

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
SYLLABUS
L-SCHEME

(Implements from the Academic Year 2011-2012 on wards)

Course Name : All Branches of Diploma in Engineering and Technology and Special Programmes except DMOP, HMCT and Film & TV
 Course Code :
 Semester : I Semester
 Subject Title : Mathematics - I

Training and Scheme of Examination:

No. of Weeks per Semester: **16 Weeks**

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
Mathematics - I	4 Hrs.	64 Hrs.	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Sl.No.	Topic	Time (Hrs.)
1	Determinants and Matrices	11
2.	Binomial Theorem and Partial Fraction	11
3.	Straight lines	11
4.	Trigonometry I	11
5.	Trigonometry II	11
	Tutorial	9
	Total	64

Rationale: This subject being a branch of "Logic" is classified as one of the basic sciences and intends to teach students, basic facts, concepts and principles of mathematics as a tool to analyse Engineering problems. Mathematics lay down foundation for understanding core technology subjects.

Objectives: This subject helps the students to develop logical thinking which is useful in comprehending the principles of all other subjects. Analytical and systematic approach towards any problem is developed through learning the subject. Mathematics being a versatile subject can be used at every stage of human life.

Learning Structure:

Application	To understand the techniques and methods for solving Engg. Problems such as simultaneous equation involved in vibrations, ckts. Laws of friction, projections, Lami's thorem, stress – strain curves etc. Work done moment of force about a point and line.
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Procedure	To explain use of properties of determinants to solve problems, use of cramer's rule, matrix inversion	Binomial Theorem for positive integral index and for rational index partial fraction of proper and improper fractions	To find distance of a point from a fixed line, distance between parallel lines, derivation of angle between two lines and pair of lines, parallel line and perpendicular line condition for two lines and pair of lines.	Using various techniques proving standard results which will be used in solving engineering problems.	Using various technique proving standard results which will be used in solving engineering problems.
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Concepts	Cramer's rule, Applications of properties to solve problems, Cramer's rule, Algebra of matrices. Inverse of a matrix	Binomial Expansion for positive and negative integral index. Cases of finding partial fractions.	Angle between lines combined equation of two lines through origin and not through origin. Angle between pair of lines.	Trigonometrical ratios of allied angles compound angles and multiple angles.	Inverse Trigonometrical ratios.
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Facts	Definition of determinants properties of determinants definition of matrix.	Definition of permutation and combination. Definition of polynomial fractions.	Combined equation of two lines.	Definition of Trigonometrical ratios, allied angles, compound angles and multiple angles.	Definition of inverse Trigonometric functions.
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CONTENTS:

Chapter No.	NAME OF TOPICS	Hours	Marks
1.	DETERMINANTS	4	7
	1.1 Definition and expansion of determinants of order 2 and 3 - Properties of determinants. Cramer's rule to solve simultaneous equations in 2 and 3 unknowns.		
	1.2 Problems involving properties of determinants	3	7
	MATRICES 1.3 Definition of matrix, Types of matrices, Algebra of matrices such as equality, addition, subtraction, scalar multiplication and multiplication of matrices. Transpose a matrix, Adjoint matrix and Inverse matrix	4	8
2.	BINOMIAL THEOREM	4	8
	2.1 Definition of factorial notation, definition of permutation and combinations with formula. Binomial theorem for positive integral index (statement only) Finding of general and middle terms.		
	2.2 Problems finding coefficient of x^n , independent term. Binomial Theorem for rational index. Expansions only upto -3 for negative integers	3	7
	2.3 Definition of Polynomial fraction, proper and improper fractions and definition of partial fractions. To resolve proper fraction into partial fraction with denominator containing non repeated linear factors, repeated linear factors and irreducible non repeated quadratic factors. To resolve improper fraction into proper fraction.	4	7
3.	STRAIGHT LINES	3	7
	3.1 Length of perpendicular distance from a point to the line and perpendicular distance between parallel lines. Angle between two straight lines and condition for parallel and perpendicular lines.		
	3.2 PAIR OF STRAIGHT LINES THROUGH ORIGIN Pair of lines passing through the origin $ax^2+2hxy+by^2=0$ expressed in the form $(y-m_1x)(y-m_2x)=0$. Derivation of $\tan\theta = \pm \frac{2\sqrt{h^2-ab}}{a+b}$ condition of parallel and perpendicular lines.	4	8
	3.3 Condition for General equation of the second degree $ax^2+2hxy+by^2+2gx+2fy+c=0$ to represent pair of lines. $\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix} = 0$ (statement only) Angle between them, condition for parallel and perpendicular lines.	4	7
4.	TRIGONOMETRY	4	8
	4.1 Trigonometrical ratios of allied angles expansion of $\sin(A \pm B)$ $\cos(A \pm B)$ (without proof). Problems using above expansion		
	4.2 Expansion of $\tan(A \pm B)$ and problems using this expansion	3	7
	4.3 Trigonometrical ratios of multiple angles (2A only) and sub multiple angles	4	7
5.	TRIGONOMETRY	3	8
	5.1 Trigonometrical ratios of multiple angles (3A only)		
	5.2 Sum and product formulae	4	7
	5.3 Definition of inverse trigonometric ratios relation between inverse trigonometric ratios.	4	7

MODEL QUESTION PAPER – 1
MATHEMATICS – 1

Time : 3Hrs

Part – A

Max Marks:75

I. Answer Any 15 Questions**15x1=15**

1. Solve : $\begin{vmatrix} x & x \\ 3 & 2x \end{vmatrix} = 0$
2. Find the value of $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ b+c & c+a & a+b \end{vmatrix} = 0$
3. If $A = \begin{pmatrix} 1 & 4 \\ 1 & 0 \end{pmatrix}$; $B = \begin{pmatrix} 4 & 5 \\ 7 & -2 \end{pmatrix}$ = Find AB
4. Find the adjoint matrix of $\begin{pmatrix} 3 & -4 \\ 1 & 2 \end{pmatrix}$
5. Find the value of $10C_7$
6. Find the general term of $(3x - y)^8$
7. Expand $(1 + x)^{-3}$ upto three terms when $|x| < 1$
8. Split $\frac{x+1}{x(x+1)}$ into partial fraction without finding the constant
9. Find the value of 'm' if the lines $2x+my=4$ and $x+5y-6=0$ are perpendicular.
10. Find the combined the equation of the lines $2x+5y=0$ and $x+3y=0$.
11. Show that the pair of lines $x^2 - 8y + 16y^2 = 0$ are parallel
12. Write down the condition for the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ to represent a pair of straight liner.
13. Show that $\sin (-330) \times \sin 420 = \frac{\sqrt{3}}{4}$
14. Find the value of $\cos 50 \cos 40 - \sin 50 \sin 40$

15. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$ Find $\tan(A+B)$

16. Find the value of $2 \sin 75^\circ \cos 75^\circ$

17. If $\sin \theta = 1/3$, find the value of $\sin 3\theta$

18. Find the value of $4\cos^3 10^\circ - 3\cos 10^\circ$

19. Show that $\frac{\sin 2A - \sin 2B}{\cos 2A - \cos 2B} = \cot(A+B)$

20. Show that $\tan^{-1} \frac{2x}{1-x^2} = 2 \tan^{-1} x$

Part – B

(Answer Any two subdivisions in each question)

5x12=60

21 a. Solve by using Cramer's Rule :
 $x+y+z=3$, $2x-y+z=2$ and $3x+2y-2z=3$

b. Short that $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+x \end{vmatrix} = x^2(x+3)$

c. Find the inverse of $\begin{pmatrix} 3 & -2 & 1 \\ -4 & 1 & -1 \\ 2 & 0 & 1 \end{pmatrix}$

22. a. Find the middle terms in the expansion of $\left(x^3 + \frac{2}{x^3}\right)^{11}$

b. Find the term independent of x in the expansion of $(2x^2+1/x)^{12}$

c. Resolve $\frac{x-3}{x(x+5)(x-6)}$ in to partial fraction

23. a. Find the equation of the straight line passing through the intersection of the lines $5x+2y=9$ and $3x-y=1$ and perpendicular to the line $7x+5y=12$

b. Find the separate equation of the pair of straight lines $9x^2+12xy+4y^2=0$. Also prove that the lines are parallel.

c. Show that the equations represented by $2x^2 - 7xy + 3y^2 + 5x - 5y + 2 = 0$ is a pair of straight lines

24. a If $\sin A = \frac{1}{\sqrt{10}}$ and $\sin B = \frac{1}{\sqrt{5}}$ prove that $A+B = \frac{\pi}{4}$

b. If $A+B = 45^\circ$ prove that $(1+\tan A)(1+\tan B) = 2$ and hence deduce the value of $\tan 22\frac{1}{2}^\circ$

c. Prove that $\frac{\sin 2A + \sin A}{1 + \cos 2A + \cos A} = \tan A$

25. a Prove that $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$

b. Prove that $(\cos \alpha - \cos \theta)^2 + (\sin \alpha - \sin \theta)^2 = 4 \sin^2 \left\{ \frac{\alpha - \theta}{2} \right\}$

c. Show that $\tan^{-1} \left\{ \frac{x-y}{1+xy} \right\} = \tan^{-1} x + \tan^{-1} y$

MODEL QUESTION PAPER – II
MATHEMATICS – 1

Time : 3Hrs

Part – A

Max Marks:75

I. Answer Any 15 Questions

15x1=15

1. Find x if $\begin{vmatrix} x-2 & 0 \\ 0 & x-2 \end{vmatrix} = 0$

2. Prove that $\begin{vmatrix} x & 2x & 3x \\ 4x & 5x & 6x \\ 7x & 8x & 9x \end{vmatrix} = 0$

3. If $A = \begin{pmatrix} 3 & 4 \\ -2 & -1 \end{pmatrix}$ Find A^2

4. Find the inverse of $\begin{pmatrix} 1 & -1 \\ -2 & 0 \end{pmatrix}$

5. Find the 11th term of $\left(3x^2 + \frac{1}{x}\right)^{20}$

6. How many middle terms are in the expansion of $(5x-y)^9$

7. Write the first three terms in the expansion of $(1-x)^{-2}$

8. Without finding the constants split $\frac{x^3-3}{(x+2)(x^2+1)}$ in to partial fraction.

9. Find the perpendicular distances from the point (2,1) to the straight line $3x+2y+1=0$.

10. Write down the condition for the pair of lines given by $ax^2+2hxy+by^2=0$ to be parallel.

11. Find 'a' if the lines represented by $3x^2+4xy+ay^2=0$ are perpendicular

12. State the expression for angle between pair of line given by $ax^2+2hxy+by^2+2gx+2fy+c=0$

13. Find the value $\sin 15^\circ$ without using tables or calculator.

14. Find the value of $\cos 40^\circ \cos 10^\circ + \sin 40^\circ \sin 10^\circ$

15. Simplify $\frac{\tan 22 + \tan 23}{1 - \tan 22 \tan 23}$
16. Prove that $\frac{\sin 2A}{1 + \cos 2A} = \tan A$
17. Find the value of $3\sin 10^\circ - 4\sin^3 10^\circ$
18. If $\cos A = \frac{3}{5}$ find the value of $\cos 3A$.
19. Show that $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ = 0$.
20. Show that $\sin^{-1} \frac{2x}{1+x^2} = 2 \tan^{-1} x$.

PART - B

(Answer any two subdivisions in each Question)

5x12=60

- 21.a) Solve the equations $4x+y+z=6$, $2x-y-2z=-6$ and $x+y+z=3$, using Cramer's rule
- b) Prove that $\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = x^2(x+a+b+c)$
- c) If $A = \begin{pmatrix} 3 & -5 \\ -4 & 2 \end{pmatrix}$ show that $A^2 - 5A - 14I = 0$
22. a) Find the middle terms in the expansion of $(2x+1/x)^{13}$
- b) Find the term independent of 'x' in the expansion of $\left(2x^2 - \frac{1}{x}\right)^{12}$
- c) Resolve $\frac{7x-4}{(x+2)(x-1)^2}$ in to a partial function.
23. a) Find the orthocenter of the triangle whose vertices are (-2,-1),(6-1) and (2,5).
- b) If the slope of one of the straight lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other. Show that $8h^2=9ab$.
- c) Find the value of ' λ ' so that the equation $3x^2+14xy+8y^2-8x-2y+\lambda=0$ represents a pair of straight lines.

24. a If $\sin A = \frac{3}{5}$, $\cos B = \frac{12}{13}$, find the values of $\sin (A-B)$ and $\cos (A-B)$

b. If $A+B=45^\circ$ Prove that $(\cot A-1)(\cot B-1)=2$. Also find the value of $\cot 22 \frac{1}{2}$

c. Show that $\frac{1+\sin \theta-\cos \theta}{1+\sin \theta+\cos \theta} = \tan \frac{\theta}{2}$

25. a Prove that $\frac{\cos^3 A - \cos 3A}{\cos A} + \frac{\sin^3 A + \sin 3A}{\sin A} = 3$

b. If $a=\sin A+\sin B$, $B=\cos A+\cos B$, Show that $\tan^2 \frac{A-B}{2} = \frac{4-(a^2+b^2)}{a^2+b^2}$

c. Show that $\tan^{-1} \frac{3x-x^3}{1-3x^2} = 3 \tan^{-1} x$
