THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY

*Zagdu Singh Charitable Trust's (Regd.)*

(Approved by AICTE, Govt. of Maharashtra & Affiliated to University of Mumbai*)
(Accredited Programmes by National Board of Accreditation, New Delhi**)

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Shyamnarayan Thakur Marg, Thakur Village,
Kandivali (East), Mumbai - 400 101.
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ISO 9001 : 2008 Certified

*Permanent Affiliated UG Programmes : • Computer Engineering • Electronics & Telecommunication Engineering • Information Technology (w.e.f.: A.Y. 2015-16 onwards)
**1st time Accredited UG Programmes : • Computer Engineering • Electronics & Telecommunication Engineering • Information Technology
**2nd time Accredited UG Programmes : • Computer Engineering • Electronics & Telecommunication Engineering • Information Technology • Electronics Engineering (3 years w.e.f.: 01-07-2016)

TCET/FRM/IP-02/09                                                    Revision: A

**Semester Plan**
**(Theory)**

Semester: V                                              Course: EXTC

Subject: Random Signal Analysis                          Class: TE- B

| S.No. | Bridge courses/Technology | Duration (Week/hrs) | Modes of Learning | Recommended Sources |
|---|---|---|---|---|
| **1.** | **Prerequisite course:** Signals and Systems | 06 Hours | Self learning | Principles of Linear Systems and Signals 2$^{nd}$ Edition -B. P. Lathi Chapter 1 (Pg. No. 1 -83) Chapter 5(Pg. No.427-526) |

Class Room Teaching

| Sr. No | Module No. | Lesson No. | Topics Planned (Technology to be used) | Teaching Aids Required | Planned /Completion Date | Resource Book Reference | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | | | **SOP** | Black Board and Chalk | 10/7/17 | | |
| 2 | | | OBE | Black Board and Chalk | 11/7/17 | | |
| 3 | | | RSA (Tut) | Black Board and Chalk | 13/7/17 | | |
| 4 | 1 | L1.1 | Sample space, events, set operations | Black Board and Chalk | 14/7/17 | M1.1 | |
| 5 | 1 | L2.1 | The notion and axioms of probability | Black Board and Chalk | 17/7/17 | M1.2 | |

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|--------|-----------|-----------|----------------------------------------|------------------------|--------------------------|-------------------------|---------|
| 6 | 1 | L2.2 | Conditional probability, Joint probability | Black Board and Chalk | 18/7/17 | M1.3 | |
| 7 | 1 | L2.3 | Baye's rule, Independence of events, Sequential Experiments. | Black Board and Chalk | 19/7/17 | M1.3 | Practice problems solved in class. Numericals as homework |
| 8 | 1 | L2.4 | Notion of random variable. | Black Board and Chalk | 20/7/17 | M1.4 | |
| 9 | 1 | L2.5 | Continuous random variables, probability density function, probability distribution function | Black Board and Chalk | 21/7/17 | M1.5 | |
| 10 | 1 | L3.1 | Uniform, Exponential and Gaussian continuous random variables and distributions. | Black Board and Chalk | 24/7/17 | M1.6 | |
| 11 | 1 | L3.2 | Discrete random variables, probability mass function, probability distribution function, binomial | Black Board and Chalk | 25/7/17 | M1.7 | |
| 12 | 1 | L3.3 | Probability mass function, probability distribution function, binomial | Black Board and Chalk | 26/7/17 | M1.8 | |
| 13 | 1 | L3.4 | Poisson and geometric discrete random variables and distributions | Black Board and Chalk | 27/7/17 | M1.9 | |
| 14 | 2 | L4.1 | Functions of a random variable and their distribution and density functions. | Black Board and Chalk | 31/7/17 | M2.1 | |
| 15 | 2 | L4.2 | Expectation, Variance and Moments of random variable. | Black Board and Chalk | 1/8/17 | M2.2 | |
| 16 | 2 | L4.3 | Transformation of a random variable, | Black Board and Chalk | 2/8/17 | M2.3 | |

| Sr. No | Module No. | Lesson No. | Topics Planned (Technology to be used) | Teaching Aids Required | Planned /Completion Date | Resource Book Reference | Remarks |
|---|---|---|---|---|---|---|---|
| 17 | 2 | L4.4 | Markov, Chebyshev and Chernoff bounds | Black Board and Chalk | 3/8/17 | M2.4 | |
| 18 | 2 | L5.1 | Characteristic functions | Black Board and Chalk | 7/8/17 | M2.5 | |
| 19 | 2 | L5.2 | Moment theorem | Black Board and Chalk | 8/8/17 | M2.6 | |
| 20 | 3 | L5.3 | Vector random variables, Pairs of random variables | Black Board and Chalk | 9/8/17 | M2.7 | |
| 21 | 3 | L5.4 | Joint CDF, Joint PDF Independence | Black Board and Chalk | 10/8/17 | M3.1 | |
| 22 | 3 | L6.1 | Conditional CDF and PDF, Conditional Expectation | Black Board and Chalk | 14/8/17 | M3.2 | |
| 23 | 3 | L6.2 | One function of two random variable | Black Board and Chalk | 16/8/17 | M3.3 | |
| 24 | 3 | L7.1 | Two functions of two random variables | Black Board and Chalk | 24/8/17 | M3.4 | |
| 25 | 3 | L8.1 | Joint moments, joint characteristic function, covariance and correlation-independent | Black Board and Chalk | 30/8/17 | M3.5 | Practice problems solved in class. Numericals as homework |

| Sr. No | Module No. | Lesson No. | Topics Planned (Technology to be used) | Teaching Aids Required | Planned /Completion Date | Resource Book Reference | Remarks |
|---|---|---|---|---|---|---|---|
| 26 | 3 | L8.2 | Uncorrelated and orthogonal random variables | Black Board and Chalk | 31/8/17 | M3.6 | |
| 27 | 4 | L9.1 | Random sequences, Limit theorems | Black Board and Chalk | 4/9/17 | M3.7 | 2 lectures will be covered in 1 lecture |
| 28 | 4 | L9.2 | Strong and weak laws of large numbers | Black Board and Chalk | 5/9/17 | M4.1 | |
| 29 | 4 | L9.3 | Central limit theorem and its significance. | Black Board and Chalk | 6/9/17 | M4.2 | |
| 30 | 5 | L9.4 | Random process: Definition, realizations, sample paths, discrete and continuous time processes | Black Board and Chalk | 7/9/17 | M5.1 | |
| 31 | 5 | L10.1 | Probabilistic structure of a Random process; mean, correlation and covariance functions | Black Board and Chalk | 11/9/17 | M5.2 | Practice problems solved in class. Numericals as homework |
| 32 | 5 | L10.2 | Stationary random process | Black Board and Chalk | 12/9/17 | M5.3 | |
| 33 | 5 | L10.3 | Ergodicity | Black Board and Chalk | 13/9/17 | M5.4 | |
| 34 | 5 | L10.4 | Transmission of WSS random process through LTI system | Black Board and Chalk | 14/9/17 | M5.5 | 2 lectures will be covered in 1 lecture |

| Sr. No | Module No. | Lesson No. | Topics Planned (Technology to be used) | Teaching Aids Required | Planned /Completion Date | Resource Book Reference | Remarks |
|--------|-----------|-----------|----------------------------------------|------------------------|--------------------------|-------------------------|---------|
| 35 | 5 | L11.1 | Spectral analysis of random processes | Black Board and Chalk | 18/9/17 | M5.6 | |
| 36 | 5 | L11.2 | Power density spectrum bandwidth, cross power density spectrum | Black Board and Chalk | 19/9/17 | M5.7 | 2 lectures will be covered in 1 lecture |
| 37 | 5 | L11.3 | Gaussian and Poisson random process | Black Board and Chalk | 20/9/17 | M5.8 | |
| 38 | 6 | L11.4 | Markov processes | Black Board and Chalk | 21/9/17 | M5.9 | |
| 39 | 6 | L12.1 | Discrete Markov chains, The n–step transition probabilities, steady state probabilities | Black Board and Chalk | 25/9/17 | M6.1 | |
| 40 | 6 | L12.2 | Introduction to Continuous time Markov chains. | Black Board and Chalk | 26/9/17 | M6.2 | |
| 41 | 6 | L13.1 | Classifications of states. | Black Board and Chalk | 3/10/17 | M6.3 | |
| 42 | 6 | L13.2 | Markovian models | Black Board and Chalk | 4/10/17 | M6.4 | |
| 43 | 6 | L13.3 | Birth and death queuing models | Black Board and Chalk | 5/10/17 | M6.5 | |
| 44 | 6 | L14.1 | Steady state results. | Black Board and Chalk | 12/10/17 | M 6.6 | |
| 45 | 6 | L15.1 | Single and Multiple server Queuing models, Finite source models and Little's formula | Black Board and Chalk | 16/10/17 | M6.7 | |
| 46 | | L15.2 | University Paper solving | Black Board and Chalk | 17/10/17 | M1-6 | |

| Course: | Syllabus Coverage: | Practice Session: | Beyond Syllabus: |
|---|---|---|---|
| | No. of (lectures planned)/(lecture taken):<br>(46) / (    ) | | |

**Bridge courses Objective:** Bridging of gaps with respect to prerequisites and industry skills or to carryout research in signal processing field**. ( 20 Hrs / Semester / student)**

| S.No. | Bridge courses/Technology | Duration (Week/hrs) | Modes of Learning | Recommended Sources |
|---|---|---|---|---|
| 1 | **Advanced course:**<br>Statistical Signal Processing (NPTEL Course) | 20 Hours | Technology Based learning | www.nptel.ac.in/syllabus/117103019/ |

**Text Books:**

1. Alberto Leon Garcia, "Probability And Random Processes For Electrical Engineering", second edition Low price edition Pearson education.

2. Miller, "Probability And Random Processes-With Applications to Signal Processing and Communication", first edition 2007, Elsevier.

3. Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.

4. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education.

5. Hwei Hsu, "Probability Random Variable,s Random Process, Schaulm's Outlines, Tata McGraw Hill, 2004.

**Reference Books:**

1) T Veerarajan, "Probability, Statistics and Random Processes" , third edition Tata McGraw Hill Education Private Limited

**Digital Reference:**

- Wikipedia
- Google
- https://www.coursera.org/learn/digital


| Sd/- | Sd/- | Sd/- |
|---|---|---|
| **(Mr.T. Seshatalpa Sai)** | **(Dr. Vinitkumar Dongre)** | **(Dr. R. R. Sedamkar)** |
| Name & Signature of Faculty | Signature of HOD | Signature of Principal /Dean (Academics) |
| Date: | Date: | Date: |

**Note:**

1. Plan date and completion date should be in compliance
2. Courses are required to be taught with emphasis on resource book, course file, text books, reference books, digital references etc.
3. Planning is to be done for 15 weeks where 1st week will be AOP, 2nd -13th for effective teaching and 14th -15th week for effective university examination oriented teaching, mock practice session and semester consolidation.

4. According to university syllabus where lecture of 4 hrs/per week is mentioned minimum 55 hrs and in case of 3 lectures per week minimum 45 lectures are to be engaged are required to be engaged during the semester and therefore accordingly semester planning for delivery of theory lectures shall be planned.
5. In order to improve score in NBA, faculty members are also required to focus course teaching beyond university prescribed syllabus and measuring the outcomes w.r.t learning course and programme objectives.
6. Text books and reference books are available in syllabus. Here only additional references w.r.t. non –digital/ digital sources can be written (if applicable)
7. Technology to be used in class room during lecture shall be written below the topic planned within the bracket.