| 15MA209 | PROBABILITY AND RANDOM PROCESSES | L | T | P | C |
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| | | 4 | 0 | 0 | 4 |
| *Co-requisite:* | NOT APPLICABLE | | | | |
| *Prerequisite:* | 15MA201 (or) 15MA202 | | | | |
| *Data Book / Codes/Standards* | Statistical Tables | | | | |
| *Course Category* | B CORE ENIGINEERING MATHEMATICS | | | | |
| *Course designed by* | Department of Mathematics | | | | |
| *Approval* | -- Academic Council Meeting -- 2016 | | | | |

| **PURPOSE** | To introduce the students to random variables, distribution and random process which forms the base for the study of signals and systems and papers like radar communication. | |
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| **INSTRUCTIONAL OBJECTIVES** | | **STUDENT OUTCOMES** |
| At the end of the course, student will be able to | | |
| 1. | Acquire knowledge about Probability and Random variables, distribution. | a e |
| 2. | Gain knowledge on 2-D Random variables | a e |
| 3. | Expose to the concepts of Random variables. | a e |
| 4. | Gain knowledge about the correlation functions | a e |
| 5. | Learn about the applications of Fourier Transforms like spectral density. | a e |

| Session | Description of Topic | Contact hours | C-D-I-O | IOs | Reference |
|---|---|---|---|---|---|
| | **UNIT I: PROBABILITY DISTRIBUTIONS** | **14** | | | |
| 1. | Types of random variables introduction and examples. | 1 | C,I | 1 | 2-4 |
| 2. | Problems based on probability mass function, CDF, mean and variance of a discrete random variable. | 1 | C,I | 1 | 2-4 |
| 3. | Problems based on probability density function, CDF, mean and variance of a continuous random variable. | 1 | C,I | 1 | 2-4 |
| 4. | Problems using the properties of expectation | 1 | C,I | 1 | 2-4 |
| 5. | Moments. | 1 | C,I | 1 | 2,3,4. |
| 6. | Moment generating function. | 2 | C,I | 1 | 2,3,4 |
| 7. | Binomial distribution. | 1 | C,I | 1 | 1,2,3,4 |
| 8. | Poisson distribution. | 1 | C,I | 1 | 1,2,3,4 |
| 9. | Geometric distribution. | 1 | C,I | 1 | 1,2,3,4 |
| 10. | Exponential distribution. | 1 | C,I | 1 | 1,2,3,4 |
| 11. | Normal distribution. | 2 | C,I | 1 | 1,2,3,4 |
| 12. | Functions of Random variables. | 1 | C,I | 1 | 2,3,4 |
| | **UNIT II: TWO DIMENSIONAL RANDOM VARIABLES** | **12** | | | |
| 13. | Two dimensional random variables introduction. | 1 | C,I | 2 | 2,3,4 |

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| 14. | Problems based on two dimensional discrete random variables and on two dimensional continuous random variables | 1 | C,I | 2 | 2,3,4 |
| 15. | Problems based - joint probability density function. | 1 | C,I | 2 | 2,3,4 |
| 16. | Problems on marginal probability density function, marginal distribution functions. | 1 | C,I | 2 | 2,3,4 |
| 17. | Problems on conditional probability density functions, | 1 | C,I | 2 | 2,3,4 |
| 18. | Independent continuous random variables, cumulative distribution function of (X, Y). | 2 | C,I | 2 | 2,3,4 |
| 19. | Transformation of Random Variables. | 1 | C,I | 2 | 2,3,4 |
| 20. | Transformation of Random Variables. | 2 | C,I | 2 | 2,3,4 |
| 21. | Central Limit Theorem (Theorem without proof) - Lindeberg Levy's form and Liapounoff's form. | 1 | C,I | 2 | 2,3 |
| 22. | Problems based on central limit theorem. | 1 | C,I | 2 | 2,3 |
| | **UNIT III: RANDOM PROCESSES** | **12** | | | |
| 23. | Classification of Random processes. | 1 | C,I | 3 | 2,3 |
| 24. | Stationary processes- definitions. | 1 | C,I | 3 | 2,3 |
| 25. | Problems based on Stationary processes - WSS and SSS processes. | 2 | C,I | 3 | 2,3 |
| 26. | Poisson Random Process definition and problems. | 2 | C,I | 3 | 2,3 |
| 27. | Renewal Process. | 1 | C,I | 3 | 1,2,3 |
| 28. | Markov Chain and transition probabilities - definitions. | 2 | C,I | 3 | 1,2,3 |
| 29. | Problems based on framing the transition probability matrix and on Markov chains. | 2 | C,I | 3 | 1,2,3 |
| 30. | Problems based on the classification of state of a Markov chain. | 1 | C,I | 3 | 1,2,3 |
| | **UNIT IV: CORRELATION FUNCTIONS** | **10** | | | |
| 31. | Autocorrelation function and its properties with proof. | 1 | C,I | 4 | 2,3 |
| 32. | Problems based on Autocorrelation function. | 2 | C,I | 4 | 2,3 |
| 33. | Cross correlation function and its properties with proof. | 2 | C,I | 4 | 2,3 |
| 34. | Problems based on Cross correlation and jointly WSS | 1 | C,I | 4 | 2,3 |
| 35. | Linear system with random inputs. | 2 | C,I | 4 | 2,3 |
| 36. | Ergodicity. | 2 | C,I | 4 | 2,3 |
| | **UNIT V: SPECTRAL DENSITY** | **12** | | | |
| 37. | Power spectral Density Function – properties | 1 | C,I | 5 | 2,3 |
| 38. | Problems based on Power density spectrum. | 2 | C,I | 5 | 2,3 |

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| 39. | Representation of system in the form of convolution. | 2 | C,I | 5 | 2,3 |
| 40. | Unit Impulse Response of the System. | 2 | C,I | 5 | 2,3 |
| 41. | Einstein – Weiner - Khinchine Relationship- statement and problems. | 2 | C,I | 5 | 2,3 |
| 42. | Cross Power Density Spectrum- definition and properties. | 1 | C,I | 5 | 2,3 |
| 43. | Problems based on Cross Power Density Spectrum. | 2 | C,I | 5 | 2,3 |
| | Total contact hours | 60 | | | |

| **LEARNING RESOURCES** | |
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| **Sl. No.** | **TEXT BOOKS** |
| 1. | Trivedi K S, "*Probability and Statistics with reliability, Queuing and Computer Science Applications",*Prentice Hall of India, New Delhi, 2nd Edition, 2002. |
| 2. | Veerarajan T., "*Probability statistics and Random Processes",* 3rd Edition, Tata McGraw-Hill, New Delhi,2008. |
| | **REFERENCE BOOKS/OTHER READING MATERIAL** |
| 3. | Sivaramakrishna Das P. and Vijayakumari.C, "*A text book of Probability and Random Processes"*, Viji's Academy, 2010. |
| 4. | Papoulis, "*Probability, Random Variables and Stochastic Processes"***,** 4th Edition, Tata McGraw-Hill, New Delhi, 2002. |

| **Course nature** | | | **Theory** | | | | |
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| **Assessment Method (Weightage 100%)** | | | | | | | |
| **In-semester** | **Assessment tool** | Cycle test I | Cycle test II | Cycle Test III | Surprise Test | Quiz | **Total** |
| | **Weightage** | **10%** | **15%** | **15%** | **5%** | **5%** | **50%** |
| **End semester examination Weightage :** | | | | | | | **50%** |