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भारतीय प्रौद्योगिकी संस्थान जम्मू
INDIAN INSTITUTE OF TECHNOLOGY JAMMU
विद्यायत्नं सर्वधन प्रधानम्

भारतीय प्रौद्योगिकी संस्थान जम्मू
जगती, पी.ओ. नगरोटा, एन एच - 44, जम्मू -181221, जम्मू और कश्मीर
Indian Institute of Technology Jammu
Jagti, P. O. Nagrota, NH-44, Jammu -181 221, J & K, India

COURSE TEMPLATE

1.	Department proposing the course	**Electrical Engineering**		
2.	Course Title	**Statistical Foundations for Machine Learning**		
3.	L-T-P structure	**L - 3.00 T - 0.00 P - 0.00**		
4.	Credits	**3.00**	Is this a Credit Earning Course	**Grade Point Earning Course**
5.	Primary Course Category	**Departmental Elective**	Primary Course Programs	
6.	Secondary Course Category		Secondary Course Programs	
7.	Scheme		Level	
8.	Course Number	**EEL092U3E**		
9.	Pre-requisite(s)	**No**		
10.	Frequency of Offering	**Every Semester**		
11.	List of faculty who can teach the course	**Karan Nathwani (IITJMU11009)**		
12.	Course Instructor	**Karan Nathwani (IITJMU11009)**		
13.	Will the course require any visiting faculty/external expert?	**No**		
14.	Course objectives (about 100 words): **The objective of the course is to provide the fundamental knowledge of probability and random theory with an application to artificial intelligence and machine learning.**			
15.	Course outcomes (about 100 words): **By the end of this course, students should:** **● Understand the concepts of random variables and random processes** **● Comprehend the various statistical models used for modeling for machine learning application ● Apply the different detection and estimation rules in real time problems**			
16.	Course contents : **Fundamentals of Probability and Random Signal Theory ● Random Processes and Convergence** **● Markov Chains and Applications** **● Frequentist Statistics and Regression** **● Bayesian Statistics and Hypothesis Testing**			

Detailed Contents		
Module No.	**Topic**	**No. Of Hours**
1	Fundamentals of Probability and Random Signal Theory Probability spaces, Conditional probability, Independence, Random Variables, Discrete and Continuous random variables, Expectation Operator, Functions of random variables, Generating random variables, Multivariate Random Variables, Joint distributions of discrete and continuous variables, Functions of several random variables, Joint Moments, Generating multivariate random variables	9.00
2	● Random Processes and Convergence Definition, Stationarity of random processes, Mean and autocovariance functions, Independent identically-distributed sequences, Power spectral density, Gaussian process, Poisson process, Random walk, Convergence of Random Processes, Types of convergence, Law of large numbers, Central limit theorem, Monte Carlo simulation	9.00
3	● Markov Chains and Applications Time-homogeneous discrete-time Markov chains, Recurrence, Periodicity, Convergence, Markov-chain Monte Carlo, Descriptive statistics, Histogram, Sample mean and variance, Order statistics, Sample covariance, Sample covariance matrix	8.00
4	Frequentist Statistics and Regression Independent identically-distributed sampling, Mean square error, Consistency, Condence intervals, Nonparametric model estimation, Parametric model estimation, Linear Regression models, Least-squares estimation, Overtting, Global warming.	8.00
5	ayesian Statistics and Hypothesis Testing Bayesian parametric models, Conjugate prior, Bayesian estimators, The hypothesis-testing framework, Parametric testing, Nonparametric testing: The permutation test, Multiple testing	8.00
	Total Lecture hours (14 times 'L')	42

18.	Brief description of tutorial activities:	
Module No.	**Topic**	**No. Of Hours**
	Total Tutorial hours (14 times 'T')	0

19.	Brief description of Practical / Practice activities :	
Module No.	**Topic**	**No. Of Hours**
	Total Practical / Practice hours (14 times 'P')	0

20.	Suggested texts and reference materials
Text Book	**Refernce Books**
1. Probability and Statistics for Data Science, by Carlos Fernandez-Granda 2. Probability for Statistics and Machine Learning: Fundamentals and Advanced Topics, by Anirban Das Gupta 3. Probability, random variables, and stochastic processes, by Athanasios Papoulis	Supplementary reading material and other resources may be provided in class throughout the semester.

21.	Resources required for the course (itemized student access requirements, if any)	
Resources Required	**If Others, Please Specify**	**Remarks**