# UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA 



## LESSON PLAN

## DEPARTMENT OF MATH\&SC



SUBJECT CODE :TH-3

NAME : Engineering Math-I

BRANCH : Mech/Chem/ETC/Elect/Civil/Ceramics/Metallurgy

SEMESTER :Diploma-I

CREDIT POINTS : 5

NUMBER OF MODULES: 6

CLASSES REQUIRED : 75

PRE-REQUISITE: i) Basic knowledge on Trigonometry
ii) Basic knowledge about geometry of different shapes.

## MODULE-I

1) MATRICES AND DETERMINANTS
a) Types of matrices
b) Algebra of matrices
c) Determinant
d) Properties of determinant
e) Inverse of a matrix (second and third order) (Question should be on second order matrix)
f) Cramer's Rule (Question should be on two variables)
g) Solution of simultaneous equations by matrix inverse method(Question should be on two variables)

## Objectives:

Student can able to distinguish between determinant and matrices, expand determinants to get a value, find the inverse of a determinant and solve system of linear equations by using determinants and matrices.

| $\begin{array}{c}\text { Lecture } \\ \text { no }\end{array}$ | $\begin{array}{c}\text { Topics to be covered }\end{array}$ | $\begin{array}{c}\text { PRIMARY } \\ \text { REFERENCE } \\ \text { (BOOKS/NOTES) }\end{array}$ |
| :---: | :--- | :---: |
| 1 | $\begin{array}{l}\text { Introduction to matrices ,order of a matrix \& Types of } \\ \text { matrices. }\end{array}$ | T |
| 2 | Operation on matrices. | T |
| 3 | $\begin{array}{l}\text { Introduction to determinant and expansion of } \\ \text { determinants. }\end{array}$ | T |
| 4 | Minors and co-factors of matrices and determinants. | T |
| 5 | Properties of determinants and matrices. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 6 | Expansion of determinant using properties . | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |$]$| 7 | Expansion of determinant using properties . |
| :---: | :---: |
| 8 | Inverse of matrix of 2 ${ }^{\text {nd }}$ and 3 3d |

## MODULE-II

## 2) TRIGONOMETRY

a) Trigonometrical ratios
b) Compound angles, multiple and sub-multiple angles (only formulae)
c) Define inverse circular functions and its properties (no derivation

## Objectives:

Students can able to apply various concepts of Trigonometric Functions and their inverses to solve different types of engineering problems where trigonometric functions are involved.

| Lecture no | Topics to be covered | $\begin{gathered} \text { PRIMARY } \\ \text { REFERENCE } \\ \text { (BOOKS/NOTES) } \\ \hline \end{gathered}$ |
| :---: | :---: | :---: |
| 19 | Angles measurement in Radian and in Degree and conversion from one measure to another | T |
| 20 | Definition of Trigonometric Functions and relationship between Trigonometric Functions proving simple Identities | T |
| 21 | Sign of Trigonometric Functions and Trigonometric functions of certain angles like $0^{\circ}, 30^{\circ}, 45^{\circ}, 60^{\circ}, 90^{\circ}$ | T |
| 22 | Related angles Complementary and Supplementary angles like $\sin (-\theta), \sin \left(90^{\circ} \pm \theta\right), \sin \left(180^{\circ} \pm \theta\right)$ etc. | T,R1 |
| 23 | Period of Trigonometric functions and graphs of Trigonometric functions their Domain and Range | T,R1 |
| 24 | Expressing $\sin (x \pm y)$ and $\cos (x \pm y)$ in terms of $\sin x, \cos x$, and cosy, and their simple applications.Deducing the identities like $\tan (\mathrm{x} \pm \mathrm{y}), \cot (\mathrm{x} \pm \mathrm{y})$ etc. | T,R1,R2 |
| 25 | Maximum and Minimum values of Trigonometric functions of the type acos $x \pm b \sin x$, or $a \sin x \pm b \cos x$ or $a \sin x \pm b \cos x \pm c$ etc. | T,R1,R2 |
| 26 | Transformation of sum or difference into products and product to sum $\sin \mathrm{C} \pm \sin \mathrm{D}, \cos \mathrm{C} \pm \cos \mathrm{D}, 2 \sin \mathrm{~A} \cdot \cos \mathrm{~B}, 2 \cos \mathrm{~A} \cdot \cos \mathrm{~B}$ etc. | T,R1,R2 |
| 27 | Multiple angles like 2A,3A etc. Expressing Trigonometric function of angle $2 \mathrm{~A}, 3 \mathrm{~A}$ in terms of A | T,R1,R2 |
| 28 | Submultiple angle like $\mathrm{A} / 2, \mathrm{~A} / 3$ etc.Expressing Trigonometric function of angle $\mathrm{A} / 2$ in terms of $\sin \mathrm{A}$ and $\cos \mathrm{A}$ and expressing angle A interms of $\mathrm{A} / 2$. | T,R1,R2 |
| 29 | Conditional Trigonometric Identities and their problems. | T,R1,R2 |
| 30 | Inverse Trigonometric functions definitions ,domain,range,principal values and their graphs | T,R1,R2 |
| 31 | Elementary properties of Inverse trigonometric functions | T,R1,R2 |
| 32 | Revision of trigonometry and solving previous year SCTE\&VT exam questions and answers | T,R1,R2 |
| 33 | Revision of Inverse trigonometry and solving previous year SCTE\&VT exam questions. | T,R1,R2 |

## MODULE-III

## 3) CO-ORDINATE GEOMETRY IN TWO DIMENSIONS (Straight line)

a) Introduction of geometry in two dimension
b) Distance formulae, division formulae, area of a triangle (only formulae no derivation)
c) Define slope of a line, angle between two lines (only formulae), condition of perpendicularity and parallelism.
d) Different forms of straight lines (only formulae)
i) One point form (ii) two point form (iii) slope form (iv) intercept form v) normal form
e) Equation of a line passing through a point and (i) parallel to a line ii) perpendicular to a line.
f) Equation of a line passing through the intersection of two lines
g) Distance of a point from a line

Objectives: Students can able to locate a point in 2-D plane, find distance between points, determine equations of lines from given data and find the distance between a point from a line.

| Lecture <br> no | Topics to be covered | PRIMARY <br> REFERENCE <br> (BOOKS/NOTES) |
| :---: | :--- | :---: |
| 34 | Introduction to Geometry in 2-D. Idea about points and quadrants. | T |
| 35 | Distance between two points, Section formula and area of a triangle. | T,R2 |
| 36 | Application of section formula to find the centroid of a triangle and <br> midpoint of a line segment.Solving problems on it. | T,R2 |
| 37 | Define angle of inclination of a line, slope of a line. Condition of <br> parallelism and perpendicularity of lines using slope concept. | $\mathrm{T}, \mathrm{R} 2$ |
| 38 | Angle between two lines. Define locus and equation of locus <br> Intercepts made by line with axes. Equation of straight line in <br> different forms. | T,R1,R2 |
| 39 | Problems on finding equation of lines. <br> feneral Equation of line and determination of slope and intercept <br> from it. Relationship between parallel and perpendicular lines. | T,R1,R2 |
| 40 | Equation of line passing through a point i) parallel to a line ii) <br> perpendicular to another line. | T,R1,R2 |
| 41 | Problems on finding equation of line passing through point i)parallel <br> ii) perpendicular to another line | T,R1,R2 |
| 43 | Intersection of two line. Equation of line passing through intersection <br> of two lines and a point. | T,R1,R2 |
| 44 | Equation of a line passing through intersection of two lines i) parallel <br> to another line ii) perpendicular to another line | T,R1,R2 |
| 45 | Distance of line from a point. Distance between two parallel lines. | T,R1,R2 |
| 46 | Problem on finding distance of line from a point. Revision of whole <br> topic. | T,R1,R2 |
|  |  |  |

## MODULE-IV

4) CIRCLE

Equation of a circle
i) Centre and redius form
ii) General equation of a circle
iii) End point of diameter form

## Objectives:

Student will able to determine equation of circle from given data and can determine the centre and radius from the equation of circle.

| Lecture <br> no | Topics to be covered <br> 46 | PRIMARY <br> REFERENCE <br> (BOOKS/NOTES) |
| :---: | :--- | :---: |
| 47 | Equation of circle with given i)centre and radius ii) centre and <br> passing through a point iii) centre and circle touches X axis iv) <br> centre and circle touches Y axis. | General Equation of circle . Determination of Centre and Radius <br> of circle from general equation of circle. |
| 48 | Determination of equation of circle when end points of the <br> diameter is given. | T |
| 49 | Equation of circle through three given points. | T |
| 50 | Equation of circle passing through two points and centre lies on a <br> given line. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 51 | Problem discussion on above topics. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 52 | Problem discussion on above topics. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 53 | Revision of the whole topic. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |

## MODULE-V

## 5) CO-ORDINATE GEOMETRY IN THREE DIMENSIONS

a) Distance formulae, section formulae, direction ratio, direction cosine, angle between two lines (condition of parallelism and perpendicularity)
b) Equation of a plane
i) General form, angle between two planes, perpendicular distance of a point from a plane, equation of a plane passing through a point and
i) parallel to a plane (ii) perpendicular to a plane

## Objectives:

Students will able to find the distance between two points in space, determine the parallelism and perpendicularity relation between two lines, determine equation of plane from given data.

| Lecture <br> no | Topics to be covered | PRIMARY <br> REFERENCE <br> (BOOKS/NOTES) |
| :---: | :--- | :---: |
| 54 | Introduction to three dimensional i.e. space. Division of space into <br> octants by the three axes. | T |
| 55 | Representation of a point. Distance between two points. Section <br> formula. | T |
| 56 | Direction cosine and direction ratio of a line. Angle between two <br> lines. Condition of parallelism and perpendicularity. | $\mathrm{T}, \mathrm{R} 2$ |
| 57 | Problem discussion on above topics | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 58 | Problem discussion on above topics | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 59 | Equation of a plane in general form | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 60 | Equation of a plane passing through a point and parallel to a line. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 61 | Equation of a plane passing through a point and perpendicular to a <br> line. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 62 | Discussion of Problems on finding equation of plane. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 63 | Discussion of Problems on finding equation of plane. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 64 | Angle between two planes. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 65 | Distance of a point from a plane. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 66 | Problem discussion on above topics. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 67 | Revision of the whole topic and previous year question discussion. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |
| 68 | Test on 3-D and assignment checking. | $\mathrm{T}, \mathrm{R} 1, \mathrm{R} 2$ |

## MODULE-VI

## 6) SPHERE

a) Equation of a sphere
i) center radius form
ii) general form
iii) two end points of a diameter form (only formulae and problems)

## Objectives:

Students will able to find equation of a sphere from the given data. And can determine the radius and centre of a sphere from given equation of line.

| Lecture <br> no | Topics to be covered | PRIMARY <br> REFERENCE <br> (BOOKS/NOTES) |
| :---: | :--- | :---: |
| 69 | Determination of equation of a sphere from given centre and radius. <br> Equation of circle passing through a given centre and touching any <br> co-ordinate axis. | T |


| 70 | Equation of a sphere in general form, determination of radius and <br> centre from the general form. | T |
| :---: | :--- | :---: |
| 71 | Equation of sphere when two end points of the diameter are given. | T,R1,R2 |
| 72 | Problems on finding equation of circle. | T,R1,R2 |
| 73 | Problems on finding equation of circle. | T,R1,R2 |
| 74 | Revision of the whole topic and previous year question discussion. | T,R1,R2 |
| 75 | Test on 3-d and sphere. | T,R1,R2 |

## Course Delivery Plan

| Week |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## BOOKS FOR REFERENCE:

## TEXT BOOKS

T: Elements of Mathematics _ Vol. _ 1 \& 2 (Odisha State Bureau of Text Book preparation \&Production)

## REFERENCE

R1: Mathematics Part- I \& Part- II- Textbook for Class XII, NCERT Publication

R2 : Text book of Engineering Mathematics Part-I by Chittaranjan Mallick and Susmita Mallick.

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