What is the curvature condition of a space curve to be a straight line?

Question 28

Is a geodesic auto parallel curve?

Question 29

What is the geodesic curvature of a great circle in the surface of a sphere?

Question 30

What is the mean curvature of a minimal surface?