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## MATHEMATICS-1

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### OBJECTIVES:

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers which are being used in electrical engineering.
- To be able to understand the binomial expansion.
- To be able to use the knowledge of trigonometry in solving problems of engineering importance.

### SHORT DESCRIPTION:

**Algebra:** AP & GP, polynomials & polynomial equations, complex number, permutation & combination, binomial theorem for positive integral index and negative & fractional index.

**Trigonometry:** ratio of associated angles, compound angles, transformation formulae, multiple angles and sub-multiple angles.

### DETAIL DESCRIPTION:

#### 1 Understand the concept of AP & GP.

- 1.1 Define AP and common difference.
- 1.2 Find last term and sum of n terms, given first term and common difference.
- 1.3 Define GP and common ratio.
- 1.4 Find the sum of n terms given first and common ratio.

#### 2 Apply the concept of polynomial in solving the problems.

- 2.1 Define polynomials and polynomial equation.
- 2.2 Explain the roots and co-efficient of polynomial equations.
- 2.3 Find the relation between roots and co-efficient of the polynomial equations.
- 2.4 Determine the roots and their nature of quadratic polynomial equations.
- 2.5 Form the equation when the roots of the quadratic polynomial equations are given.
- 2.6 Find the condition of the common roots of quadratic polynomial equations.
- 2.7 Solve the problems related to the above.

#### 3 Understand the concept of complex numbers.

- 3.1 Define complex numbers.
- 3.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form  $a + ib$ .
- 3.3 Find the cube roots of unity.
- 3.4 Apply the properties of cube root of unity in solving problems.

#### 4 Apply the concept of permutation.

- 4.1 Explain permutation.
- 4.2 Find the number of permutation of n things taken r at a time when,
  - i) Things are all different.
  - ii) Things are not all different.
- 4.3 Solve problems related to permutation:
  - i) Be arranged so that the vowels may never be separated.
  - ii) From 10 men and 6 women a committee of 7 is to be formed. In how many ways can this be done so as to include at least two women in the committee.

#### 5 Apply the concept of Combination.

- 5.1 Explain combination.
- 5.2 Find the number of combination of n different things taken r at a time.
- 5.3 Explain  $nCr$ ,  $nCn$ ,  $nC0$
- 5.4 Find the number of combination of n things taken r at a time in which p particular things
  - i) Always occur
  - ii) never occur.
- 5.5 Establish
  - i)  $nCr = nCn-r$
  - ii)  $nCr + nCr-1 = n+1Cr$
- 5.6 Solve problems related to the combination.

**6 Apply partial fractions to break the numerator and denominator.**

6.1 Define proper and improper fractions.

6.2 Resolve into partial fraction of the following types:

- Denominator having a non-repeated linear factor.
- Denominator having a repeated linear factor.
- Denominator having a quadratic factor.
- Denominator having a combination of repeated, non repeated and quadratic factors.

**7 Apply the concept of the binomial theorem.**

7.1 State binomial expression.

7.2 Express the binomial theorem for positive index.

7.3 Find the general term, middle term, equidistant term and term independent of x.

7.4 Use binomial theorem to find the value of

i)  $(0.9998)^2$ , correct to six places of decimal.

ii)  $(1 + \sqrt{2})^5 - (1 - \sqrt{2})^5$

**8 Apply the concept of the binomial theorem for negative index.**

8.1 Express the binomial theorem for negative and fractional index.

8.2 Solve problems of the following types:

Expand (i)  $(1 - nx)^{-\frac{1}{n}}$  (ii)  $\frac{1}{\sqrt{4.08}}$

**9 Apply the concept of associated angles.**

9.1 Define associated angles.

9.2 Find the sign of trigonometrical function in different quadrants.

9.3 Calculate trigonometrical ratios of associated angle.

9.4 Solve the problems using above.

**10 Apply the principle of trigonometrical ratios of compound angles.**

10.1 Define compound angles.

10.2 Establish the following relation geometrically for acute angles.

i)  $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ .

ii)  $\cos(A \pm B) = \cos A \cos B \pm \sin A \sin B$ .

10.3 Deduce formula for  $\tan(A \pm B)$ ,  $\cot(A \pm B)$ .

10.4 Apply the identities to work out the problems:

i) Find the value of  $\sin 750$ ,  $\tan 750$ .

ii) Show that  $\frac{\sin 75^\circ + \sin 15^\circ}{\sin 75^\circ - \sin 15^\circ} = \sqrt{3}$

iii) if  $\alpha + \beta = \theta$ ,  $\tan \alpha + \tan \beta = b$ ,  $\cot \alpha + \cot \beta = a$ ,  
Show that  $(a - b) = ab \cot \theta$ .

**11 Apply sum and product formula of trigonometrical ratios.**

11.1 Express sum or difference of two sines and cosines as a product and vice-versa

11.2 Solve problems of the Following types:

i) Show that,  $\sin 55^\circ + \cos 55^\circ = \sqrt{2} \cos 10^\circ$

ii) Prove that,  $\cos 80^\circ \cos 60^\circ \cos 40^\circ \cos 20^\circ = \frac{1}{16}$

**12 Apply the concept of ratios of multiple angles.**

12.1 State the identities for  $\sin 2A$ ,  $\cos 2A$  and  $\tan 2A$ .

12.2 Deduce formula for  $\sin 3A$ ,  $\cos 3A$  and  $\tan 3A$ .

12.3 Solve the problems of the following types.

i) express  $\cos 5\theta$  in terms of  $\cos \theta$ .

ii) if  $\tan \alpha = 2 \tan \beta$ , show that,  $\tan(\alpha + \beta) = \frac{3 \sin 2\alpha}{1 + 3 \cos 2\alpha}$

**13 Apply the concept of ratios of sub-multiple angles.**

13.1 Find mathematically the identities for  $\sin \alpha$ ,  $\cos \alpha$  and  $\tan \alpha$  in terms of  $\frac{\alpha}{2}$  and  $\frac{\alpha}{3}$

13.2 Solve the problems of the type:

find the value of  $\cos 3^\circ$ ,  $\cos 6^\circ$ ,  $\cos 9^\circ$ ,  $\cos 18^\circ$ ,  $\cos 36^\circ$  etc.

**REFERENCE:**

SL No	Author	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students (Volume I)	S.Chand Prakashan
03	Ashim Kumar Saha	Higher Mathematics	Akshar Patra Prakashani
04	S.U Ahamed & M A Jabbar	Higher Mathematics	Alpha Prakashani