INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Mathematics

6. **Subject Code:** MAI-102 **Course Title**: Mathematics II
7. **Contact Hours:** **L:** 3 **T:** 1 **P:** 0
8. **Examination Duration (Hrs.):** **Theory:** 03 **Practical:** 00
9. **Relative Weightage:** **CWS:** 20-35 **PRS: 0** **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
10. **Credits:** 04 **6. Semester:** Spring **7. Subject Area:** BSC
12. **Prerequisite:** NIL
13. **Objective:** To introduce the basic concepts of linear algebra, probability and statistics.

14. **Details of the Course**

S. No.	Contents	Contact Hours
1.	**Vector Spaces:** Vector spaces (over the field of real numbers), subspaces, spanning set, linear independence, basis and dimension. Linear transformations, range and null space, rank-nullity theorem, matrix of a linear transformation.	8
2.	**Inner Product Spaces:** Inner-product spaces, Gram-Schmidt process, orthonormal basis; spectral theorem for real symmetric matrices, singular value decomposition; low-rank approximation.	6
3.	**Probability and distributions:** Concept of probability, random variables and their probability distributions, expectation, moments and moment generating functions, Chebyshev's inequality.	6
4.	**Special distributions:** (Discrete): Binomial, Poisson, Negative binomial, and Geometric distributions. (Continuous): Uniform, Exponential, Gamma, and Normal distributions.	5
5.	**Bivariate random variables:** Joint, marginal, and conditional distributions, statistical independence. Distributions of functions of random variables. Correlation and regression.	6
6.	**Sampling Distributions:** Random sampling and sampling distributions, law of large numbers, central limit theorem.	3
7.	**Estimation:** Point estimation, unbiased estimators, maximum likelihood estimation. Interval estimation, interval estimation of mean, variance and proportion for normal populations.	4
8.	**Testing of Hypothesis:** Simple and composite hypothesis, Type I and Type II errors, power of a test. Hypothesis testing for mean, variance and proportion for normal populations.	4
	Total	**42**

15. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Axler, S., "Linear Algebra Done Right", 3rd Ed., Springer Nature.	2015
2.	Strang, G., "Linear Algebra and Its Applications" 4th Ed., Cengage India Private Limited.	2005
3.	Hogg, R. V., Mckean, J. and Craig, A. T., "Introduction to Mathematical Statistics", 8th Ed., Pearson Education India	2021
4.	Rohatgi, V. K. and Saleh, A. K. Md. E., "An Introduction to Probability and Statistics" 2nd Ed., Wiley India	2008
5.	Miller, I. and Miller, M., "John E. Freund's Mathematical Statistics with Applications", 8th Ed., Pearson Education India	2013