GOVERNMENT OF TAMILNADU

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN ENGINEERING
I YEAR

SEMESTER SYSTEM

L - SCHEME

2011 - 2012

II SEMESTER

ENGINEERING MATHEMATICS - III

CURRICULUM DEVELOPMENT CENTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING - 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

Subject Code : **22002**

Semester : II Semester

Subject Title : **ENGINEERING MATHEMATICS - III**

TRAINING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
Engineering Mathematics - III			Internal Assessment	Board Examination	Total	
	5 Hrs.	80 Hrs.	25	75	100	3 Hrs

Topics and Allocation of Hours:

Sl.No.	Topic	Time (Hrs.)
1	Vector Algebra – I	14
2.	Vector Algebra – II	14
3.	Integration – I	14
4.	Integration – II	14
5.	Probability Distribution-I	14
	Tutorial	10
	Total	80

Rationale: Many of the physical problems in Engineering becomes differential equation when mathematical modeling is done. To solve these problems, integration, the strong tool in mathematics is utilized, which intends to give basic concepts of Integration.

Objectives: Acquires knowledge of mathematical terms, concepts, principles and different methods. Develop the ability to solve physical problems.

LEARNING STRUCTURE:

Application	Unit – I	Unit – II	Unit - III	Unit –IV	Unit - V
	Use of vectors in dynamics for calculation of force, moment velocity etc.		To find length of curve area, volumes surface area		Analysis of experimental data for estimation.

Procedure	To explain methods addition, subtraction, scalar multiplication of vector	To explain methods of vector and scalar multiplication of two, three and four vectors.	To explain methods for finding integral values of different function.	To explain methods for finding integral value of function using by parts and bernoulli's formula. Method to find definite integrals.	To find probability distribution of discrete random variable mean and variance using mathematical expectation.

Concepts	Addition and subtraction of vector, scalar product of two vectors, work done and projection.	Vector product of two vectors scalar and vector product of 3 and 4 vectors.	Integral of standard functions using reverse process of differentiation, decomposition & substitution methods.	Integration using by parts method and Bernoulli's Theorem. Definite integrals	Probability mass function, probability distribution Binomial distribution. Their mean and variance

Facts	Definition of vector modulus, position vector, direction cosine, direction ratio. Definition scalar product.	Definition of vector product.	Integration as reverse process. Decomposition using Trigonometrical relations.	Definition of definite Integral Its properties	Definition of probability. Probability axioms definition of random variable types – mathematical expectation mean and variance.

DETAILED SYLLABUS

CONTENTS

UNIT	NAME OF TOPICS	Hours	Mark
I	**VECTOR ALGEBRA – I** **1.1**. **INTRODUCTION**: Definition of vector - types, addition, and subtraction of Vectors, Properties of addition and subtraction. Position vector. Resolution of vector in two and three dimensions. Directions cosines, direction ratios. Simple problems.	5	8
	SCALAR PRODUCT OF VECTORS **1.2**. Definition of Scalar product of two vectors – Properties – Angle between two vectors. Simple Problems.	5	7
	APPLICATION OF SCALAR PRODUCT 1.3 Geometrical meaning of scalar product. Work done by Force. Simple Problems.	4	7
II	**VECTOR ALGEBRA – II** **VECTOR PRODUCT OF TWO VECTORS** **2.1** Definition of vector product of two vectors. Geometrical meaning. Properties – Angle between two vectors – unit vector perpendicular to two vectors. Simple Problems.	5	8
	APPLICATION OF VECTOR PRODUCT OF TWO VECTORS & SCALAR TRIPLE PRODUCT **2.2**. Definition of moment of a force. Definition of scalar product of three vectors – Geometrical meaning – Coplanar vectors. Simple Problems.	5	7
	PRODUCT OF MORE VECTORS **2.3**. Vector Triple product. Scalar and vector product of four vectors. Simple Problems.	4	7
III	**INTEGRATION – I** **3.1**. **INTRODUCTION:** Definition of integration – Integral values using reverse process of differentiation – Integration using decomposition method. Simple Problems.	5	8
	INTEGRATION BY SUBSTITUTION Integrals of the form $\int [f(x)]^n f^1(x)\,dx$ where $(n\neq -1)$, $\int \frac{f^1(x)}{f(x)}\,dx$, $\int F[f(x)]\, f^1(x)dx$ Simple Problems.	4	7

UNIT	NAME OF TOPICS	Hours	Mark
III	**STANDARD INTEGRALS** **3.3**. Integrals of the form $\int \frac{dx}{a^2 \pm x^2}$, $\int \frac{dx}{x^2-a^2}$, $\int \frac{dx}{\sqrt{a^2-x^2}}$, $\int \frac{Ax+B}{ax^2+bx+c}$ Simple Problems.	5	7
IV	**INTEGRATION – II** **INTEGRATION BY PARTS** **4.1**.Integrals of the form $\int x \sin nx\, dx$, $\int x \cos nx\, dx$, $\int x e^{nx} dx$, $\int x^n \log x\, dx$, $\int \log x dx$ Simple Problems.	5	7
	BERNOULLI'S FORMULA **4.2.** Evaluation of the integrals $\int x^m \cos nx\, dx$, $\int x^m \sin nx\, dx$, $\int x^m e^{nx} dx$, when $m \leq 2$ using Bernoulli's formula. Simple Problems.	4	7
	DIFINITE INTEGRALS **4.3**. Definition of definite Integral. Properties of definite Integrals. Simple Problems.	5	8
V	**PROBABILITY DISTRIBUTION-I** **RANDOM VARIABLE** **5.1**. Definition of Random variable – Types – Probability mass function –Probability density function. Simple Problems.	5	8
	5.2. Mathematical Expectation of discrete random variable, mean and variance. Simple Problems.	4	7
	BINOMIAL DISTRIBUTION **5.3. Definition** **P(x=x) =** $\begin{cases} nc_x\, p^x\, q^{n-x} & x=0,1,2,\ldots\ldots n \\ 0 & \text{other wise} \end{cases}$ Statement only. Expression for mean and variance. Simple Problems.	5	7

<u>Text Book:</u>
Mathematics for Higher Secondary – I year and II year (Tamil nadu Text Book Corporation)

<u>Reference Book:</u>
Engineering Mathematics - Dr.M.K.Venkatraman, National Publishing Co, Chennai
Engineering Mathematics – Dr.P.Kandasamy & Others, S.Chand & Co Ltd, New Delhi

MODEL QUESTION PAPER - 1

ENGINEERING MATHEMATICS – III

Time three hours (Maximum Marks: 75)

PART – A

(Marks: 15 x 1 = 15)

Answer any fifteen (15) questions:

1. If position vectors of the points A and B are $2\vec{i}+\vec{j}-\vec{k}$ and $\overline{5i}+\overline{4j}+\overline{3k}$ find $|\overline{AB}|$
2. *If the vectors* $\vec{a} = 2\vec{i} - 3\vec{j}$ *and* $\vec{b} = -6\vec{i} + m\vec{j}$ are collinear,find the value of m.
3. Define scalar product of two vectors.
4. Find the projection of the vector $2\vec{i}+3\vec{j}-\vec{k}$ on $-2\vec{i}+4\vec{j}-\vec{k}$
5. If $\vec{a} = 2\vec{i} - \vec{j} + \vec{k}$ *and* $\vec{b} = \vec{i} + 2\vec{j} + 3\vec{k}$ *find* $\vec{a} \times \vec{b}$
6. Prove that $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) = 2(\vec{a} + \vec{b})$
7. Find the value of $[\vec{i}, \vec{j}, \vec{k}]$
8. Find $\vec{i} \times (\vec{j} \times \vec{k})$ and $(\vec{i} \times \vec{j}) \times \vec{k}$
9. Evaluate $\int (3x^2-5\sec^2x+7/x)\, dx$
10. Evaluate $\int \sin^2x\, dx$
11. Evaluate $\int \frac{e^x}{e^x+1} dx$
12. Evaluate $\int \frac{1}{\sqrt{4x^2-25}} dx$
13. Evaluate $\int x\, e^x dx$
14. Evaluate $\int \log x\, dx$

15. Evaluate $\int_1^3 3x^2 + 1\, dx$

16. Evaluate $\int_{-2}^{2} x^3\, dx$

17. Define discrete random variable.

18. A random variable X has the following probability distribution

X :	0	1	2	3	4
P(x) :	a	5a	3a	7a	4a

Find the value of a

19. A random variable X has the following probability distribution

X :	0	1	2	3
P(x) :	1/7	2/7	1/7	3/7

Find E(X)

20. Find the mean and variance of the binomial distribution given by
$P(X=x) = 10C_x\,(1/4)^x\,(3/4)^{10-x}$ when x=0,1,2……10

PART - B

(Marks : 5 x 12 = 60)

[N.B :- (1) Answer all questions choosing any two divisions from each question.
(2) All questions carry equal marks.]

21 (a) Show that the points whose position vectors $2\vec{i} + 3\vec{j} - 5\vec{k}, 3\vec{i} + \vec{j} - 2\vec{k}$ and $6\vec{i} - 5\vec{j} + 7\vec{k}$ are collinear.

(b) Prove that the vectors are $\vec{a} = \vec{i} + 2\vec{j} + \vec{k},\ \vec{b} = \vec{i} + \vec{j} - 3\vec{k}\ and$, and $\vec{c} = 7\vec{i} - 4\vec{j} + \vec{k}$ are mutually perpendicular..

(c) A particle acted on by the forces $3\vec{i} - 2\vec{j} + 2\vec{k}\ and\ 2\vec{i} + \vec{j} - 3\vec{k}$ is displaced from the point $\vec{i} + 3\vec{j} - \vec{k}$ to the point $4\vec{i} - \vec{j} + 2\vec{k}$. Find the work done.

22 (a) Find the area of the triangle formed by the points whose position vectors are
$2\vec{i} + 3\vec{j} + 4\vec{k}, 3\vec{i} + 4\vec{j} + 2\vec{k}, 4\vec{i} + 2\vec{j} + 3\vec{k}$

(b) Find the magnitude of the moment about the point (1,-2,3) of a force 2i + 3j + 6k whose line of action passes through the origin

(c) If $\vec{a} = \vec{i} + \vec{j}$; $\vec{b} = \vec{j} + \vec{k}$; $\vec{c} = \vec{k} + \vec{i}$; $\vec{d} = \vec{i} + \vec{j} + \vec{k}$ verify that
$(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}\,\vec{d}\,\vec{b}]\vec{c} - [\vec{a}\,\vec{b}\,\vec{c}\,]\vec{d}$

23 (a) Integrate (i) $\frac{\sin x}{1+\cos x}$ (ii) Sin7x Cos5x

(b) Evaluate (i) $\int \frac{6x+5}{\sqrt{3x^2+5x+6}}\,dx$ (ii) $\int \frac{e^{\tan x}}{\cos^2 x}\,dx$

(c Evaluate $\int \frac{1}{3x^2-13x-10}\,dx$

24 (a) Evaluate (i) $\int x^2 \log x\,dx$ (ii) $\int x\cos 5x$

(b) Using Bernoulli's formula evaluate
(i) $\int x^2 e^{2x} dx$ (ii) $\int x^2 \cos 2x\,dx$

(c) Evaluate (i) $\int_1^2 x^2 - 3\sqrt{x} + \frac{1}{x^2}\,dx$ (ii)) $\int_0^{\frac{\pi}{6}} \cos^2\frac{x}{2}\,dx$

25 (a) A Random variable X has the following probability distribution

X	0	1	2	3	4	5
P(X)	a	3a	5a	7a	9a	11a

Find (i) Value of a (ii) P(X>3) (iii) P(1≤x≤4)

(b) The random variable X has the following probability distribution

X	0	1	2	3	4	5
P(x)	1/16	¼	3/8	3/16	1/16	1/16

Find the mean and variance

(c) A perfect cube is thrown 8 times. The occurrence of 2 or 4 is called a success, find the probability of (i) 2 success (ii) atleast 2 successes.

MODEL QUESTION PAPER - 2
ENGINEERING MATHEMATICS – III

Time three hours (Maximum Marks: 75)

PART – A
(Marks: 15 x 1 = 15)

1. If $\vec{a} = 3\vec{i} - \vec{j} - 4\vec{k},\ b = -2\vec{i} + 4\vec{j} - 3\vec{k}\ and\ c = \vec{i} + 2\vec{j} - \vec{k}, find\ |2\vec{a} - \vec{b} + 3\vec{c}|$

2. Find the direction cosines of the vector $2\vec{i} + 3\vec{j} - 4\vec{k}$

3. If $\vec{a} = 5\vec{i} - \vec{j} - 6\vec{k},\ b = -7\vec{i} + 3\vec{j} - 2\vec{k}$ find dot product of $\vec{a}\ and\ \vec{b}$

4. State the formula to find work done by the force $\vec{f}$ in displacing the particle from the point A to B.

5. Define vector product of two vectors.

6. If $\vec{a}\ and\ \vec{b}$ are the two adjacent sides of a parallelogram, find its area.

7. Define scalar product of three vectors

8. Express $(\vec{a} \times \vec{b}).(\vec{c} \times \vec{d})$ in the form of determinant.

9. Evaluate $\int \sec^2(3 + 4x)\,dx$

10. Evaluate $\int sin5x\,cos2x\,dx$

11. Evaluate $\int \frac{2x}{1+x^2}\,dx$

12. Evaluate $\int \frac{1}{16+x^2}\,dx$

13. Evaluate $\int logx\,dx$

14. Evaluate ∫ x sjnx dx

15. Evaluate $\int_2^3 3x^2 + 4\,dx$

16. Evaluate $\int_{-2}^{2} (2x^3 + 5x)\, dx$

17. Define Random variable

18. A random variable X has the following the probability distribution

X	:	1	2	3	4	5
P(X)	:	1/16	5/16	3/16	3/16	¼

Find P (X<3)

19. If E(X) = 5 and E (X^2) = 35 find variance of X

20. In a binomial distribution, the mean and standard deviation are 12 and 2 respectively. Find p.

PART – B
(Marks: 5 x 12 = 60)

[N.B :- (1) Answer all questions choosing any two divisions from each question.
(2) All questions carry equal marks.]

21 (a) Show that the points given by the vectors $4\vec{i} + 5\vec{j} + \vec{k}, -\vec{j} - \vec{k}, 3\vec{i} + 9\vec{j} + 4\vec{k}$ and $-4\vec{i} + 4\vec{j} + 4\vec{k}$ are coplanar.

(b) Find the angle between the vectors $3\vec{i} + 4\vec{j} + 12\vec{k}$ *on* $\vec{i} + 2\vec{j} + 2\vec{k}$.

(c) The work done by force $\vec{F} = a\vec{i} + \vec{j} + \vec{k}$ in moving the point of application from $\vec{i} + \vec{j} + \vec{k}$ *to* $2\vec{i} + 2\vec{j} + 2\vec{k}$ along a straight line is given to be 5 units. Find the value of a.

22 (a) Find the angle and the unit vector perpendicular to both the vectors $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$ *and* $\vec{b} = \vec{i} - \vec{j} - \vec{k}$.

(b) Find the moment about the point $\vec{i} + 2\vec{j} - \vec{k}$ of a force represented by $3\vec{i} + \vec{k}$ acting through the point $2\vec{i} - \vec{j} - 3\vec{k}$.

(c) Prove that $[\,\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}\,] = [\,\vec{a}\,\vec{b}\,\vec{c}\,]^2$

23 (a) Evaluate (i) $\int (tanx + cotx)^2\, dx$ (ii) $\int \sqrt{1 + sin2x\, dx}$

(b) Evaluate (i) $\int \tan^4 x \sec^2 x$) $\int \frac{sin\sqrt{x}}{\sqrt{x}} dx$

(c Evaluate $\int \frac{4x-3}{x^2+6x+8} dx$

24 (a) Evaluate (i) $\int x log x\, dx$ (ii) $\int x\cos 5x$

(b) Using Bernoulli's formula evaluate
(i) $\int x^2 e^{2x} dx$ (ii) $\int x^2 cos2x\, dx$

(c) Evaluate (i) $\int_0^1 \frac{e^{\tan^{-1} x}}{1+x^2}\, dx$ (ii)) $\int_0^{\frac{\pi}{2}} \frac{sinx}{sinx + cosx}\, dx$

25 (a) Show that $f(x) = \frac{2}{\pi} \quad \frac{1}{1+x^2}$ $-1 < x < 1$, is a probability density function.

(b) A random variable X has the following probability distribution

X :	0	1	2	3
P(X) :	1/8	3/8	3/8	1/8

Find $E(2X+3)^2$

(c) Four coins are tossed simultaneously. What is the probability of getting (a) exactly 2 heads (b) at least two heads (c) at most two heads.