Syllabus

20 marks

Q1 TRANSFORMATION (PIVOT POINT)

Q2 2D Transformation

Q3 Theoretical (Transformation, Polygon filling, clipping TBRL)

Q4 clipping

def. of filling apply

polygon filling

LECTURE NO 15

2-05-18

Terminal Syllabus.

5 marks ← 1) curves (definite) - Parabola - hyperbola - ellipse - circle

20 marks ← 2) Curves (indefinite) ~ . supplying curve . bazier curve.

3) Lighting and Shading (Phong Reflection Model)

4) Projection

5) ANIMATION (11 rules of animation)

Projection

How to Project 3D object in 2D screen

- Parallel Projection

-

LECTURE NO 16.

3-05-18   www.mathisfun.com/geometry

Curves

Parametric Curve
- Parameters are known
- Formulas are known
- are known as definite curves.
- conic- circle- Parabola- hyperbola- ellipse

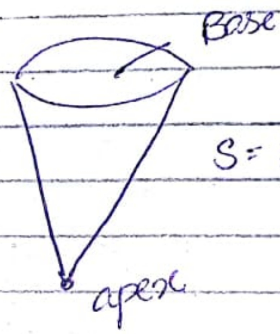
Non Parametric Curve

e.g
- Bazier curves
- ~~Spline~~ Supline curve.
- thermite curve
- ~~Non~~ are also known as indefinite curves.
- Parameters are unknown in this case

PARAMETRIC CURVE. -5 Marks

Cones

- Flat base



~~Area = $\pi r^2 h$~~

S = side length

Surface area = $\pi \times r * (r+s)$

Base area = πr^2

Side area = $\pi \times r \times s$.

Volume = $\frac{1}{3} \pi r^2 \times h$.

Example

$h = 8, \; r = 6$

$\frac{1}{3} \pi r^2 h$

$= \frac{1}{3} \times \pi \times (6)^2 \times (8)$

$= \frac{\pi \times \cancel{36}^{12} \times 8}{\cancel{3}} = 96\pi.$

Surface area

$\cancel{\pi \times r \times r \times (r+s)}$ $\quad \pi \times r \times s$

Surface area of side $= \pi \times r \times \underbrace{\sqrt{r^2+h^2}}_{s}$

$= \pi \times$

Example

$h = 24$ cm

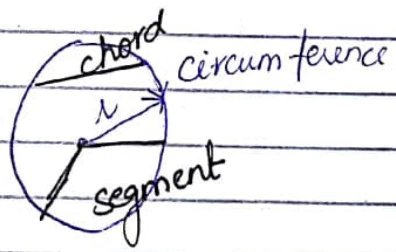
$d = 14$ cm.

$r = 7$.

$\frac{1}{\cancel{3}} \times \frac{22}{\cancel{7}} \times \cancel{49}^{7} \times \cancel{24}^{8}$

$= 1232 \text{ cm}^3$.

2 CIRCLE



$\pi = \frac{\text{circumference}}{\text{diameter}}$.

$C = 2 \times \pi \times r$

$A = \pi \times r^2$

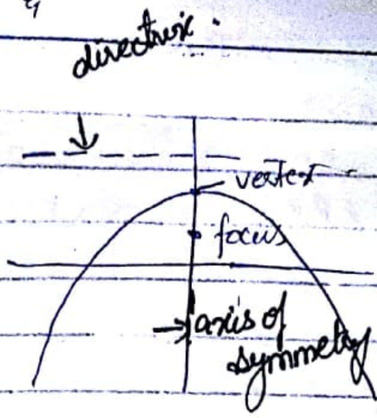
circumference = distance walked.

distance between focus & vertex

③ Parabola

$y^2 = 4ax$

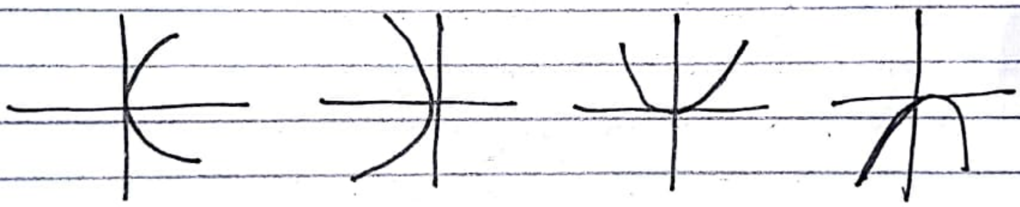
f = focus
dirretrix. (Line)
axis of symmetry
vertex



Focus
└ point

dirrectrix = is ⊥ ar tend there is a focus point is known as axis of symmetry.

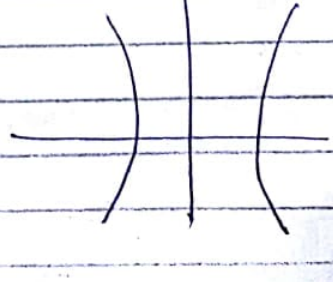
distance between directrix & vertex = distance between focus and curve.



$y^2 = 4ax$ $\quad$ $y^2 = -4ax$ $\quad$ $x^2 = 4ay$ $\quad$ $x^2 = -4ay$

③ Ellipse

curves are same like parabola
- two focci
- two vertex
- two directrix

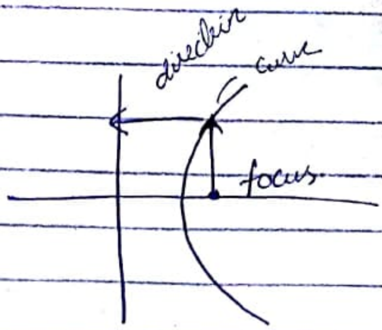


eccentricity e
└ ~~the distance~~
ratio between two distance

$$e = \frac{|\text{focus} - \text{curve}|}{|\text{curve} - \text{directrix}|}$$

e of parabola = 1

Focci & vertex are present on axis of symmetry.



$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

major axis   L minor axis

minor axis

$\therefore$ L : l_2

major axis

$e > 1$ (incase of hyperbola)

Example

vertices of hyperbola = ? $\frac{x^2}{9} - \frac{y^2}{16} = 1$

b = 4 major axis

a = 3 minor axis

(-3,0) & (3,0)

④ Ellipse

$\cancel{x^2/a^2 + y^2/b^2 = 1}$

$e < 1$ Area = $\pi \times a \times b$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \leftarrow \text{General equation}$$

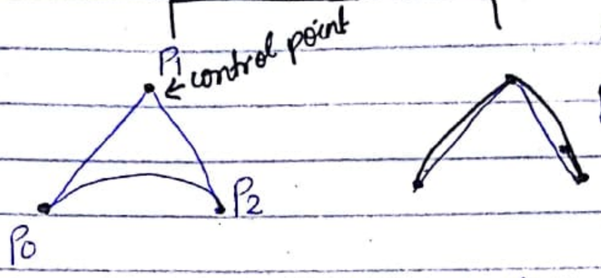
Solve the question available on the website.

LECTURE No 17.

9-05-18.

BAZIER CURVE:- imp topic:-

i) ~~Suppline~~ spline curve special type of ~~Suppline~~ spline curve ~~and approximative~~



curve passing through control point interpolative control point

- controll through control point but must not pass through control point (approximative control point)

ii) approximative ~~Suppline~~ spline curve.

iii) we get n- degree polynomial from n+1 control point.

Polynomial:-

equation like $P(x) = a_0 x^n + a_1 x^{n-1} + a_2 x^{n-2} + \dots$

degree = max power of polynomial.

$P_1(x) = x^3 + 2x + 1$ ← cubic
degree = 3.

$P(x) = x^2 + 4x + 4$ ← quadratic polynomi
degree = 2

degree = 4 = quantic polynomial

iv) It is a parametric curve. (Some parameters are involved in drawing that control points.)

range = $0 \leq U \leq 1$
↑ parameter

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v) Camcat, blender, unity all graphic designer software uses Bazier curve.

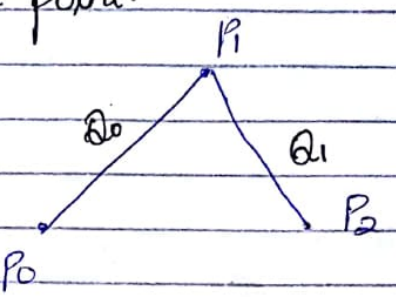
vi) very easy to apply therefore it is most beneficial in graphics designing and modeling.

Deravation

through control point.

$0 \leq u \leq 1$

parametric eq. for Q_0 and Q_1.



Q_0 = point b/w P_0 & P_1

Q_1 = point b/w P_1 & P_2

$Q_0 = (1-u)P_0 + uP_1$

$Q_1 = (1-u)P_1 + uP_2$

$C(u) = (1-u)Q_0 + uQ_1$

C = pt b/w Q_0 & Q_1

$C(u) = (1-u)[(1-u)P_0 + uP_1] + u[(1-u)P_1 + uP_2]$,

$= (1-u)^2 P_0 + u(1-u)P_1 + u(1-u)P_1 + u^2 P_2$.

$C(u) = (1-u)^2 P_0 + 2u(1-u)P_1 + u^2 P_2$. Eq. for Bazier curve

Parameter controlling ~~Points~~ bazier curve

P_0, P_1 & P_2 = control point.

General eq. of Bazier curve.

n = degree of polynomial

$$C(u) = \sum_{i=0}^{n} P_i B_{(i,n)}(u) \qquad 0 \leq u \leq 1$$

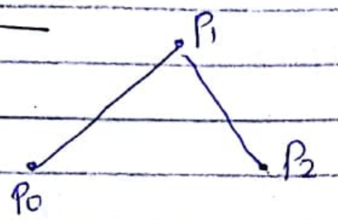
Blending function of

contain subprope- rty of geometric function.

$B_{(i,n)}(u) = {}^{n}C_{i}(u)^{i}(1-u)^{n-i}$

$${}^{n}C_{1} = \frac{n!}{i!(n-i)!}$$

example



$cP = 3, \; n = 2$

$$c(u) = P_0 B_{(0,2)}(u) + P_1 B_{(1,2)}(u) + P_2 B_{(2,2)}(u)$$

${}^{2}C_{0} = 1 \qquad {}^{2}C_{1} = 2 \qquad {}^{2}C_{2} = 1$

$$= P_0(1-u)^2 + P_1 2u(1-u) + P_2 u^2$$

eq if $cP = 4$. $n = 3$.

$$c(u) = \sum_{i=0}^{3} P_i B_i$$

$$= P_0 B_{(0,3)}(u) + P_1 B_{(1,3)}(u) + P_2 B_{(2,3)}(u)$$

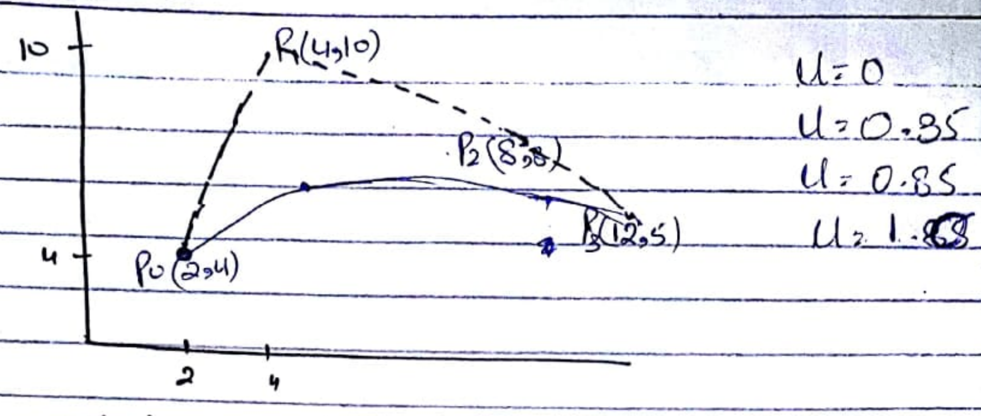
$$+ P_4 B_{(3,3)} u.$$

${}^{3}C_{0} = 1 \qquad {}^{3}C_{1} = 3 \qquad {}^{3}C_{2} = 3 \qquad {}^{3}C_{3} \; 1$

$$c(u) = P_0(1-u)^3 + P_1 3u(1-u)^2 + P_2 3u^2(1-u) + P_3 u^3$$

$\Uparrow$

General eq for cubic bazier curve.



u	$x(u)$	$y(u)$	(x,y)
0	2	4	$(2,4)$
0.35	~~3.56~~ 4.74	~~4.70~~ 7.7	$(4.74, 7.7)$
0.85	10.21	6.26	$(10.21, 6.26)$
1	12	5	$(12,5)$

$x(u) = x_0(1-u)^3 + x_1 3u(1-u)^2 + x_2 3u^2(1-u) + x_3 u^3.$

$x(u) = 2\cancel{+}$

at $u = 0.35$

$x(u) = 2(1-0.35)^3 + 4(0.35)(1-0.35)^2 + 8(3 \times (0.35)^2)((1-0.35) + 12(0.35)^3.$

$y(u) = .$

⇒ greater the value of u ~~there~~ ~~will~~ more ~~b~~ smoother it will be

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$$P_{(i,n)}(u) = {}^{n}C_i (u)^i (1-u)^{n-i}$$

${}^4C_0 = 1$ ${}^4C_1 = 4$ ${}^4C_2 = 6$ ${}^4C_3 = 4$ ${}^4C_4 = 1$

$$C(u) = P_0(1-u)^4 + 4u(1-u)^3 P_1 + 6u^2(1-u)^2 P_2 + 4u^3(1-u) P_3 + P_4 u^4$$

when	$u = 0.35$	$u = 0.65$	$u = 0.9$
$x(u) =$	5.98	10.78	15.71
$y(u) =$	9.34	9.07	5.86
$z(u) =$	12.56	13.38	11.65

LECTURE NO 19
16-05-18

Lighting And Shading.
When ray of light strike the object

Reflect ⇒ mirrors

Refract / Transmit ⇒ glass

Absorb ⇒ black body.

Phong When we want to look for the lighting effect of object we'll consider reflection
components of Reflection
diffusion
~~Specter~~ Specular
ambient

candela (cd) unit of intensity of light
Diffusion. (Lembertein)
Reflection which we don't know the source of lightning such reflection are known as diffusion (Lembertein)
- cannot calculate an angle.

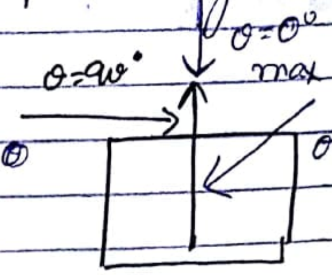
~~Specter~~:- Specular:-
Reflection which we know the source & origin of reflection (lightning)

Ambient
Rays emit from natural sources / phenomenon like sun light
- Threshold value ← ↑ or ↓ the value after an object is modeled.

DIFFUSION
- reflect in all direction
- According to rule of physics few of energy is aborbed

In pure (lembertein)

- does not originate from any source
- spread in all direction
- direction of reflection depends upon angle of incident ray.



$I_d = I_s l_d \cos\theta$

intensity of incoming ray

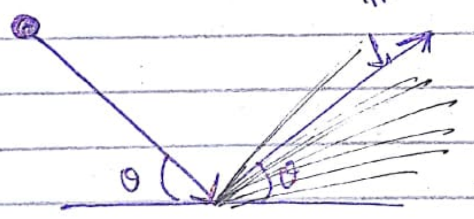
reflecting body (diffusion reflection component)

Required
- Intensity of incoming ray.
- diffusion reflection component (constant value)

e.g glass = 0.17

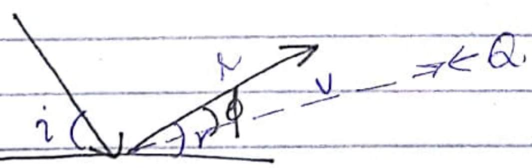
SPECULAR

- Know the source from ray of light is emitted.



"Angle of incidence is always equal to reflected angle"
- spread in all directions

max intensity = reflected ray



$I_{sp} = I_s l_s \left[\frac{r \cdot v}{|r||v|}\right]^f$

specular coefficient reflection.

r = reflected vector
v ⇒ ray of interest
f = no of reflected ray to be calculated

$I_{sp} = I_s l_s [\cos\phi]^f$

$r \cdot v = |r||v| \cos\theta$

$\cos\theta = \frac{r \cdot v}{|r||v|}$

in open GL

gl-lighting.

- used in softwares where we want to add lighting and shading effects.