FOURIER TRANSFORMS, PROBABILITY AND STATISTICS

Course Code: 22BM1107

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Course Outcomes: At the end of the course, the student will be able to
CO1: evaluate Fourier series and Fourier transform of a function **(L3)**
CO2: solve partial differential equations, heat flow and wave propagation problems **(L3)**
CO3: determine the mean and variance of discrete and continuous random variables **(L3)**
CO4: measure the confidence interval for the mean of a population and test a hypothesis concerning means **(L5)**
CO5: test a hypothesis concerning variances and proportions **(L5)**

UNIT-I **10 Lectures**

Fourier series and Fourier Transforms:
Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period, odd and even functions - half range series. Fourier integrals, Fourier cosine and sine integrals, Fourier transform, Fourier sine and Fourier cosine transforms and properties.
(Sections 10.1 – 10.8, 22.1 – 22.4 of the textbook)
Learning Outcomes:
At the end of this unit, the student will be able to
- evaluate the Fourier series expansion for different periodic functions (L5)
- analyze the properties of a Fourier transform (L4)
- determine the Fourier transform of a function (L3)

UNIT-II **10 Lectures**

Partial Differential Equations:
First order partial differential equations, solutions of first order linear and nonlinear PDEs. Method of separation of variables, solution of wave, heat and Laplace's equation in Cartesian coordinates
(Sections 17.1 – 17.3, 17.5, 17.6, 18.1-18.7 of the textbook)
Learning Outcomes:
At the end of this unit, the student will be able to
- discuss first order linear partial differential equations (L2)
- solve a boundary value problem and initial value problem by method of separation of variables (L3)
- determine a solution for wave, heat and Laplace's equations (L3)

UNIT-III **10 Lectures**

Random Variables:
Random variables, types of random variables, probability distribution function, probability density function, the mean and variance of a probability distribution, Binomial distribution, Poisson distribution, Normal distribution: calculating normal probabilities, normal approximation to the binomial distribution. (Sections 4.1, 4.2, 4.4, 4.6, 5.1-5.3 of textbook)

Learning Outcomes:
At the end of the unit, the student will be able to
- determine the mean and variance of a random variable (L3)
- calculate the probabilities using density and distribution function (L3)
- interpret the properties of the normal distribution and its applications (L2)

UNIT-IV **10 Lectures**

Sampling Distribution and Test of Hypothesis of Means:
Population and sample, sampling distribution of the mean (σ known), sampling distribution of the mean (σ unknown), Point estimation, interval estimation, introduction to test of hypothesis, hypothesis concerning one mean, hypothesis concerning two means, matched pair comparisons.
(Sections 6.1, 6.2, 7.1, 7.2, 7.4, 7.5, 7.6, 8.2, 8.3, 8.4 of textbook 2)

Learning Outcomes:
At the end of this unit, the student will be able to
- determine the mean and variance of a sampling distribution of means (L3)
- calculate confidence intervals for the mean of a population (L3)
- test a hypothesis concerning one and two means (L5)

UNIT-V **10 Lectures**

Test of Hypothesis of Variances and Proportions:
Estimation of variance, hypothesis concerning one variance, hypothesis concerning two variances, estimation of proportion, hypothesis concerning one proportion, hypothesis concerning several proportions (Sections 9.1- 9.3, 10.1 – 10.3 of textbook 2)

Learning Outcomes:
At the end of the unit, the student will be able to
- calculate the confidence interval for the variance and the proportion of a population (L3)
- discuss the test of a hypothesis concerning population variance (L2)
- test a hypothesis concerning proportions (L5)

Textbooks:
1.B. S. Grewal, "*Higher Engineering Mathematics*", 44th edition, Khanna publishers, 2017.
2. Richard A.Johnson, "Miller & Freund's Probability and Statistics for Engineers", 8th edition, PHI Learning India Private Limited, 2011.

Reference Books:
1. Erwin kreyszig, "*Advanced Engineering Mathematics*", 9th edition, John Wiley & Sons, 2006.
2. S.C.Gupta and V.K. Kapoor "*Fundamentals of Mathematical Statistics*" Sultan Chand and Sons.
3. Web References: https://nptel.ac.in/courses/111/106/111106111/
https://nptel.ac.in/courses/111/105/111105090/