U17MAT4102 PROBABILITY AND STATISTICS

(FT)

L	T	P	PJ	C
3	1	0	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1:Compute measures of central tendencies, dispersions and correlate the variables.

CO2:Understand the concept of probability and its role in engineering.

CO3 : Construct probabilistic models for observed phenomena through distributions, which play an important role in many engineering applications.

CO4 : Carry out hypothesis testing and interpret the results

CO5: Understand the principles of design of experimentsand perform analysis of variance.

CO6: Sketchcontrol charts and outlines the process control.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S							M	M		M
CO2	S	S							M	M		M
CO3	S	S							M	M		M
CO4	S	S							M	M		M
CO5	S	S							M	M		M
CO6	S	S							M	M		M

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

STATISTICAL MEASURES **9 +3 Hours**

Measures of central tendency: Arithmetic Mean, Median and Mode **–** Measures of variation: Range, Mean deviation, Standard deviation and Coefficient of variation – Correlation (Discrete Data) – Karl Pearson's Correlation coefficient – Spearman's Rank Correlation – Regression lines (Discrete Data).

PROBABILITY AND RANDOM VARIABLES **9+3 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments - Moment Generating functions.

STANDARD DISTRIBUTIONS **9+3 Hours**

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial and Poisson distributions

9+3 Hours

TESTING OF HYPOTHESIS

Testing of hypothesis for large samples (single mean, difference of means, single proportion, difference of proportions) – Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit

DESIGN OF EXPERIMENTS **5 +2 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

STATISTICAL QUALITY CONTROL **4 +1 Hours**

Concept of process control - Control charts for variables – Mean and Rangecharts – Control charts for attributes – p, np, c – charts.

Theory: 45 Tutorial: 15 Practical: 0 Project: 0 Total: 60 Hours

REFERENCES

1. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill, 3rd edition, 2008.
2. Gupta S. P, Statistical Methods, Sultan Chand & Sons Publishers, 2014.
3. Johnson R. A., Miller & Freund's "Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
4. Gupta.S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
5. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2012.
6. Gupta S.C, and Kapur V.K, Fundamentals of Applied Statistics, Sultan Chand, New Delhi, 4th Edition, 2014.
7. Charles Henry Brase and CorrinnePellilloBrase "Understandable Statistics", D.C. Heath and Company, Toronto, 9th edition, 2007.

L	T	P	PJ	C
3	1	0	0	4

U17MAT3104 DISCRETE MATHEMATICS
(Common to CSE, IT, ISE)

Course Outcomes:
After successful completion of this course, the students should be able to

CO1: Have a better understanding of sets and application of set theory.
CO2: Apply the knowledge of relations, equivalence relation and their properties.
CO3: Understand different kinds of functions.
CO4: Apply the knowledge of Combinatorics
CO5: Understand logical arguments and constructs simple mathematical proofs.
CO6: Know various graphs and learn different algorithms.

Pre-requisite courses:
Set theory, Functions.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	M										
CO3	S	M										
CO4	S	S	M									
CO5	S	S	M									
CO6	S	S	M									

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

Topics covered:

SET THEORY **9+3 Hours**
Algebra of sets – The power set – Ordered pairs and Cartesian product – principle of inclusion and exclusion.

Relations on sets –Types of relations and their properties - Equivalence relations –Relational matrix and the graph of relation – Operations on relations.

FUNCTIONS **9+3 Hours**

Functions – Classification of functions –Type of functions – Injective, surjective and bijective functions –Composition of functions – Inverse functions –Permutation functions.

COMBINATORICS **9+3 Hours**

Mathematical induction- The basics of counting–Permutations and combinations-Recurrence relations-Solving linear recurrence relations

LOGIC **9+3 Hours**

Propositions- Logical operators- Normal forms –Rules of inference-Consistency and inconsistency-Propositional logic- Proofs-Predicates- Quantifiers- Universe of discourse – Logical equivalences and implications for quantified statements-Rules of specification and generalization – Validity of arguments.

GRAPH THEORY **9+3 Hours**

Graphs- Types of graphs- Matrix representation of graphs- Graph isomorphism- Walk - Path- Cycles- Eulerian graphs -Hamiltonian graphs- Planar graphs- Euler formula- Shortest path algorithms.

Theory: 45 Hrs **Tutorials: 15 Hrs** **Total Hours: 60 Hrs**

REFERENCES

1. Liu C.L, "Elements of Discrete Mathematics, Second Edition, McGraw Hill 1985.
2. Mott J.L, Kandel A. and Baker T.P.,"Discrete Mathematics for Computer Scientists and Mathematicians, Second Edition, Prentice Hall India, 1986.
3. J.P.Trembly, R. Manohar, Discrete Mathematical Structures with applications to Computer Science, TMHInternational Edition (Latest Edition).
4. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science, Prentice – Hall, Engle Cliffs, N. J.
5. Harary F, Graph Theory, Narosa, 1969.
6. Thomas H.C., A Leiserson C.E., Rivest R.L, Stein C.A., "Introduction to a Algorithms(2^{nd} Edition),MIT press and McGraw-Hill.2001.

U17MAT3102

NUMERICAL METHODS AND PROBABILITY

(EIE)

L	T	P	PJ	C
3	1	0	0	4

COURSE OUTCOMES

After successful completion of this course, the students will be able to

- **CO1:** Apply the concepts of various numerical techniques for solving non-linear equations and systems of linear equations.
- **CO2:** Analyze and apply the knowledge of interpolation and determine the integration and differentiation of the functions by using the numerical data.
- **CO3:** Predict the dynamic behaviour of the system through solution of ordinary differential equations by using numerical methods.
- **CO4:** Apply the concepts of probability, conditional probability and total probability.
- **CO5:** Analyze random or unpredictable experiments and investigate important features of random experiments.
- **CO6:** Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.

Pre-requisite:

System of equations, Frequency distribution, mean, median, mode.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S										
CO2	S	S										
CO3	S	S							M			
CO4	S	S										
CO5	S	S							M			
CO6	S	S										

COURSE ASSESSMENT METHODS

Direct

4. Continuous Assessment Test I, II
5. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
6. End Semester Examination

Indirect

1. Course-end survey

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **9+3 Hours**

Linear interpolation method – Iteration method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss - Seidel methods – Inverse of matrix by Gauss – Jordan method – Eigenvalues of a matrix by Power method.

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION **9+3 Hours**

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's rules.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9+3 Hours**

Single step methods: Taylor's series method – Euler and Improved Euler methods for solving a first order equations – Fourth order Runge – Kutta method for solving first and second order equations – Multistep method: Milne's predictor and corrector method.

PROBABILITY **3+1 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem

RANDOM VARIABLES **6+2 Hours**

Random variable – Distribution function – properties – Probability mass function-
Probability density function – moments and moment generating function – properties.

STANDARD DISTRIBUTIONS **9+3 Hours**

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial and Poisson distributions.

Theory: 45 Hours **Tutorials: 15 Hours** **Total: 60 Hours**

REFERENCES

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
4. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
5. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th edition, 2017.

L	T	P	PJ	C
3	1	0	0	4

U17MAT3103 NUMERICAL METHODS (TXT)

Course outcomes

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

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation.

CO4: Estimate integrals from discrete data through numerical methods.

CO5: Predict the system dynamic behaviour through solution of ODEs modeling the system

CO6: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.

Pre-requisite:

Basic knowledge in differentiation, integration and numerical operations.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	S	S			M				M	M			S	
CO2	S		S	S									M	
CO3	S	S	M		M				M	M			S	
CO4	S	S		S	M								S	
CO5	S	S	M	M					M	M			M	
CO6	S													

Course Assessment methods:

Direct

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

Indirect

1. Course-end survey

NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS 9+3 Hrs

Solution of nonlinear equations - False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non- linear equations. Solution of linear system of equations by Gaussian elimination, Gauss Jordan method - Gauss Seidel method. Matrix Inversion by Gauss Jordan method - Eigenvalues of a matrix by Power method.

CURVE FITTING AND INTERPOLATION **9+3Hrs**

Curve fitting – Method of least squares - Newton's forward and backward difference formulas – Divided differences – Newton's divided difference formula - Lagrange's interpolation – Inverse interpolation.

NUMERICAL DIFFERENTIATION AND INTEGRATION **9+3Hrs**

Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9+3Hrs**

Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge – Kutta method – Multistep method: Milne's predictor - corrector method.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
9+3Hrs

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain–Solution of one dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes –Solution of one dimensional wave equation by explicit scheme.

Theory : 45Hours **Tutorial :15 Hours** **Total:60Hours**

REFERENCES:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2007.
2. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers with Programming and Software Applications", McGraw-Hill, 2004.
3. John H. Mathews and Kurtis D. Fink, "Numerical Methods using Matlab", Prentice Hall of India, 2004.
4. Gerald C. F. and Wheatley P.O, "Applied Numerical Analysis",Pearson Education Asia, New Delhi, 2002.
5. Sastry S.S, "Introductory Methods of Numerical Analysis", PrenticeHall of India Pvt Ltd, New Delhi, 2003.

U17MAT3101 **PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS (Common to AE/AUE/CE/ME/ MCE/EEE)**

L	T	P	PJ	C
3	1	0	0	4

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

CO1: Form partial differential equations and solve certain types of partial differential equations.

CO2: Know how to find the Fourier Series and half range Fourier Series of a function

CO3: To know how to solve one dimensional wave equation, one dimensional heat equation in steady state using Fourier series.

CO4: Apply Fourier series to solve the steady state equation of two dimensional heat equation in Cartesian coordinates.

CO5: Apply the Fourier transform, Fourier sine and cosine transform to certain functions and use Parseval's identity to evaluate integrals..

CO6: Evaluate Z – transform for certain functions. Estimate Inverse Z – transform of certain functions and to solve difference equations using them.

Pre-requisite: NIL

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M			M				M	M		S
CO2	S	M		M								
CO3	S	S	S		S				M	M		S
CO4	S	M	M									M
CO5	S	M	M		S							
CO6	S	S			S				M	M		S

Course Assessment methods:

Direct
4. Continuous Assessment Test I, II 5. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 6. End Semester Examination
Indirect
1. Course-end survey

PARTIAL DIFFERENTIAL EQUATIONS **9+3 Hours**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first

order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES 9+3 Hours

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS 5+2 Hours

Classification of second order quasi linear partial differential equations – Formulation of wave and heat equations using physical laws - Solutions of one dimensional wave equation – One dimensional heat equation (excluding insulated ends)

BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS 4+1 Hours

Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

FOURIER TRANSFORM 9+3 Hours

Fourier Integral Theorem – Representation of Functions – Infinite Fourier transforms – Sine and Cosine Transforms – Properties – Transforms of simple functions – convolution theorem – Parseval's identity.

Z –TRANSFORM

9+3 Hours

Z-transform - Elementary properties – Convolution theorem- Inverse Z – transform (by using partial fractions, residue methods and convolution theorem) – Solution of difference equations using Z - transform.

Theory : 45 Hours Tutorial: 15 Hours Total:60 Hours

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition. 2014.
2. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company ltd., New Delhi, 2006.
4. Ian Sneddon., "Elements of partial differential equations", McGraw – Hill, New Delhi, 2003.
5. Arunachalam T., "Engineering Mathematics III", Sri Vignesh Publications, Coimbatore 2009.

U17MAT4104 **OPERATIONS RESEARCH (TXT)**

L	T	P	J	C
3	1	0	0	4

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Apply linear programming model and assignment model to domain specific situations

CO2: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3: Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5: Analyze and apply appropriate inventory techniques in domain specific situations.

CO6: Analyze and apply appropriate queuing theories in domain specific situations.

Pre-requisite: NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S		S								
CO2	S	S		S								
CO3	S	S		S							S	
CO4	S	S		S								
CO5	S	S		S								
CO6	S	S		S								

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

LINEAR MODEL **9+3 Hours**

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique -Big M method

TRANSPORTATION AND ASSIGNMENT PROBLEM **9+3 Hours**

Transportation model – Initial solution by North West corner method – least Cost method – VAM. Optimality test – MODI method and stepping stone method. Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM **9+3 Hours**

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – PERT Cost

REPLACEMENT AND SEQUENCING MODELS **9+3 Hours**

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).
Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines

INVENTORY CONTROL **5+1 Hours**

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.

QUEUING THEORY **4+2 Hours**

Queueing system and its structure – Kendall's notation – Markovian queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞

Theory: 45 Hours **Tutorials: 15 Hours** **Total: 60 Hours**

REFERENCES

1. Taha H.A., "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2012
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2013
4. Wagner, "Operations Research", Prentice Hall of India, 2011
5. S.Bhaskar, "Operations Research", Anuradha Agencies, Second Edition, 2014

L	T	P	Pj	C
3	1	0	0	4

U17MAT4105 **BIOSTATISTICS**

BT

Course Outcomes:
After successful completion of this course, the students should be able to

CO1: Compute measures of central tendencies, dispersions and correlate the variables.
CO2: Analyze random or unpredictable experiments and investigate important features of random experiments.
CO3: Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
CO4: Analyze sample data and interpret the same for population.
CO5: Analyze the data when the sampling distribution is unknown.
CO6 Analyze the experimental designs for one way, two way and three way classified data.

Pre-requisite courses:
Frequency distribution, Sample and Population.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S										
CO2	S	S										
CO3	S	S			M							
CO4	S	S		S	M				M	S	M	
CO5	S	S		S					M	S	M	
CO6	S	S	S	S					M	S	M	

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course Exit Survey

STATISTICAL MEASURES **9+3 Hours**

Measures of central tendency: Arithmetic Mean, Median and Mode – Measures of variation: Range, Mean deviation, Standard deviation and Coefficient of variation – Correlation (Discrete

Data) – Karl Pearson's Correlation coefficient – Spearman's Rank Correlation – Regression lines (Discrete Data).

PROBABILITY AND RANDOM VARIABLE **9+3 Hours**

Axioms of probability - Conditional probability – Total probability – Baye's theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments and moment generating function – properties.

STANDARD DISTRIBUTIONS **9+3 Hours**

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial and Poisson distributions.

TESTING OF HYPOTHESIS **9+3 Hours**

Testing of hypothesis for large samples (single mean, difference of means, single proportion, difference of proportions) – Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit.

3+1 Hours

NONPARAMETRIC TESTS

Mann Whitney U test, Kruskal Wallis Test and Run test.

DESIGN OF EXPERIMENTS **6+2 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD) – Factorial Design – 2^2 design.

Theory: 45 Hrs **Tutorial: 15 Hrs** **Total Hours: 60**

REFERENCES

1. Veerarajan T., Probability, Statistics And Random Processes, Tata McGraw Hill, 3rd edition, 2008.
2. Gupta S. P, Statistical Methods, Sultan Chand & Sons Publishers, 2014.
3. Gupta.S.C and Kapoor.V.K, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
4. Wayne W. Daniel, Biostatistics- A Foundation for Analysis in the Health Sciences, Wiley India, Seventh edition,2007.
5. Veer Bala Rastogi, Fundamentals of Biostatistics, Ane books Pvt. Ltd, Second edition, 2009.
6. Shein-Chung Chow, "Jun Shao Statistics in drug research methodologies and recent developments" Marcel Dekker, Inc.,2002

U17MAT4101

NUMERICAL METHODS AND PROBABILITY

L	T	P	PJ	C
3	1	0	0	4

(Common to AE/AUE/CE/ME/MCE/EEE)

COURSE OUTCOMES

After successful completion of this course, the students will be able to

- **CO1:** Apply the concepts of various numerical techniques for solving non-linear equations and systems of linear equations.
- **CO2:** Analyze and apply the knowledge of interpolation and determine the integration and differentiation of the functions by using the numerical data.
- **CO3:** Predict the dynamic behaviour of the system through solution of ordinary differential equations by using numerical methods.
- **CO4:** Apply the concepts of probability, conditional probability and total probability.
- **CO5:** Analyze random or unpredictable experiments and investigate important features of random experiments.
- **CO6:** Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.

Pre-requisite:

System of equations, Frequency distribution, mean, median, mode.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S										
CO2	S	S										
CO3	S	S							M			
CO4	S	S										
CO5	S	S							M			
CO6	S	S										

COURSE ASSESSMENT METHODS

Direct

7. Continuous Assessment Test I, II
8. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
9. End Semester Examination

Indirect

1. Course-end survey

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **9+3 Hours**

Linear interpolation method – Iteration method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss - Seidel methods – Inverse of matrix by Gauss – Jordan method – Eigenvalues of a matrix by Power method.

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION **9+3 Hours**

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's rules.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9+3 Hours**

Single step methods: Taylor's series method – Euler and Improved Euler methods for solving a first order equations – Fourth order Runge – Kutta method for solving first and second order equations – Multistep method: Milne's predictor and corrector method.

PROBABILITY **3+1 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem

RANDOM VARIABLES **6+2 Hours**

Random variable – Distribution function – properties – Probability mass function- Probability density function – moments and moment generating function – properties.

STANDARD DISTRIBUTIONS **9+3 Hours**

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial and Poisson distributions.

Theory: 45 Hours **Tutorials: 15 Hours** **Total: 60 Hours**

REFERENCES

6. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
7. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.
8. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
9. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
10. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th edition, 2017.

U17MAT4103 PROBABILITY AND RANDOM PROCESSES (ECE)

L	T	P	PJ	C
3	1	0	0	4

Course Outcomes:
After successful completion of this course, the students should be able to

CO1: Analyze random or unpredictable experiments and investigate important features of random experiments and analyse various distributions.
CO2: Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
CO3: Analyze various random processes with practical applications
CO4: Analyze correlation related to various random processes and establish the properties of spectral densities.
CO5: Study the application of linear systems with random inputs in relation with auto correlation and cross correlation.
CO6: Find the autocorrelation and cross correlation functions of input and output .

Pre-requisite courses: NIL

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S										
CO2	S	S		M				S				
CO3	S	S			M			S				
CO4	S	S		S	M				M	S	M	
CO5	S	S		S					M	S	M	

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

RANDOM VARIABLE AND STANDARD DISTRIBUTIONS 9+3Hours

Random variable - Probability mass function - Probability density functions- Properties – Moments - Moment generating functions and their properties - Binomial, Poisson, Uniform, Exponential and Normal distributions and their properties.

TWO DIMENSIONAL RANDOM VARIABLES **9+3Hours**

Joint distributions -Marginal and conditional distributions – Covariance - Correlation and regression.

RANDOM PROCESSES **9+3Hours**

Definition and examples – Stationary Process - wide – sense stationary and Ergodic processes - Markov process – Markov chain - Poisson and Normal processes.

CORRELATION AND SPECTRAL DENSITIES **9+3Hours**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khinchine relation – Relationship between cross power spectrum and cross correlation function .

LINEAR TIME INVARIANT SYSTEM **9+3Hours**

Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Theory: 45 Hours **Tutorials: 15 Hours** **Total: 60 Hours**

REFERENCES:

1. Cooper. G.R., Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", 3rd Indian Edition, Oxford University Press, New Delhi, 2012.
2. Hwei Hsu, "Schaum‟s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
3. Ibe.O.C., “Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
4. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.
5. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
6. Stark. H, and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2002.
7. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

U17MAI4201 **PROBABILITY AND STATISTICS**
(Common to CSE, IT)

L	T	P	PJ	C
3	0	2	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Compute the statistical measures of correlation and regression.

CO2: Understand the concept of probability and its role in engineering.

CO3 : Construct probabilistic models for observed phenomena through distributions, which play an important role in many engineering applications.

CO4 : Carry out hypothesis testing and interpret the results

CO5: Understand the principles of design of experiments and perform analysis of variance.

CO6: Sketch control charts and outlines the process control.

Pre-requisites: Statistical measures – Measures of central tendency and dispersion.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S							M	M		M
CO2	S	S							M	M		M
CO3	S	S							M	M		M
CO4	S	S							M	M		M
CO5	S	S							M	M		M
CO6	S	S							M	M		M

Course Assessment methods

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT

CORRELATION AND REGRESSION **6 Hours**

Correlation – Karl Pearson's Correlation coefficient – Spearman's Rank Correlation – Regression lines.

PROBABILITY AND RANDOM VARIABLES **12 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments- moment generating functions.

NORMAL DISTRIBUTION **5 Hours**

Normal distribution – Moments, Moment Generating functions and properties.

TESTING OF HYPOTHESIS **9 Hours**

Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit

DESIGN OF EXPERIMENTS **8 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

STATISTICAL QUALITY CONTROL **5 Hours**

Concept of process control - Control charts for variables – Mean and Range charts – Control charts for attributes – p, np, c – charts.

REFERENCES

8. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill, 3rd edition, 2008.
9. Gupta S. P, "Statistical Methods", Sultan Chand & Sons Publishers, 2014.
10. Johnson R. A., Miller & Freund's "Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
11. Gupta.S.C and Kapoor.V.K, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
12. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2012.
13. Gupta S.C, and KapurV.K "Fundamentals of Applied Statistics", Sultan Chand, New Delhi, 4th Edition, 2014.
14. Charles Henry Brase and Corrinne Pellillo Brase "Understandable Statistics", D.C. Heath and Company, Toronto, 9th edition, 2007.

LAB COMPONENT : Using R Studio **30 Hours**

1. Introduction to R programming
2. Application of descriptive statistics – Mean, Median, Mode and standard deviation
3. Applications of Correlation and Regression
4. Application of Normal distribution
5. Application of Student – t test
6. Application of F test
7. Application of Chi-square test
8. ANOVA – one way classification
9. ANOVA - two way classification
10. Control charts for variables (mean and range chart)

Theory: 45 Tutorial: 0 Practical: 30 Project: 0 Total : 75 Hours

U17MAT5102 DISCRETE MATHEMATICS
(FT)

Course Outcomes:
After successful completion of this course, the students should be able to

L	T	P	PJ	C
3	1	0	0	4

CO1: Have a better understanding of sets and application of set theory.
CO2: Apply the knowledge of relations, equivalence relation and their properties.
CO3: Understand different kinds of functions.
CO4: Apply the knowledge of Combinatorics
CO5: Understand logical arguments and constructs simple mathematical proofs.
CO6: Know various graphs and learn different algorithms.

Pre-requisite courses:
Set theory, Functions.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	M										
CO3	S	M										
CO4	S	S	M									
CO5	S	S	M									
CO6	S	S	M									

Course Assessment methods:

Direct
10. Continuous Assessment Test I, II 11. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 12. End Semester Examination
Indirect
1. Course-end survey

Topics covered:

SET THEORY **9+3 Hours**
Algebra of sets – The power set – Ordered pairs and Cartesian product – principle of inclusion and exclusion.

Relations on sets –Types of relations and their properties - Equivalence relations –Relational matrix and the graph of relation – Operations on relations.

FUNCTIONS **9+3 Hours**

Functions – Classification of functions –Type of functions – Injective, surjective and bijective functions –Composition of functions – Inverse functions –Permutation functions.

COMBINATORICS **9+3 Hours**

Mathematical induction- The basics of counting–Permutations and combinations-Recurrence relations-Solving linear recurrence relations

LOGIC **9+3 Hours**

Propositions- Logical operators- Normal forms –Rules of inference-Consistency and inconsistency-Propositional logic- Proofs-Predicates- Quantifiers- Universe of discourse – Logical equivalences and implications for quantified statements-Rules of specification and generalization – Validity of arguments.

GRAPH THEORY **9+3 Hours**

Graphs- Types of graphs- Matrix representation of graphs- Graph isomorphism- Walk - Path- Cycles- Eulerian graphs -Hamiltonian graphs- Planar graphs- Euler formula- Shortest path algorithms.

Theory: 45 Hrs **Tutorials: 15 Hrs** **Total Hours: 60 Hrs**

REFERENCES

7. Liu C.L, “Elements of Discrete Mathematics, Second Edition, McGraw Hill 1985.
8. Mott J.L, Kandel A. and Baker T.P.,”Discrete Mathematics for Computer Scientists and Mathematicians, Second Edition, Prentice Hall India, 1986.
9. J.P.Trembly, R. Manohar, Discrete Mathematical Structures with applications to Computer Science, TMHInternational Edition (Latest Edition).
10. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science, Prentice – Hall, Engle Cliffs, N. J.
11. Harary F, Graph Theory, Narosa, 1969.
12. Thomas H.C., A Leiserson C.E., Rivest R.L, Stein C.A., ”Introduction to a Algorithms(2nd Edition),MIT press and McGraw-Hill.2001.

U17MAT5101 **PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**

(IT)

L	T	P	PJ	C
3	1	0	0	4

Course Outcomes (COs):

After successful completion of this course, the students should be able to:

CO1: Form partial differential equations and solve certain types of partial differential equations.

CO2: Know how to find the Fourier Series and half range Fourier Series of a function

CO3: To know how to solve one dimensional wave equation, one dimensional heat equation in steady state using Fourier series.

CO4: Apply Fourier series to solve the steady state equation of two dimensional heat equation in Cartesian coordinates.

CO5: Apply the Fourier transform, Fourier sine and cosine transform to certain functions and use Parseval's identity to evaluate integrals..

CO6: Evaluate Z – transform for certain functions. Estimate Inverse Z – transform of certain functions and to solve difference equations using them.

Pre-requisite: NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M			M				M	M		S
CO2	S	M		M								
CO3	S	S	S		S				M	M		S
CO4	S	M	M									M
CO5	S	M	M		S							
CO6	S	S			S				M	M		S

Course Assessment methods:

Direct
7. Continuous Assessment Test I, II 8. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 9. End Semester Examination
Indirect
1. Course-end survey

PARTIAL DIFFERENTIAL EQUATIONS **9+3 Hours**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first

order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES 9+3 Hours

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS 5+2 Hours

Classification of second order quasi linear partial differential equations – Formulation of wave and heat equations using physical laws - Solutions of one dimensional wave equation – One dimensional heat equation (excluding insulated ends)

BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS 4+1 Hours

Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

FOURIER TRANSFORM 9+3 Hours

Fourier Integral Theorem – Representation of Functions – Infinite Fourier transforms – Sine and Cosine Transforms – Properties – Transforms of simple functions – convolution theorem – Parseval's identity.

Z –TRANSFORM

9+3 Hours

Z-transform - Elementary properties – Convolution theorem- Inverse Z – transform (by using partial fractions, residue methods and convolution theorem) – Solution of difference equations using Z - transform.

Theory : 45 Hours Tutorial: 15 Hours Total:60 Hours

References:

6. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition. 2014.
7. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
8. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company ltd., New Delhi, 2006.
9. Ian Sneddon., "Elements of partial differential equations", McGraw – Hill, New Delhi, 2003.
10. Arunachalam T., "Engineering Mathematics III", Sri Vignesh Publications, Coimbatore 2009.