SEMESTER - I
DIFFERENTIAL EQUATIONS

1. Course Description

Programme: B.Sc
Course Code: U26/MAT/DSC/101
Course Type: DSC- I
No. of credits: 4

Max. Hours : 60
Hours per week: 04
Max. Marks : 100

2. Course Objectives

1. To develop the ability to solve various types of differential equations using analytical methods and explore applications of differential equations in Biology, Chemistry and Social Sciences.
2. To introduce students to the basic theory of Partial Differential Equations and develop in them competence in solving higher order linear differential equations with constant coefficients.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Classify ordinary differential equations into exact and non-exact forms to determine appropriate solution strategies. (L II)
CO2: Solve first-order differential equations that are not of first degree and interpret their applications in modelling real-world phenomena. (L II)
CO3: Apply various methods for solving higher order linear differential equations with constant coefficients. (L III)
CO4: Analyze higher order differential equations with non-constant coefficient and Partial Differential Equations. (L IV)

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4. Course Content

MODULE I: **15 Hours**

Differential Equations of First Order & First Degree:
Introduction, Equations in which Variables are Separable, Homogeneous Differential Equations, Differential Equations reducible to Homogeneous Form, Linear Differential Equations, Differential Equations reducible to Linear Form, Exact Differential Equations, Integrating Factors.

Sections: - 2.1- 2.8, Pg. No. 27-55, 60-61

MODULE II: **15 Hours**

Differential Equations of the First Order but not of the First Degree:
Equations solvable for p, y, x, that do not contain x or y, Homogeneous in x & y, Equations of the first degree in x & y, Clairaut's Equation.

Sections: 3.1- 3.2.5, Pg. No.63-74

Applications of First Order Differential Equations:
Growth and Decay, Dynamics of Tumour growth, Radioactivity and Carbon Dating, Compound Interest, Biological Growth, A problem in Epidemiology, Orthogonal Trajectories.

Sections: 4.1- 4.4, 4.8-4.9, 4.20, Pg. No. 75-84, 92-98, 133-140

MODULE III: **15 Hours**

Higher Order Linear Differential Equations:

Introduction, Solution of homogeneous linear differential equations of order n with constant coefficients, Solution of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators:

1. When $Q(x) = b x^k$ and $P(D) = D - a^n$, $a^n \neq 0$
2. When $Q(x) = b x^k$ and $P(D) = a^n D^n + a^{n-1} D^{n-1} + \ldots\ldots + a^1 D$
3. When $Q(x) = b e^{ax}$
4. When $Q(x) = b \sin ax$ or $b \cos ax$
5. When $Q(x) = e^{ax} V$, where V is a function of x
6. When $Q(x) = be^{ax}$ & $P(a) = 0$
7. When $Q(x) = xV$ where V is any function of x

Method of Undetermined Coefficients, Method of Variation of Parameters.

Sections: - 5.1-5.5, Pg. No. 159-190, 239- 241

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MODULE IV: **15 Hours**

Higher Order Linear Differential Equations with Non-Constant Coefficients:

Linear Differential Equations with non-constant coefficients, The Cauchy- Euler Equations, Legendre's Linear Equation.

Sections: - 5.6-5.8, Pg. No. 190– 196, 241

Partial Differential Equations

One dimensional Heat Flow, Introduction, Formation and Solution of Partial Differential Equations, Equations Easily Integrable, Linear Equations of the First Order, Nonlinear Equations of the First Order. **Sections: 4.15, 9.1-9.5, Pg. No. 110,428- 439, 537**

5. Reference Books

1. Zafar Ahsan, Differential Equations & their Applications (Third Edition), Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Rai Singhania, Ordinary & Partial Differential Equations, S. Chand & Co., New Delhi.
3. Richard Bronson, Differential Equations International Edition, Schaum's Outline Series.
4. V. Venkateshwara Rao, N. Krishna Murthy, B.V.S.S. Sarma, S. Anjaneya Sastry, The Textbook of B.Sc. Mathematics, Revised edition of 2014, Volume 1, S.Chand and Co Private Ltd.
5. B. Sc First Year Mathematics, Telugu Akademi.

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
National	Differential equations help students understand how changing quantities are related and modelled, enabling their application in scientific research, engineering, economics, and technology across the country.
Global	Differential equations serve as foundational mathematical tools for modelling dynamic systems, enabling the prediction of system behaviour, optimization of processes, and evidence-based solutions to complex real-world challenges. Their interdisciplinary applications span celestial mechanics, population dynamics, epidemiological modelling, and beyond.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I, III & IV	Solving differential equations using Mathematical Software.
Employability	Module II	Modelling of real-world problems

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Skill Tests, Quiz, Group Discussions, Presentations
2.	Experiential Learning	Field Trips
3.	Problem Solving	Assignments, Research Projects

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA- I (Written Exam)	Written Exam
CO2	CIA- I (Written Exam)	
CO3	CIA- II (Skill Tests)	
CO4	CIA- II (Assignments/Presentations)	

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b) Model Question Paper- End Semester Exam Theory

DIFFERENTIAL EQUATIONS

Course Code: U26/MAT/DSC/101 **Max. Marks :60M**
No. of credits: 4 **Time: 2 Hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

I. Answer ALL questions: **Marks: 4 x 10 =40M**

1. Solve $xdx + ydy + \frac{xdy - ydx}{x^2+y^2} = 0.$

OR

2. Solve $(1+x)\frac{dy}{dx} - xy = 1 - x.$
3. Solve $p^2 + 2pycotx = y^2.$

OR

4. A culture initially has N_0 number of bacteria. At $t = 1$ hour the number of bacteria is measured to be $\left(\frac{3}{2}\right)N_0$. If the rate of growth is proportional to the number of bacteria present, determine the time necessary for the number of bacteria to triple.
5. Solve $(D^3 + 2D^2 + D)y = x^2 + e^{2x} + x.$

OR

6. Using method of variation of parameters solve $y'' + 3y' + 2y = 12e^x$
7. Solve $x^2\left(\frac{d^2y}{dx^2}\right) + x\frac{dy}{dx} - 4y = x^2.$

OR

8. Solve $y\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 4xy$

SECTION –B (Short Essay Type)

II. Answer any <u>FOUR</u> of the following questions: **Marks: 4 x 5=20M**

9. Solve $\frac{dy}{dx} = (x^2 + y^2 + 1)/2xy.$
10. Solve $y(1 - xy)dx - (1 + xy)xdy = 0.$
11. Solve $sinpxcosy = cospxsiny + p.$
12. Find the particular integral of $(D^2 - 3D + 2)y = x.$
13. Solve $(D^2 - 2D + 5)y = 0$ given that y=0 and $\frac{dy}{dx} = 4$ when x=0.
14. Solve $p^2 + q^2 = x+y.$

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Question Paper Format- Bloom's Taxonomy Level

SECTION A-INTERNAL CHOICE				**4Q X10=40M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Bloom's Taxonomy Level)**
1	Module I	Solve $xdx + ydy + \frac{xdy - ydx}{x^2+y^2} = 0.$	CO1	Level II
2	Module I	Solve $(1+x)\frac{dy}{dx} - xy = 1 - x.$	CO1	Level II
3	Module II	Solve $p^2 + 2pycotx = y^2.$	CO2	Level II
4	Module II	A culture initially has N_0 number of bacteria. At $t = 1$ hr. the number of bacteria is measured to be $\left(\frac{3}{2}\right)N_0$. If the rate of growth is proportional to the number of bacteria present, determine the time necessary for the number of bacteria to triple.	CO2	Level II
5	Module III	Solve $(D^3 + 2D^2 + D)y = x^2 + e^{2x} + x.$	CO3	Level III
6	Module III	Using method of variation of parameters solve $y'' + 3y' + 2y = 12e^x$	CO3	Level III
7	Module IV	Solve $x^2\left(\frac{d^2y}{dx^2}\right) + x\frac{dy}{dx} - 4y = x^2.$	CO4	Level IV
8	Module IV	Solve $y\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 4xy.$	CO4	Level IV
SECTION B-ANSWER ANY 4 OUT OF 6				**4Q X 5M=20M**
(To compulsorily have ONE question from each module)				
9	Module I	Solve $\frac{dy}{dx} = (x^2 + y^2 + 1)/2xy$	CO1	Level II

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10	Module I	Solve $y(1-xy)dx-(1+xy)xdy=0.$	CO1	Level II
11	Module II	Solve $sinpxcosy=cospxsiny+p.$	CO2	Level II
12	Module III	Find the particular integral of $(D^2-3D+2)y=x.$	CO3	Level III
13	Module III	Solve $(D^2-2D+5)y=0$ given that y=0 and $\frac{dy}{dx}=4$ when x=0.	CO3	Level III
14	Module IV	Solve $p^2+q^2=x+y$	CO4	Level IV

c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4 x 10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hours)
1	1,2	Classify	15
2	1,2	Understanding	15
3	1,7	Applying	15
4	1,2	Analyze	15

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DIFFERENTIAL EQUATIONS

Practical Syllabus

1. Course Description

Programme: B.Sc.
Course Code: U26/MAT/DSC/101/P
Course Type: DSC-1
No. of credits: 01

Max. Hours: 30
Hours per week: 02
Max. Marks : 50

2. Course Objectives

1. To solve differential equations using analytical and computational methods.
2. To apply differential equation models to real-world problems and interpret the results graphically.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Solve first order differential equations using Bernoulli's method.

CO2: Solve problems of first order but not of first degree.

CO 3: Apply various methods to solve linear differential equations with constant coefficients.

CO 4: Solve linear equations with non-constant coefficients and Partial Differential Equations.

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PRACTICAL SESSIONS

1. Linear and Bernoulli Differential Equations.
2. Exact Differential Equations and Integrating Factors – I.
3. Integrating Factors-II.
4. Equations solvable for p and y.
5. Equations solvable for x and Clairaut's equations.
6. Applications of First Order Differential Equations.
7. Higher Order Linear Differential Equations.
8. Method of Undetermined Coefficients and Variation of Parameters.
9. Linear Differential Equations with non- constant coefficients, Cauchy- Euler Equations, Legendre's Linear equations
10. Partial Differential Equations.

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6. Model Question Paper – End Semester Exam Practical

MODEL QUESTION PAPER
PRACTICAL

Course Code: U26/MAT/DSC/101/P | **Max. Marks: 30**

No. Of Credits: 1 | **Time: 2 Hours**

I. Answer the following: **5 x 6 = 30 M**

1. Solve $\frac{dy}{dx} = \frac{\sin^2 x}{1+x^3} - \frac{3x^2}{1+x^3}y$
2. Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$
3. Solve $y + px = p^2x^4$
4. If *Rs.* 10,000 is invested at 6 percent per annum, find what amount has accumulated after years if interest is compounded: (a) annually, (b) quarterly, and (c) continuously.
5. Find the particular integral of $y'' + 3y' + 2y = 8 + 6e^x + 2\sin x$
6. Solve the following differential equations by the method of variation of parameters.

   $y'' + 2y' + y = x^2e^{-x}$
7. Solve $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x.$
8. Solve (y +z) p + (x + z) q = x + y

Prepared by Course Teacher [Name & Signature]	Checked &Verified by HOD [Name & Signature]	Approved by Principal
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SEMESTER - I

MICRO ECONOMIC ANALYSIS

1. Course Description

Programme:	B. Sc	Max. Hours:60
Course Code:	U26/ECM/DSC/101	Hours per week :4
Course Type:	DSC	Max Marks :100
No. of credits:	4	

2. Course Objectives

- To study the basic principles in Microeconomic theory
- To learn the practical application of the theory

3. Course Outcomes

On completion of the course the student will be able to:

CO1 Understand the basic concept of micro economics (understand)

CO2 Apply economic theories and understanding consumer behavior (Apply)

CO3 Evaluate production theory with the help of graphical representation (Evaluate)

CO4 Analyze cost and revenue concepts under different markets (Analyze)

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4. Course Content

Module I - Consumer Behaviour **15 Hours**

1. Demand: Determinants of demand, law of demand, Elasticity: price, income and cross elasticity of demand, Income elasticity (Mathematical problems using calculus)
2. Ordinal utility analysis: Indifference curve analysis- introduction, properties/ assumptions of IC, diminishing marginal of substitution, budget line, consumer's equilibrium under IC analysis
3. Income consumption curve and income effect, price consumption curve and price effect and Substitution effect
4. Nudge Theory-Origin, principles, benefits and criticism

Module II-Production Analysis **13 Hours**

1. Production functions: law of variable proportions, importance and limitations
2. Two variables - isoquants, properties of isoquants, producers' equilibrium,
3. Internal and external economies of scale, Economies of Scope
4. Law of returns to scale.
5. Cobb Douglas Production theory.

Module III Cost and Revenue Analysis **17 Hours**

1. Different concepts of cost, Short Run cost curves (Mathematical Problems using Calculus). Accounting profit and Economic Profit (Mathematical problems)
2. Long Run cost curve (LAC and LMC)
3. Concepts of Revenue – Total, average and marginal revenue, Relationship between AR and MR curves under perfect competition and imperfect competition (Mathematical Problems using Calculus)
4. Break even analysis, Breakeven point
5. Profit Maximization using cost and revenue analysis (Mathematical Problems using Calculus)

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Module IV – Pricing under different markets **15 Hours**

1. Monopoly- characteristics, Price and Output determination under monopoly and price determination.
2. Monopolistic competition – characteristic features, Short Run & Long Run price and output determination, excess capacity
3. Oligopoly – characteristics of, reasons for price rigidity in non-collusive oligopoly, kinked demand curve
4. Duopoly - Cournot's model of duopoly.
5. Pricing strategies in large enterprises and small enterprises

5. Reference Books:

1. Ahuja, H. L. (2014). *Microeconomics*. New Delhi: S. Chand & Company Ltd.
2. Agarwal, H. S. (2013). *Principles of economics*. Global Professional Publishing Ltd.
3. Baumol, W. J. (1985). *Economic theory and operations analysis*. Prentice Hall.
4. Chopra, P. N. (2011). *Advanced economic theory*. Kalyani Publications.
5. Mankiw, N. G. (2014). *Principles of microeconomics* (7th ed.). South-Western College Publishing.
6. Henderson, J., & Quandt, R. A. (1984). *Microeconomic theory: A mathematical approach*. McGraw-Hill.
7. Jhingan, M. L. (2014). *Microeconomic theory*. Vrinda Publications.
8. Koutsoyiannis, A. (2003). *Modern microeconomics* (2nd ed.). Palgrave Macmillan.
9. Mithani, D. M. (2011). *Managerial economics*. Himalaya Publishing House.
10. Rittenberg, L., & Tregarthen, T. (2009). *Principles of microeconomics*. Flat World Knowledge.

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6.Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global	The Course will Examine Demand and Supply in different markets and understand the behavior of produces and consumers

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	**Syllabus Content**	**Description of Activity**
EMP	Module I	Case Study
SD	Module 4	Presentation

7. Pedagogy

S. No	**Student Centric Methods Adopted**	**Type / Description of Activity**
1.	Seminar Presentation	Participative Learning
2.	Quiz	Experiential Learning
3.	Group Discussion	Participative Learning

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8. Course Assessment Plan

a) Weight age of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Presentation	
CO4	CIA-2 Assignment	

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MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE			**4 Q X 10 M = 40 M**	
Question Number	**Module**	**Question**	**CO**	**BTL(Blooms Taxonomy Level)**
1	**Module 1**	a. Explain the reason for the downward slope of demand curve. b. Given the demand function p = 60-2q, find price elasticity at p=6.	CO 1	BL 2
2	**Module 1**	Illustrate with an example the types of Price Elasticity of Demand	CO 1	BL 2
3	**Module 2**	Critically evaluate law of variable proportions	CO 2	BL 4
4	**Module 2**	Analyze consumer's equilibrium with help of indifference curve.	CO 2	BL 4
5	**Module 3**	Explain how a Long Run Average cost curve is derived	CO 3	BL 2
6	**Module 3**	1. The cost and revenue of a firm are set under $C = 100+0.015X^2$; $R= 3X$. Find the production rate that will maximize the profit of the firm and also profit when x=120	CO 3	BL 2
7	**Module 4**	Explain Cournot's model of duopoly	CO 4	BL 2
8	**Module 4**	A TV Manufacturer produced X sets per week at TC of $(X^2/25) +3X+100$, The demand for his product is X=75-3P. Show that the maximum revenue is obtained when about 30 sets are produced per week, what is the monopoly price.	CO 4	BL 2
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			**4 Q X 5 M = 20 M**	
9	**Module 1**	Income Elasticity of Demand	CO 1	BL 1
10	**Module 2**	Substitution effect	CO 2	BL 1
11	**Module 2**	Properties of indifference Curves	CO 2	BL 1
12	**Module 3**	TVC,TFC,TC	CO 3	BL 1
13	**Module 3**	Break Even Analysis	CO 3	BL 1
14	**Module 4**	Short run in Monopolistic competition	CO 4	BL 1

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	1	5
2	15	CO-2	2	10	1	5
3	15	CO-3	2	10	1	5
4	15	CO-4	2	10	1	5

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions (hrs)
1	1	Understand	15
2	3	Analyse	15
3	6	Remember	15
4	1	Apply	15

Prepared by	Checked &Verified by	Approved by
Name and Signature of the teaching faculty	Name and Signature of HoD	Name and Signature of Principal
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SEMESTER – I

COMPUTER APPLICATION IN ECONOMICS

1. Course Description

Programme: B.SC | Max. Hours :30

Course Code: U26/ECM/DSC/101/P | Hours per week : 2

Type: DSC | Max. Marks :50

No. of credits: 1

2. Course Objectives:

The students learn to estimate and apply various economic concepts and their working.

3. Course Outcome

On completion of the course the student will be able to:

1. To enable students to apply production and cost theories using computer-based tools (Excel), and analyze the relationship between input usage, output, and cost structures.
2. To develop practical skills in computing and interpreting TP, MP, AP, cost curves, and profit-maximizing output, thereby linking microeconomic theory with real-world data analysis.

4. Course Content

1. Introduction to Data & Excel for Economics
2. Measures of central tendency
3. Graphical representation of data
4. AI in consumer decision making -regression and correlation
5. Cost and revenue analysis
6. Pivot tables
7. Mini project and viva

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BASIC STATISTICS AND PROBABILITY

1. **Course Description:**

Programme : B.Sc
Course Code : U26/STA/DSC/101
Course Type : DSC
No. of credits: 4

Max. Hours: 60
Hours per week:4
Max. Marks:100

2. **Course Objectives:**

- To enable students to analyze and interpret statistical data using measures of central tendency, dispersion, moments, skewness, and kurtosis.
- To develop a strong foundation in probability theory, including definitions, probability laws, and fundamental theorems for solving real-life problems.
- To analyze data pertaining to discrete and continuous variables and to interpret the results and also obtain a probability distribution of random variable (one or two dimensional) in the given situation.

3. **Course Outcomes :** On completion of the course, the student will be able to:

CO	Description	BTL	
CO1	**Apply** descriptive statistical measures including central tendency, dispersion, moments, skewness, and kurtosis to analyze raw and grouped data.	Apply	III
CO2	**Demonstrate** understanding of probability concepts and apply probability theorems to solve problems involving joint, conditional probabilities and Bayes' theorem.	Demonstrate	II
CO3	**Analyze** discrete and continuous random variables, their probability distributions, joint and conditional distributions, transformations.	Analyze	IV
CO4	**Compute** mathematical expectation, moments, covariance, generating functions, and study the application of inequalities.	Compute	III

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4. **Course Content**

MODULE I : BASIC STATISTICS **(15 Hrs)**

Scales of Measurement, Concept of primary and secondary data – their sources, collection and editing. Construction of Frequency distribution. Classification and tabulation of data. Review of measures of central tendency and dispersion. Central and Non-central moments, Sheppard's corrections for moments. Skewness and kurtosis and their inter-relationships and computations to the raw & grouped data and data sets. Usage in the domains of image analysis, pattern recognitions, Preparation of descriptive statistical analysis report based on the above descriptive statistics.

MODULE II :PROBABILITY **(15 Hrs)**

Basic concepts used for defining probability, Mathematical, Statistical and Axiomatic definitions of probability, their merits and demerits. Marginal, Joint and Conditional probabilities and independence of events, Multiplication & Addition theorems for 'n' events, Boole's inequality and Bayes' theorem, Problems on computation of Probability and including the usage of theorems.

MODULE III : RANDOM VARIABLES **(15 Hrs)**

Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass, density and distribution functions with their properties and simple problems and illustrations. Notion of bivariate random variable, bivariate distribution, statements of its properties, Joint, marginal and conditional distributions, Independence of random variables. Transformation of one and two-dimensional random variable(s), simple problems on transformation of the random variable(s).

MODULE IV : MATHEMATICAL EXPECTATION **(15 Hrs)**

Mathematical expectation of a random variable, function of a random variable, Computation of raw and central moments, covariance using mathematical expectation with examples, Addition and multiplication theorems of expectation. Generating function, Definitions of moment generating function (MGF), cumulant generating function (CGF), probability generating function (PGF) and characteristic function (Ch.F), their basic properties, applications and computation of those for simple probability functions, Moment inequalities: Chebyshev's and Cauchy-Schwartz's inequalities and their applications.

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5.List of Reference books:

1. V.K.Kapoor and S.C.Gupta(2010): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi .
2. S.C.Gupta and Kapoor (2010): Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
3.B. L. Agarwal(2007) : Programmed Statistics, New Age International Publishers, New Delhi.
4. Sanjay Arora and Bansi Lal(2000):New mathematical Statistics: Satya Prakashan, New Delhi.
5. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I& II, 8th The World Press, Kolkata.

6. Syllabus Focus

a) Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global	These statistical concepts are widely used worldwide in modern technologies such as image analysis and pattern recognition, which are core parts of fields like Artificial Intelligence and Machine Learning. They are applied globally in areas such as medical imaging, facial recognition systems, autonomous vehicles, and big data analytics.
National	Statistical methods are essential for government planning, economic policy, and data analysis. Organizations like the National Statistical Office (India) use probability and statistical measures to analyze census data, employment statistics, agriculture production, and health surveys. These analyses help the government make informed decisions for national development, policy making, and resource allocation.

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b) **Components on Skill Development/Entrepreneurship Development/Employability**

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I	Descriptive statistical analysis report
SD	Module II & III	Problem Solving and applying probabilities to real life data.
Employability	Module II	Use probability theorems and Bayes' theorem to interpret data thereby developing skills useful for data analyst jobs.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	MCQ test	Experiential learning
2.	Assignment	Experiential learning
3.	Case Study	Problem Solving

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA-1- Written Exam	Written Exam
CO2		
CO3	CIA-2 written test/Assignment	
CO4	CIA-2 MCQ test	

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b) Model Question Paper- End Semester Exam Theory

BASIC STATISTICS &PROBABILITY

Course Code: U26/STA/DSC/101 **Max. Marks: 60**
Credits : 4 **Time: 2 Hrs.**

SECTION –A (Essay Questions)

I. Answer ALL questions. **4 X 10 = 40 Marks**

1. Explain the Various methods of collecting primary data and secondary data ?

OR

2. Define the raw and central moments of a frequency distribution? Derive the relationship between central moments in terms of raw moments?

3. Define conditional probability. State and prove Baye's theorem.

OR

4.A bag contains 6 white and 9 black balls. Four balls are drawn at a time from the bag. Find the probability for the first draw to give 4 white and the second draw to give 4 black balls in each of the following cases :

a) The balls are replaced into the bag before the second draw.

b) The balls are not replaced into the bag before the second draw.

5.(i) Define Distribution Function of a random variable and State its properties?

(ii) A D.T.P operator's profit (X) per page is a random variable with the pdf

$$f(x) = \begin{cases} \frac{1}{8}(x+1), -1 < x < 5 \\ 0, elsewhere \end{cases}$$

Where the units are in rupees. Find the expected value and variance of the profit.

OR

6. (i)Define Discrete and Continuous random variables.

(ii) A random variable have a bivariate distribution $P(X=x, Y=y) = (x^2 + y) / 32$ for x= 0,1,2 and y= 0,1. Find (i) Marginal pdf of X and Y (ii) Conditional density of X=x given Y=1.

7. Define CGF of a r.v. Establish the relationship between the moments and cummulants.

OR

8. State and prove Chebychev's inequality.

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SECTION –B (Short Answer Questions)

II. Answer any FOUR. **4x5=20 Marks**

8. Write a short notes on Skewness.

9. Show that coefficient of kurtosis is greater than unity.

10. If A and B are independent events then show that $\bar{A}$ and $\bar{B}$ are also independent.

11. A random variable X has the following probability distribution

X= x :	-2	-1	0	1	2	3
P(x) :	0.1	k	0.2	2k	0.3	3k

(i) Find k (ii) Evaluate $P(X<20)$, $P(X\geq 1)$

12. Define Expectation. State its properties.

13. Define MGF of a r.v 'X' and state its properties.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain the Various methods of collecting primary data and secondary data	CO 1	Level I & III
2	Module 1	Define the raw and central moments of a frequency distribution? Derive the relationship between central in terms of raw moments?	CO 1	Level I
3	Module 2	Define conditional probability. State and prove Baye's theorem.	CO 2	Level I & II
4	Module 2	A bag contains 6 white and 9 black balls. Four balls are drawn at a time from the bag. Find the probability for the first draw to give 4 white and the second draw to give 4 black balls in each of the following cases : a) The balls are replaced into the bag before the second draw. b) The balls are not replaced into the bag before the second draw.	CO 2	Level III & V
5	Module 3	.(i) Define Distribution Function of a random variable and State its properties? (ii) A D.T.P operator's profit (X) per page is a random variable with the pdf $f(x) = \begin{cases} \frac{1}{8}(x+1), -1 < x < 5 \\ 0, elsewhere \end{cases}$ $f(x) = \begin{cases} \frac{1}{8}(x+1), -1 < x < 5 \\ 0, elsewhere \end{cases}$ Where the units are in rupees. Find the expected value and variance of the profit.	CO 3	Level I & V
6	Module 3	(i)Define Discrete and Continuous random variables. (ii) A random variable have a bivariate distribution P(X=x, Y=y) = $(x^2 + y) / 32$ for x= 0,1,2 and y= 0,1. Find (i) Marginal pdf of X and Y (ii) Conditional density of X=x given Y=1.	CO 3	Level I & V

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7	Module 4	Define CGF of a r.v. Establish the relationship between the moments and cummulants.	CO 4	Level I &II
8	Module 4	State and prove Chebychev's inequality.	CO 4	Level I & II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1	Write a short notes on Skewness.	CO 1	Level I
10	Module 1	Show that coefficient of kurtosis is greater than unity.	CO 1	Level II
11	Module 2	If A and B are independent events then show that $\bar{A}$ and $\bar{B}$ are also independent.	CO 2	Level II
12	Module 3	A random variable X has the following probability distribution X= x : -2 -1 0 1 2 3 P(x) : 0.1 k 0.2 2k 0.3 3k (i) Find k (ii) Evaluate P(X<20), P(X≥1)	CO 3	Level III
13	Module 4	Define Expectation. State its properties.	CO 4	Level I
14	Module 4	Define MGF of a r.v 'X' and state its properties.	CO 4	Level I

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c)Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hrs)
1	1,2	Apply/Understand	15
2	2	Remember/Apply	15
3	1,2	Analyze/Apply	15
4	2	Remember/ Apply	15

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SEMESTER I

PRACTICAL

BASIC STATISTICS AND PROBABILITY

1.Course Description

Programme : B.Sc **No of hrs alloted: 2H/W**
Course Code :U26/STA/DSC/101/P **Max . Marks: 50**
Course Type : DSC
No of Credits : 1

2.Course Objectives :

- To develop practical skills in presenting and summarizing data using diagrammatic, graphical, and numerical statistical methods.
- To apply statistical measures and probability concepts, including Bayes' theorem, for data analysis and problem solving.

3.Course Outcomes :

CO 1 : **Construct** diagrammatic and graphical presentations of data and compute measures of central tendency, dispersion, moments, and skewness for grouped and ungrouped data.

CO 2 : **Analyze** statistical results and apply Bayes' theorem to solve probability problems and interpret data-driven conclusions.

4.LIST OF PRACTICALS:

1. Diagrammatic presentation of data (Bar, Pie ,Stem and leaf and Box-plots).
2. Graphical presentation of data (Histogram, Frequency polygon, Ogives) .
3. Computation of Measures of Central tendancy and partion values (For ungrouped and grouped data)
4. Computation of Measures of Dispersion (For ungrouped and grouped data)
5. Computation of Non-central and Central moments –Sheppard's corrections for grouped data.
6. Computation of Karl Pearson and Bowley's coefficients of Skewness .
7. Problems on Baye's Theorem.

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PRACTICALS USING MS-EXCEL AND SPSS

1. Basics of SPSS - data entry, formation of frequency tables, editing and saving, using built in functions in SPSS, copy and exporting to MS word document.
2. Graphical presentation of data (Histogram, frequency polygon, Ogives) using SPSS and EXCEL
3. Diagrammatic presentation of data (Bar and Pie) using SPSS and EXCEL.
4. Stem and Leaf Chart, Box Plot using SPSS.
5. Computation of measures of central tendency, dispersion and coefficients of Skewness, Kurtosis using SPSS and EXCEL .

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Model Question Paper – End Semester Exam Practical

Course Code: U26/STA/DSC/101/P **Max. Marks: 50**
Credits : 1 **Time: 2 Hrs.**

Answer any THREE questions. **3 x 10= 30**

1. (a)The following data relates to the age distribution of 1000 workers in an industry Draw less than Ogive curve .

Age(Years)	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
No of workers	120	125	180	160	150	140	100	25

(b) The following data represents the defects in all computer key-boards produced by a company during a three –month period. Draw pie diagram.

Cause	**Frequency**
Black spots	413
Spray mark	292
Jetting	258
Pin mark	834
Scratches	442
Shot mold	275

2. (a) A person owns two petrol filling stations A and B. At station A, a representative sample of 200 consumers who purchase petrol were taken. The results were as follows.

Number of litres of petrol purchased	0-2	2-4	4-6	6-8	8-10	10-12
Number of consumers	15	40	65	40	30	10

A similar sample at station B users showed a mean of 4 litres with a standard deviation of 2.2 litres. At which station is the purchase of petrol relatively more variable.

(b) An automobile insurance company divides customers into three categories good risks, medium risks and poor risks, Assume that 70% of the customers are good risks, 20% are medium risks, and 10% are poor risks. Assume that during the course of a year, a good risk customer has probability 0.005 of filing an accident claim, a medium risk customer has a probability 0.01, and a poor risk customer has probability 0.025. A customer is chosen at random. What is the probability that the customer is a good risk and has filed a claim?

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3. For the following frequency distribution, compute first four central moments and find coefficient of skewness and kurtosis. Apply Sheppard's corrections.

CI	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	8	10	19	23	18	13	4

4. An automobile travelling on a road that has a posted speed limit of 55 miles per hour is checked for speed by a state police radar system. A frequency distribution of speeds is as follows.

Speed(Miles/hr)	45-50	50-55	55-60	60-65	65-70	70-75	75-80
Frequency	10	40	150	175	75	15	10

Calculate karl Pearson's and Bowley's coefficient of Skewness.

PRACTICAL EVALUATION

S. No	Evaluation	Marks
1	Written Exam	30M
2	Lab	10M
3	Viva	5M
4	Record	5M
	Total	50M

Prepared by	Checked &Verified by	Approved by
Name and Signature of the teaching faculty (Dr. Ch.Yugandhar)	Name and Signature of HoD (Dr. Ch.Yugandhar)	Name and Signature of Principal (Prof. T. Uma Joseph)

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PROBABILITY DISTRIBUTIONS

1.Course Description:

Programme: B.Sc
Course Code: U26/STA/DSC/201
Course Type: DSC
No. of credits: 4

Max. Hours: 60
Hours per week:4 hrs.
Max. Marks:100

2.Course Objectives: At the end of this course students are expected to be able,

- To develop a comprehensive understanding of discrete and continuous probability distributions and their properties.
- To study relationships between distributions, their approximations, and generating functions.
- To introduce sampling theory and exact sampling distributions for statistical inference.

3.Course Outcomes : On completion of the course the student will be able to

CO	Description	BTL	
CO1	**Memorize** and **apply** important discrete distributions such as Binomial, Poisson, Negative binomial and Geometric distributions and their interrelations	**Apply**	**III**
CO2	**Understand** Hyper geometric distribution and develop the ability to use and **interpret** normal probability.	**Understand**	**II**
CO3	**Understand** important continuous distributions such as Exponential, Gamma, Beta and Cauchy distributions and their significant properties.	**Understand**	**II**
CO4	**Analyse** and **apply** the exact sampling distributions including chi-square (χ^2), Student's t, and F distributions and **identify** situations where each distribution is applicable.	**Apply**	**III**

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4.Course Content :

MODULE I: DISCRETE DISTRIBUTIONS (15 Hrs)

Discrete Uniform and Bernoulli distributions: definitions, mean, variance and simple examples. Binomial, Poisson, Negative-Binomial and Geometric distributions: Physical conditions. derivation of probability mass functions, central and moments up to fourth order, median, mode, M.G.F, C.G.F., P.G.F., Ch. F. nature of the curve and, reproductive property (wherever exists) special properties if any and real-life applications in various domains and probability problems related to these distributions. Poisson approximation to Binomial distribution, Poisson approximation to Negative binomial distribution.

MODULE II- CONTINUOUS DISTRIBUTIONS - I (15 Hrs)

Hyper-geometric distribution: definition, real life applications, derivation of probability function, mean, variance. Binomial approximation to Hyper-geometric distribution.
Continuous distributions: Rectangular and Normal distributions - definition, properties such as M.G.F, C.G.F., Ch. F. and moments up to fourth order, reproductive property, wherever exists and their real-life applications. Normal distribution as a limiting case of Binomial and Poisson distributions.

MODULE III- CONTINUOUS DISTRIBUTIONS - II (15 Hrs)

Exponential, single and two parameter Gamma distributions: Definition, Moments up to fourth order, M.G.F, C.G.F., Ch. F., reproductive property (wherever exists), nature of the curves and their real-life applications special properties (if any) and problems. Beta distribution of two kinds: Definitions, mean and variance, nature of the curve, special properties (if any) & applications. Cauchy distribution: Definition, nature of the curve, derivation of density, C.f. and its special properties and its statistical significance.

MODULE IV- EXACT SAMPLING DISTRIBUTIONS (15 Hrs)

Concepts of Population, Parameter, sample, Statistic, Sampling distribution and Standard error. Standard errors for various statistics. Exact sampling distributions: χ^2, t and F Definitions, curves and properties of distributions and their interrelationships. Independence of sample mean and variance in random sampling from normal distributions.

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5. List of Reference books:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II , 8th Edition , The World Press, Kolkata
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. V.K.Kapoor and S.C.Gupta(2010): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
4. S.C.Gupta and Kapoor (2010): Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
5. Sanjay Arora and Bansi Lal(2000):New mathematical Statistics: Satya Prakashan, New Delhi.

6.Syllabus Focus

a) Relevance to Local ,Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global	Discrete probability distributions find applications in various fields where outcomes are countable or finite. Coin tossing and dice rolling, bio statistics and epidemiology, queueing theory, reliability engineering, inventory management, finance and risk management, game theory. Continuous probability distributions are used in financial analysis, quality control, biometrics, reliability engineering, queuing theory, telecommunications, insurance and actuarial sciences, healthcare management, engineering.
National	Statistical distributions and sampling methods help in government surveys, economic planning, population studies, and business analytics for national development.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I and II	Fitting of distributions during practical hours
SD	Module IV	Problem solving using sample data and apply conclusions to large population.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	MCQ test	Experiential learning
2.	Assignment	Experiential learning

8. Course Assessment Plan

a)Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA-1- Written Exam	Written Exam
CO2		
CO3	CIA-2 written test/Assignment	
CO4	CIA-2 MCQ test	

b)Question Paper Pattern End Semester Theory

PROBABILITY DISTRIBUTIONS

Course Code: U26/STA/DSC/201 **Max. Marks: 60**
Credits : 4 **Time: 2 Hrs.**

SECTION –A (Essay Questions)

I. Answer the following **4x10=40Marks**

1. Derive the Cumulant generating function of Binomial Distribution. Using Cumulants find first four Central moments.

(OR)

2. Define Negative Binomial Distribution .Show that Poisson distribution as a limiting case of Negative Binomial Distribution

3. Explain the situation and conditions where Hyper Geometric Distribution Occurs and give its pmf. Obtain Mean and Variance of Hyper Geometric Distribution .

(OR)

4. Show that for Normal Distribution, Mean=Median=Mode.

5. Define Exponential distribution. State and prove lack of memory property of exponential distribution.

(OR)

6. If X is a Gamma Variate with Parameter λ then obtain its m.g.f. Hence show that m.g.f of standard Gamma Variate tends to standard Normal Variate.

7. Define t- distribution. State its properties and applications.

(OR)

8. Derive the MGF of Chi square distribution. Write the applications of Chi square distribution.

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SECTION-B

II. Answer any FOUR **4x5=20Marks**

9. Derive the mode of Poisson distribution.
10. State and prove lack of memory property of Geometric distribution.
11. Define Uniform Distribution on (a,b).Find its mean and variance.
12. Define Cauchy distribution. State and prove additive property of Cauchy distribution.
13. Write the characteristics of Normal distribution.
14. Define F- distribution. State its applications.

Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Derive the Cumulant generating function of Binomial Distribution. Using Cumulants find first four Central moments.	CO 1	Level I
2	Module 1	Define Negative Binomial Distribution .Show that Poisson distribution as a limiting case of Negative Binomial Distribution	CO 1	Level I
3	Module 2	Explain the situation and conditions where Hyper Geometric Distribution Occurs and give its pmf. Obtain Mean and Variance of Hyper Geometric Distribution .	CO 2	Level II & III
4	Module 2	Show that for Normal Distribution, Mean=Median=Mode.	CO 2	Level I
5	Module 3	Define Exponential distribution. State and prove lack of memory property of exponential distribution.	CO 3	Level I &II

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Derive the Cumulant generating function of Binomial Distribution. Using Cumulants find first four Central moments.	CO 1	Level I
2	Module 1	Define Negative Binomial Distribution .Show that Poisson distribution as a limiting case of Negative Binomial Distribution.	CO 1	Level I
3	Module 2	Explain the situation and conditions where Hyper Geometric Distribution Occurs and give its pmf. Obtain Mean and Variance of Hyper Geometric Distribution .	CO 2	Level II & III
4	Module 2	Show that for Normal Distribution, Mean=Median=Mode.	CO 2	Level I
5	Module 3	. Define Exponential distribution. State and prove lack of memory property of exponential distribution.	CO 3	Level I &II
6	Module 3	If X is a Gamma Variate with Parameter λ then obtain its m.g.f. Hence show that m.g.f of standard Gamma Variate tends to standard Normal Variate.	CO 3	Level I
7	Module 4	Define t- distribution. State its properties and applications.	CO 4	Level I

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8	Module 4	Derive the MGF of Chi square distribution. Write the applications of Chi square distribution.	CO 4	Level I

SECTION B - ANSWER ANY 4 OUT OF 6 **4Q X 5 M = 20 M**
(To compulsorily have ONE question from each module)

9	Module 1	Derive the mode of Poisson distribution.	CO 1	Level I
10	Module 1	State and prove lack of memory property of Geometric distribution.	CO 1	Level II
11	Module 2	Define Uniform Distribution on (a,b).Find its mean and variance.	CO 2	Level II
12	Module 3	Define Cauchy distribution. State and prove additive property of Cauchy distribution.	CO 3	Level III
13	Module 4	Write the characteristics of Normal distribution.	CO 4	Level I
14	Module 4	Define F- distribution. State its applications	CO 4	Level I

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c) Question Paper Blue print

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10 = 40	6 (By taking at least one question from each Module)	4x5= 20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

CO - PO Mapping:

CO	PO	Cognitive level	Class room sessions (hrs)
1	2	Remember/Apply	15
2	1	Understand	15
3	1	Apply/Understand	15
4	2	Remember	15

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