# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

# DEPARTMENT OF MATHEMATICS

| COURSE PLAN – PART I | | | | |
|---|---|---|---|---|
| **Name of the programme and specialization** | B.Tech ( ECE) IV Semester –A | | | |
| **Course Title** | Probability Theory and Random Processes ( B.Tech. IV Sem ECE) | | | |
| **Course Code** | MAIR 45 | No. of Credits | 3 | |
| **Course Code of Pre-requisite subject(s)** | MAIR 21 | MAIR 34 | | |
| **Session** | Jan.2019 | Section (if, applicable) | A | |
| **Name of Faculty** | Dr.D.Deivmoney selvam | Department | Mathematics | |
| **Official Email** | selvam@nitt.edu | Telephone No. | 0431-2503667 | |
| **Name of Course Coordinator(s) (if, applicable)** | | | | |
| **Official Email** | as above | Telephone No. | As above | |
| **Course Type** | yes Core course | | | Elective course |

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| **Syllabus (approved in BoS)** |
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| Axioms of probability theory. Probability spaces. Joint and conditional probabilities. Bayes' Theorem- Independent events |
| Random variables and random vectors. Distributions and densities. Independent random variables. Functions of one and two random variables. |
| Moments and characteristic functions. Inequalities of Chebyshev and Schwartz. Convergence concepts. |
| Random processes. Stationarity and ergodicity. Strict sense and wide sense stationary processes. Covariance functions and their properties. Spectral representation. Wiener -Khinchine theorem. |
| Gaussian processes. Processes with independent increments. Poisson processes. Low pass and Band pass noise representations |
| **COURSE OBJECTIVES** |
| 1. To understand the basic concept of randomness, random variable, its categories and behaviour |
| 2. To study various probabilistic tools systematically |

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| 3. To formulate problems arising in engineering and technology, using the tool of probaility and random process, solving them and giving interpretation for the results and modifing, if necessary. | |

**COURSE OUTCOMES**

| Course Outcomes | Aligned Programme Outcomes (PO) |
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| 1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena. <br> 2. characterize probability models and function of random variables based on single & multiples random variables. <br> 3.To evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits. <br> 4. To understand the concept of random processes and determine covariance and spectral density of stationary random processes. <br> 5. To demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models | 1.To identify and use probabilistic tool like random variable, its type for the framing the problems in electronic topics <br> 2. To study the randomness in communications using distribution and other related tool of probability like MGF,CF <br> 3. To study the behavior of the problems in the engineering with reference to time using stochastic processes. |

| COURSE PLAN – PART II |
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| COURSE OVERVIEW |
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| refer syllbus above |

**COURSE TEACHING AND LEARNING ACTIVITIES**

| S.No. | Week/Contact Hours | Topic | Mode of Delivery |
|---|---|---|---|

| S.No. | Week | Topic | Mode of Delivery |
|---|---|---|---|
| 1 | 1 | I-Introduction & definitions <br> Addition theorems- conditional probability- Mutually exclusive & independent events-problems | Chalk & Talk |
| 2 | 2 | Total & Baye's Theorems Probability space & sigma space II Random variables definition & types | Chalk & Talk |
| 3 | 3 | pmf, pdf, PDF. Mixed definitions & properties <br> Standard distributions | Chalk & Talk |

| 4 | 4 | Non-standard distributions<br>Two random variables and joint distribution function | Chalk & Talk |
|---|---|---|---|
| 5 | 5 | Joint probability mass function (pmf), probability density function (pdf), probability distribution function(PDF) properties & problems independent random variables<br>Marginal distributions | Chalk & Talk |
| 6 | 6 | Conditional densities & conditional expectations<br>Covariance function and correlation coefficient<br>Function of one random variable   Y= f(X) | Chalk & Talk |
| 7 | 7 | Y=f(X)   for f(X) = aX+b, $X^2$, $X^{1/2}$, $e^{ax}$, log(X), $(X)^{1/2}$ problems | Chalk & Talk |
| 8 | 8 | Function of two random  variables Z=f(X,Y)   for f(X,Y)= X+Y,X-Y, XY,X/Y max(X,Y) and min(X,Y)   problems | Chalk & Talk |
| 9 | 9 | MGF& CF definitions & properties-  MGF problems nonstandard df ,CF properties and problems | Chalk & Talk |
| 10 | 10 | Chebychev's inequality-Schwartz's inequality and problems, Convergences types and definitions Problems in convergence | Chalk & Talk |
| 11 | 11 | Random process and types -Stationary process & types<br>WSS and SSS problems-Ergodicity Types and problems | Chalk & Talk |
| 12 | 12 | Covariance function and its properties and Problems<br>Spectral representation-I | Chalk & Talk |
| 13 | 13 | Spectral representation-II problems<br>Wiener-Khinchine theorem.- Gaussian process- problems | Chalk & Talk |
| 14 | 14 | Processes with independent increments.<br>Poisson processes- properties- problems | Chalk & Talk |
| 15 | 15 | Low pass Band pass noise representations. | Chalk & Talk |

**COURSE ASSESSMENT METHODS (shall range from 4 to 6)**

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Asignment-1 | 5th week | 4 weeks | 5% |
| 2 | Test-1 | 6th week | one hour | 20% |
| 3 | Asignment-2 | 12th week | 4 weeks | 5% |
| 4 | Test-2 | 13th week | one hour | 20% |
| CPA | Compensation Assessment* | 14th week | one hour | 20% |
| 5 | Final Assessment * | 16th/17th week | 3 hpours | 50% |

**\*mandatory; refer to guidelines on page 4**

| COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed) |
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|     feedback in the mid semester |

| COURSE POLICY (including compensation assessment to be specified) |
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| One test is permissible for the students who miss on or both the Tests. <br> No deviation from the stated Attendance policy. <br> Disciplined learning of the subject is expected and the faculty will be available for understanding, clarifying and pursue any topic of the subject. |

**ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- ➢ At least 75% attendance in each course is mandatory.

- ➢ A maximum of 10% shall be allowed under On Duty (OD) category.

- ➢ Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

**ACADEMIC DISHONESTY & PLAGIARISM**

- ➢ Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.

- ➢ Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

- ➢ The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

- ➢ The above policy against academic dishonesty shall be applicable for all the programmes.
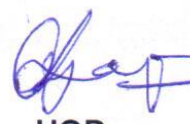
**ADDITIONAL INFORMATION**

**nil**

**FOR APPROVAL**

**Course Faculty** 24/1/2019      **CC-Chairperson**      **HOD**