

Name of College $\rightarrow$ S.S. College, J-Bad Page 1
27-07-2020

Dep't — Mathematics

Topic $\rightarrow$ Different Systems of Co-ordinates

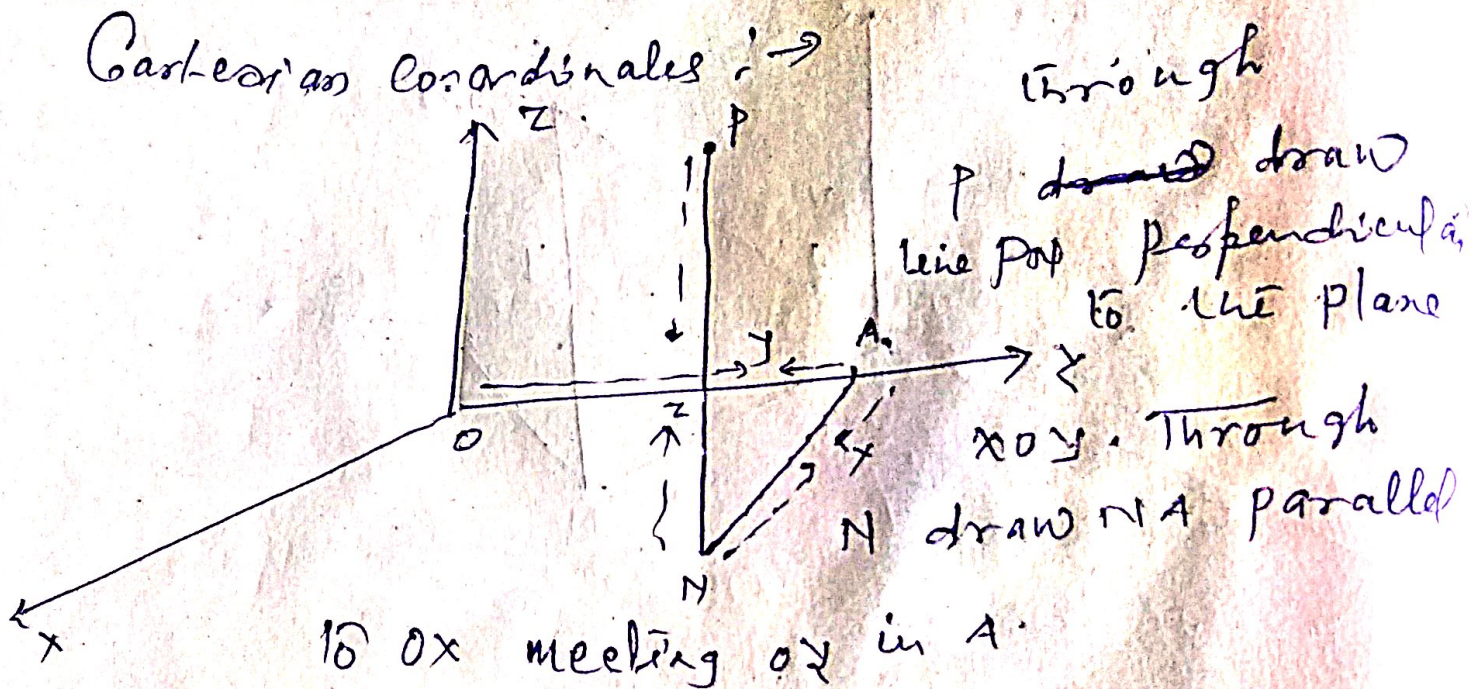
B.Sc (Sub) 1.00 P.M to 1.45 P.M

Date — 27-07-2020

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Study Material

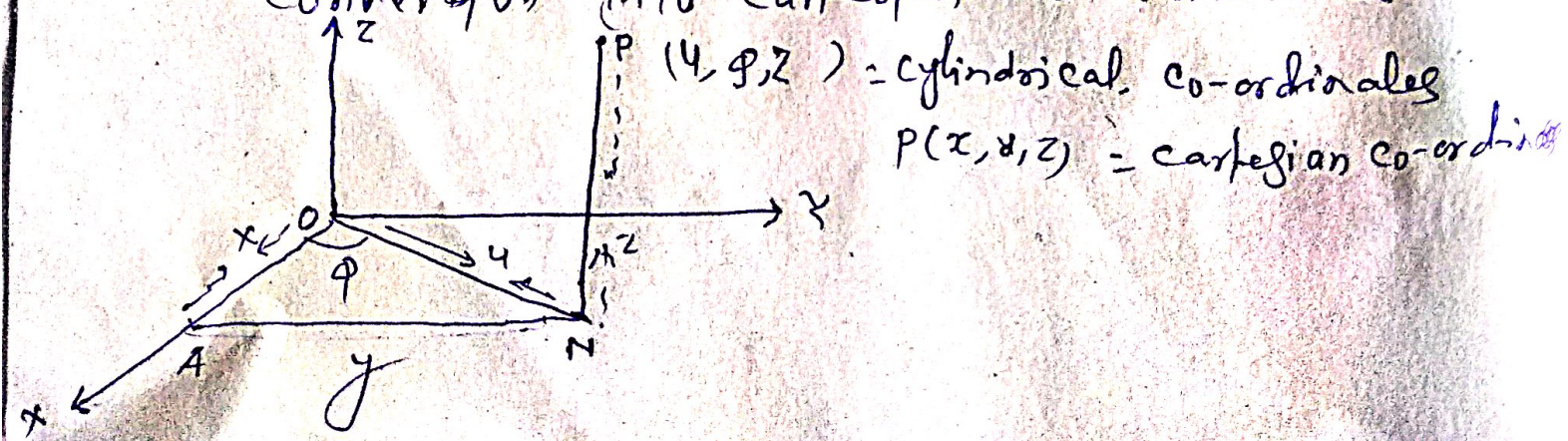
Cartesian Co-ordinates $\rightarrow$



If $AN = x$, $OA = y$ and $NP = z$

then (x, y, z) are called co-ordinates of the point P

① Cylindrical Co-ordinates and their Conversion into Cartesian Co-ordinates



through P draw a line PN perpendicular to the plane XOY.
Join O and N

Let $NP = z$ and $\angle NOX = \phi$
 $ON = y$

then we say that (y, ϕ, z) are the cylindrical co-ordinates of P.

If Cartesian co-ordinates of P are (x, y, z)

From right-angled triangle:
 $OA = x$
 $AN = y$
 $PN = z$
 $\frac{x}{y} = \cos \phi \Rightarrow x = y \cos \phi$

$\frac{y}{y} = \sin \phi \Rightarrow y = y \sin \phi$
 $z = z$

$y^2 \cos^2 \phi + y^2 \sin^2 \phi = x^2 + y^2$

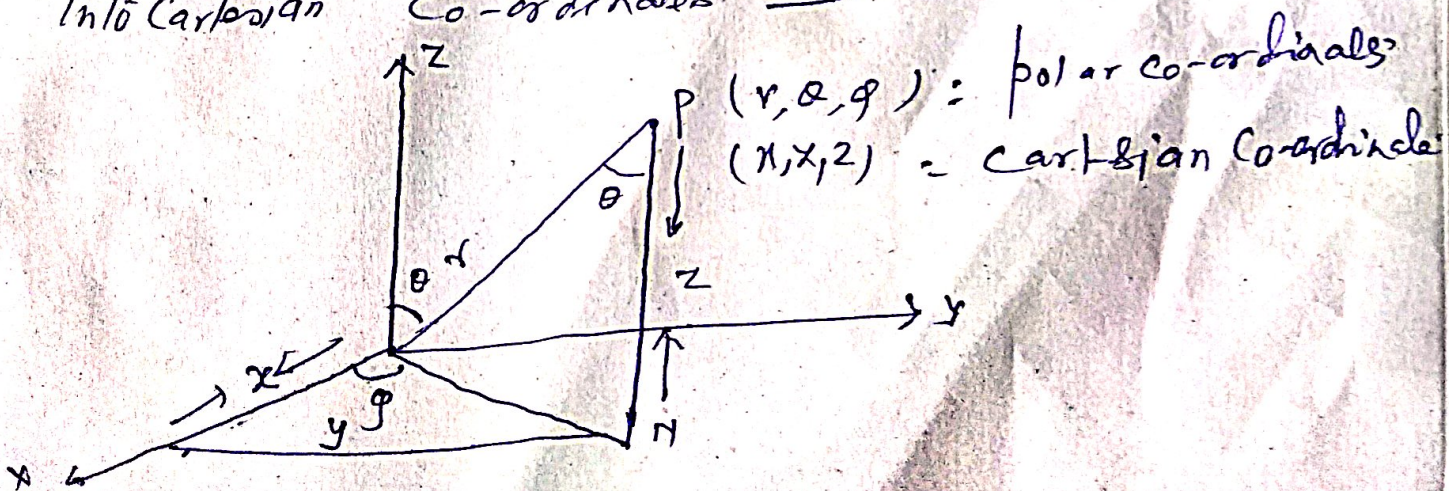
$\Rightarrow y^2 = x^2 + y^2$

$\Rightarrow y = \sqrt{x^2 + y^2}$

$\tan \phi = y/x$

$\phi = \tan^{-1} y/x$

(III) Spherical Polar Co-ordinates and their Conversion into Cartesian Co-ordinates



Through P draw a line PN perpendicular
to the plane XOY .

Join O, N and OP .

$$\text{Let } OP = r \quad \angle NOX = \varphi$$

$$\angle POZ = \theta \quad \text{then } (r, \varphi, \theta)$$

are called the polar co-ordinates
of P .

$$x = OA = ON \cos \varphi = r \sin \theta \cos \varphi$$

$$y = AN = ON \sin \varphi = r \sin \theta \sin \varphi$$

$$\text{and } z = NP = r \cos \theta$$

This gives

$$r = \sqrt{x^2 + y^2 + z^2}$$