PG TRB MATHS /POLYTECNIC

TRB MATHS

CLASSES WILL BE STARTED ON JULY 7TH

UNITWISE STUDY MATERIALS

AND

QUESTION PAPERS AVAILABLE

PG TRB MATHS

DIFFERENTIAL GEOMETRY

TOTAL MARKS:100 **DURATION: 2 Hours**

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1. The arc length of the curve x =3sinh2t,y= 3cosh2t ,z=6t from t=0 to t=π is

(a) $\sqrt{18}sinh2\pi$ (b)6 $\sqrt{2}sinh2\pi$ (c)3 $\sqrt{2}cosh2\pi$ (d) none

2. The principal normal is orthogonal to

(a) osculating plane (b) normal plane (c) Rectifying plane

(d) osculating circle

3. By serrent- Frenet Formula for the Darbouxe vector $\vec{\omega}$ is called

(a) $\tau\vec{t}$ +k$\vec{b}$ (b) $\tau\vec{b}$ +k$\vec{t}$ (c) τb −k$\vec{t}$ (d)- $\tau\vec{t}$ +k$\vec{t}$

4. At a point p the condition for the point of inflexion is

(a) $\vec{r}^{1}$= 0 (b) $\vec{r}^{11}$= 0 (c) $\vec{r}^{111}$= 0 (d) r= 0

5. The torsion of the cubic curve $\vec{r} = \vec{r}(u$,u^2,u^3) is

(a) $\tau = \frac{2\sqrt{9u^4+9u^2+1}}{(9u^4+9u^2+1)}$ (b) $\frac{1}{3a(u^2+1)^2}$ (c) $\frac{3}{(9u^4+9u^2+1)}$ (d) $\frac{3}{\sqrt{(9u^4+9u^2+1)}}$

6. The radius of the spherical curvature is given by

(a) R =$\sqrt{\rho^2 + (\rho^1\sigma)^2}$ (b) R =$\rho^2 + (\rho^1\sigma)^2$ (c) R = $(\rho^2 + (s^1\sigma)^2)^{\frac{3}{2}}$

(d) $\sigma = \rho$

7. The necessary and sufficient condition that a curve to be plane curve is

(a) K =0 at all points (b) $\tau = 0$ at all points (c) K = 0 at same points

(d) Z = 0 at same points

8. The osculating sphere is contact of order

(a) 2 (b) 1 (c) 4 (d) 3

9. Find curvature K , The curve $\vec{r} = \vec{r}(s)$ *in terms of arc length is given by*

(a) K = $\frac{|\dot{\vec{r}} \times \ddot{\vec{r}}|}{|\dot{\vec{r}}|^3}$ (b) K = $|\dot{\vec{r}} \times \ddot{\vec{r}}|$ (c) $K^2 = |\vec{r}^1 \times \vec{r}^{11}|^2$ (d) K = $|\vec{r}^1 \times \vec{r}^{11}|^{\frac{1}{2}}$

10. The equation of the evolute is

(a) $\vec{R} = \vec{r} + \rho\vec{n} + \rho cot(\psi + c)\vec{b}$ (b) $\vec{R} = \vec{r} + \rho\vec{n} + \rho cot(\int \tau ds + c)\vec{b}$

(c) both (a) and (b) (d) none

11. The direction coefficient of the parametric curve v=constant is

(a) $(0,\frac{1}{\sqrt{G}})$ (b) $(\frac{1}{\sqrt{E}},0)$ (c) $(0,\frac{1}{\sqrt{E}})$ (d) $(\frac{1}{\sqrt{G}},0)$

12. The Involute of a circular helix are

(a) plane curves (b) sphere (c) cylindrical helix (d) none

13. The Intrinsic eqation of the space curve is of the form

(a) K =f(t),$\tau = g(t), t$ *paramer* (b) K =f(s),$\tau = g(s)$,s is arclength

(c) ctanψ (d) none

14. A curve lies on a sphere then

(a) $\frac{\rho}{\sigma} + \frac{d}{ds}(\rho^1\sigma) = 0$ (a)) $\frac{\sigma}{\rho} + \frac{d}{ds}(\rho^1\sigma) = 0$ (c) $\frac{\rho}{\sigma} + \frac{d}{ds}(\rho\sigma^1) = 0$

(d) $R^2 = \rho^2 + (\rho^1\sigma)^2$

15. The principle normal at concecutive points do not intersect unless

(a) $\tau \neq 0$ (b) k=0 (c) $\tau = o$ (d) K = τ

16. For any curve $\vec{r} = \vec{r}(u$,v),then the value of $\vec{t}^1.\vec{b}^1$=?

(a) kτ (b) - kτ (c) $\frac{k}{\tau}$ (d) - $\frac{k}{\tau}$

17. If p is a regular or ordinary points on a surface ,then

(a) $\vec{r}_1 \times \vec{r}_2 = 0$ (b) $\vec{r}_1 \times \vec{r}_2 \neq 0$ (c) $\vec{r}_1.\vec{r}_1 = 0$ (d)) $\vec{r}_1.\vec{r}_1 \neq 0$

18. The parametric curves are orthogonal only when

(a) N = 0 (b) L = 0 (c) $H^2 = EG$ (d) M = 0

19. The angle between the parametric curves is given by

(a) tan$\theta = \frac{H}{F}$ (b) sin$\theta = \frac{H}{F}$ (c) cos$\theta = \frac{H}{F}$ (d) none

20. If x = u ,y=v,z = $u^2 - v^2$,then the value of E,F

(a) 1-4$u^2, -4uv$ (b) 1+4$u^2, 4uv$ (c) 1+4$u^2, -4uv$ (d) 1-4$v^2, -4uv$

21.The curve given by x=a $sin^2 u, y = a\ sinucosu, z = a\ cosu$ lies on a

(a) sphere (b) cone (c) cylinder (d) circular helix

22. Find the value of E,F,G for the helicoids $\vec{r}$=(u cosv,u sinv,c v)

(a) (0,1, $u^2 + c^2$) (b) (1,0, $u^2 - c^2$) (c) $(u^2 + c^2, 0,1)$

(d) (1,0, $u^2 + c^2$)

23. The spherical Indicatrix of a curve is a circle iff

(a) the curve is straight line (b) the curve is a helix

(c) the curve is a cylinder (d) the curve is a plane

24. For the helix, The ratio of curvature and Torsion is

(a) one (b) zero (c) constant (d) None

25. A necessary and sufficient condition for the curve to be geodesic

(a) V$\frac{\partial T}{\partial \dot{u}} - U\frac{\partial T}{\partial \dot{v}}$ = 0 (b) V$\frac{\partial T}{\partial \dot{u}} + U\frac{\partial T}{\partial \dot{v}}$ = 0 (c) U$\frac{\partial T}{\partial \dot{u}} - V\frac{\partial T}{\partial \dot{v}}$ = 0

(d) u$\frac{\partial T}{\partial \dot{u}} - v\frac{\partial T}{\partial \dot{v}}$ = 0

26. The vector $perpendicular$ to the normal plane is

(a) Tangent (b) Normal (c) binormal (d) None

27. The curve bisecting the angle between the parametric curves are given by

(a) $Edu^2-Gdv^2 = 0$ (b)) $Edu^2-Gdv^2 \neq 0$ (c)) $Edu^2+Gdv^2 = 0$
(d)) $Gdu^2-Edv^2 = 0$

28. If Kg is gaussian curvature ,then Kg = ?

(a) $\theta^1+Pu^1+Qv^1$ (b) $\theta^1+\theta V^1$ (c) $\theta^1+PU+QV^1$ (d) $\theta^{11}+PU+QV^1$

29. A curve on a plane is geodesic is a

(a) straight line (b) circle (c) great circle (d) cylinder

30. The Intersection of plane and sphere gives a

(a) straight line (b) circle (c) cone (d) cylinder

31. The necessary and sufficient condition for the curve V = constant to be geodesic is

(a) $EE_2+FE_1+2EF_1 = 0$ (b) $GG_1+FG_2-2GF_2 =0$ (c) $EE_2+FE_1-2EF_1 =0$
(d) None

32. The curvature K = 0 at all points, then the curve is a

(a) straight line (b) circle (c) sphere
(d) None

33. The osculating sphere of given point P on the curve γ has

(a) Two point contact (b) Three point contact
(c) Four point contact (d) none

34. The radius of the spherical curvature is constant then the curve

(a) Either lies on a sphere or a constant curvature
(b) Neither lies on a spherical Nor a constant
(c) lies on a sphere also a constant curvature

35. For the curve plane curve

(a) Both k = 0 and τ =0 at all points (b) Neither K = 0 nor $\tau = 0$at all points

(c) K = 0 but $\tau \neq 0$at all points (d) $\tau = 0$at all points

36. Let $\vec{t}, \vec{n}, \vec{b}$ denote tangent ,normal and binormal respectively also K and τ are the curvature and Torsion ,then

(a) $\vec{n}^1 = \tau\vec{b} - k\vec{t}$ (b) $\vec{n}^1 = \tau\vec{b} + k\vec{t}$ (c) $\vec{n}^1$ =k$\vec{b} - \tau\vec{t}$ (d) none

37. The Rectifying plane contains

(a) Tangent and normal (b) binoral and tangent

(c) normal and binormal (d) None

38. Choose from the following the Torsion of a geodesic in the principle direction

(a) 0 (b) 1 (c) ∞ (d) -1

39. A surface is a minimal if

(a) mean curvature is zero at all aoints

(b) Gaussian curvature is zero at all points

(c) Gaussian curvature is zero at somepoints

(d) Gaussian curvature is not zero at all points

40. The equatipn of the osculating plane in the parameter u

(a) $\left[\vec{R}, \dot{\vec{r}}, \dot{\vec{r}}\right]$= 0 (b) $\left[\vec{R} - \vec{r}, \dot{\vec{r}}, \ddot{\vec{r}}\right]$= 0

(c) $[\vec{r}^{1}, \vec{r}^{11}, \vec{r}^{111}]$=0 (d) $[\vec{r}^{1}, \vec{r}^{11}, \vec{r}^{11}]$=0