DTE Code: 4151 www.tgpcet.com

TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

AN AUTONOMOUS INSTITUTE

# DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

NATIONAL BOARD OF ACCREDITATION

# B.Tech Electronics & Communication Engineering

## As Per NEP-2020

## III Year (V Sem)

## Scheme & Syllabus

## Session :- 2025-26

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# DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

## Vision of the Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

## Mission of the Institute

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics , transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

# DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

## Vision of the Department

"To emerge as a learning hub and center of excellence in the domain of Electronics and Communication Engineering"

## Mission of the Department

- To impart quality technical education through effective teaching learning process.
- To provide a platform for addressing societal issues and challenges encountered by industries.
- To foster a culture of research and instill innovative and entrepreneurial skills.
- To promote lifelong learning in order to foster the holistic development of students and staff through the knowledge and professional ethics.

# DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

## PEO's of the Department

PEO 1: Demonstrate essential technical skills to identify, analyze and solve problems and design issues in Electronics and Communication Engineering.

PEO 2: Apply field knowledge, research and professional practices to meet the requirements of industries.

PEO3: Imbibe lifelong learning practices and entrepreneurship skills in tune with emerging technologies.

PEO 4: Inculcate professional ethics and managerial skills to satisfy real life problems for serving the needs of society and environment.

## PSO's of the Department

PSO1: Formulate solutions to intricate engineering problems by applying fundamental principles from the Electronics and Communication Engineering technology.

PSO2: Develop methodologies to analyze and design circuits in electronics for communication applications to meet the societal needs.

PSO3: Implement project-based learning techniques to conduct experiments in Embedded Systems, communication system, signal and Image processing, Circuit analysis and design to work professionally in the industry or as an entrepreneur

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**Scheme of Instruction for Third Year of B. Tech. (UG) Programme Department of Electronics and Communication Engineering**

# Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering

## Semester V

| SN | Sem | Type | Bos /Dept. | Sub. Code | Subject | T/P | Contact Hours | | | Credits | % Weightage | | | | ESE Duration Hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | L | P | Hrs | | CT/ IA | CA | ESE | Total Marks | |
| **FIFTH SEMESTER** | | | | | | | | | | | | | | | |
| 1 | V | **PCC** | **EC** | **BEC33501** | Analog & Digital Communication | T | 3 | 0 | 3 | 3 | 30 | 10 | 60 | 100 | 3 |
| 2 | V | **PCC** | **EC** | **BEC33502** | Microcontroller and Embedded Systems | T | 3 | 0 | 3 | 3 | 30 | 10 | 60 | 100 | 3 |
| 3 | V | **PCC** | **EC** | **BEC33504** | Digital Signal Processing | T | 3 | 0 | 3 | 3 | 30 | 10 | 60 | 100 | 3 |
| 4 | V | **MDM** | **IT** | **BIT33515** | Artificial Intelligence | T | 4 | 0 | 4 | 4 | 30 | 10 | 60 | 100 | 3 |
| 5 | V | **PEC** | **EC** | **BEC33506-8** | Program Elective-I | T | 4 | 0 | 4 | 4 | 30 | 10 | 60 | 100 | 3 |
| 6 | V | **OE** | **EC** | **BEC33509** | Open Elective-III | T | 2 | 0 | 2 | 2 | 14 | 6 | 30 | 50 | 2 |
| 7 | V | **PCC** | **EC** | **BEC33503** | Microcontroller and Embedded Systems Lab | P | 0 | 2 | 2 | 1 | 0 | 25 | 25 | 50 | 2 |
| 8 | V | **PCC** | **EC** | **BEC33505** | Digital Signal Processing Lab | P | 0 | 2 | 2 | 1 | 0 | 25 | 25 | 50 | 2 |
| 9 | V | **PCC** | **EC** | **BEC33506** | Analog & Digital Communication Lab | P | 0 | 2 | 2 | 1 | 0 | 25 | 25 | 50 | 2 |
| **TOTAL FIFTH SEM** | | | | | | | **19** | **6** | **25** | **22** | **164** | **135** | **405** | **700** | |

| Course Category | BSC/ ESC (Basic Science Course/ Engineering Science Course.) | PCC (Program me Core Courses) | PEC (Programme Elective Courses) | (MDM/OEC) Multidisciplinary Minor/ (OEC) Open Elective Course) | SEC (Skill course) | Humanities Social Science & Management | Experiential Learning Courses | CC (Co-Curricular Courses) |
|---|---|---|---|---|---|---|---|---|
| Credits | – | 12 | 4 | 6 | – | – | – | -- |
| Cumulative Sum | 16 / 13 | 30 | 4 | 16 | 6 | 10 | 10 | 4 |

**PROGRESSIVE TOTAL CREDITS: 83+22= 105**

| | | | | | |
|---|---|---|---|---|---|
| Chairperson | Dean Academics | Vice-Principal | Principal | June,2025 | 1.00 | Applicable for AY 2025-26 Onwards |
| | | | | Date of Release | Version | |

Dr. Pragati Patil, Vice-Principal, Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur

Dr. Prem..., Principal, Nakoda, TGPCET, Nagpur

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**Scheme of Instruction for Third Year of B. Tech. (UG) Programme Department of Electronics and Communication Engineering**

# Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering

## Program Elective List for U.G.

| **Semester V** | **Semester VI** | |
|---|---|---|
| **Program Elective- I** | **Program Elective- II** | **Program Elective- III** |
| **BEC3506:** Electromagnetic Field and Antenna | **BEC33605:** Microwave & Radar Engineering | **BEC33608:** Wave guide & Antenna |
| **BEC3507: CMOS VLSI Design** | **BEC33606:** HDL Using Verilog | **BEC33609:** VLSI Signal Processing |
| **BEC3508:** Instrumentation and Control System | **BEC33607:** PLC Fundamental | **BEC33610**: SCADA |
| **Semester VII** | **Semester VIII** | |
| **Program Elective- IV** | **Program Elective- V** | **Program Elective- VI** |
| **BEC34702:** Optical Fiber Communication | **BEC34805: Mobile Communication** | **BEC34808:** Satellite Communication |
| **BEC34703:** Robotics & Automation | **BEC34806:** VLSI Testing | **BEC34809**: Nanotechnology |
| **BEC34704**: Mixed Signal Design | **BEC34807**: Distributed Control Systems | **BEC34810:** System Security |

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Tulsiramji Gaikwad-Patil College Of Engineering and Technology. Nagpur

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# Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering

## Open Elective List for U.G.

| Open Elective-I (SEM-III) | | |
|---|---|---|
| **Sr. No.** | **Course Code** | **Course** |
| **1** | **B$$325XX** | **Basic Electronics & Communication** |

| Open Elective-II (SEM-IV) | | |
|---|---|---|
| **Sr. No.** | **Course Code** | **Course** |
| **1** | **B$$324XX** | **Evoluation in Communication Technologies** |

| Open Elective-III(SEM-V) | | |
|---|---|---|
| **Sr. No.** | **Course Code** | **Course** |
| **1** | **B$$325XX** | **ICT in Rular Sector** |

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Engg & Technology, Nagpur

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# Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering

## HONORS SPECIALIZATION IN VLSI Design and Technology

| Sr. No | Sem | Course Code | Subject | Nature of Evaluation | Credits |
|---|---|---|---|---|---|
| 1 | III | BEC32306 | Integrated Circuits and Applications | NPTEL/ESE | 03 |
| 2 | IV | BEC32410 | Hardware Modelling using Verilog | NPTEL/ESE | 03 |
| 3 | V | BEC33510 | System Design Through Verilog | NPTEL/ESE | 03 |
| 4 | VI | BEC33611 | Digital IC Design | NPTEL/ESE | 03 |
| | | BEC33612 | VLSI Design Flow: RTL to GDS | NPTEL/ESE | |
| 5 | VII | BEC34708 | VLSI Physical Design | NPTEL/ESE | 03 |
| 6 | VIII | BEC34813 | Internship(VLSI 1 month) | ESE | 03 |
| 7 | | BEC34814 | Capstone Project | ESE | |
| **Total** | | | | | 18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| HOD / Chairperson | Dean Academics | Dr. Pragati Patil / Vice-Principal | Principal | June,2025 / Date of Release | 1.00 / Version | Applicable for AY 2025-26 Onwards |

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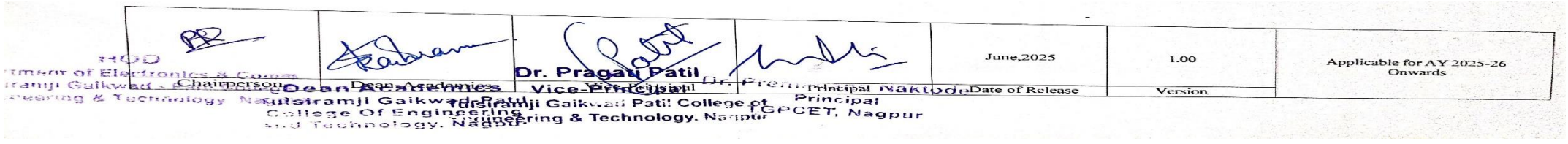
**Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering**

## MINORS SPECIALIZATION IN EMBEDDED SYSTEM & IOT

| Sr. No | Sem | Course Code | Subject | Nature of Evaluation | Credits |
|---|---|---|---|---|---|
| 1 | III | BEC32306 | Microcontrollers & Applications | NPTEL/ESE | 03 |
| 2 | IV | BEC32410 | Embedded Systems | NPTEL/ESE | 03 |
| 3 | V | BEC33510 | RISC-processor | NPTEL/ESE | 03 |
| 4 | VI | BEC33611 | ARM-based Development | NPTEL/ESE | 03 |
| 5 | VII | BEC34708 | Real-Time Operating Systems (RTOS) | NPTEL/ESE | 03 |
| 6 | VIII | BEC34813 | Industrial IoT (IIoT) | ESE | 03 |
| **Total** | | | | | 18 |



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## Scheme of Instructions: Third Year B. Tech. in Electronics and Communication Engineering

## Exit Course

**Award of UG Certificate (After First Year)**

| Sr. No | Course Name | Mode of conduction | Credits |
|---|---|---|---|
| 01 | Digital Electronics | Certification Online/Offline/NPTEL | 04 |
| 02 | Microprocessor 8085 | Certification Online/Offline/NPTEL | 04 |
| **OR** | | | |
| 03 | Internship(16 week) | - | 08 |
| **Total** | | | **08** |

**Award of Diploma (After 2 Year)**

| Sr. No | Course Name | Mode of conduction | Credits |
|---|---|---|---|
| 01 | PCB Design & Development | Certification Online/Offline/NPTEL | 04 |
| 02 | PLC & SCADA | Certification Online/Offline/NPTEL | 04 |
| **OR** | | | |
| 03 | Internship(16 week) | - | 08 |
| **Total** | | | **08** |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33501: Analog and Digital Communication

| Teaching Scheme | |
|---|---|
| **Lectures** | 3 Hrs/week |
| **Tutorial** | 0 Hrs/week |
| | |
| **Total Credit** | **3** |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| | |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03 Hrs 00 Min. | |

### Course Outcomes (CO)

Students will be able to

| | |
|---|---|
| 1 | **Illustrate** the concepts of modulation and demodulation techniques for amplitude modulation. |
| 2 | **Determine** the concept of angle modulation in FM transmitter and receiver . |
| 3 | **Examine** the digital modulation schemes PCM ,DM,ADM with their limitations. |
| 4 | **Apply** digital passband transmission techniques including shift keying and division multiplexing methods. |
| 5 | **Analyze** the line coding techniques and spread spectrum techniques of DSSS,FHSS and CDMA |

### Course Contents

| | |
|---|---|
| **Unit I** | **Amplitude Modulation:** Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB. |
| **Unit II** | **Angle Modulation:** Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Transmission bandwidth of FM Wave - Generation of FM Signal-Armstrong Method, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis. |
| **Unit III** | **Radio Receivers:** - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver **Sampling and Analog to digital Conversion**: -Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, **Pulse Modulation:** Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM.PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM. |
| **Unit IV** | **Digital Modulation Techniques:**ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non- Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM. detection of QAM, FDM & TDM signal multiplexing |
| **Unit V** | **Line coding & Spread Spectrum Techniques :-** line coding techniques, PN sequence generation technique, Spread spectrum Communications, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access of DSSS, Error Detection and correction techniques Hamming code, Huffman code, Cyclic redundancy check |

### Text Books

| | |
|---|---|
| T.1 | B.P. Lathi, "Modern Digital and Analog Communication System", Oxford University Press, 3rd Edition, 2005 |

| | |
|---|---|
| T.2 | John G. Proakis, “Digital Communication”, McGraw Hill Inc, 5th Edition, 2008. |
| T.3 | Singh. R. P &Sapre. S. D, “Communication Systems: Analog & Digital,” 3rd edition, McGrawHill Education, Seventh Reprint, 2016. |
| **Reference Books** | |
| R.1 | Simon Haykin, “Communication Systems”, John Wiley & Sons, 4th Edition, 20008. |
| R.2 | Simon Haykin and Michael Moher, “Communication Systems,” 5th edition, John Wiley & Sons, 2013 |
| R 3 | Shu Lin, Daniel Costello, “Error control coding – Fundamentals and Applications”, Prentice Hall, Upper Saddle River, NJ, 2nd Edition, 2004. |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/117/105/117105143 |
| 2 | https://nptel.ac.in/courses/117/105/117105144 |
| 3 | https://nptel.ac.in/courses/117/104/117104121 |

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# Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33502 : Microcontroller & Embedded System

| Teaching Scheme | |
|---|---|
| **Lectures** | 3 Hrs/week |
| **Tutorial** | 0 Hrs/week |
| **Total Credit** | 3 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03 Hrs 00 Min. | |

**Course Outcomes (CO)**

Students will be able to

| |
|---|
| **Illustrate** the core concepts and programming techniques of the 8051 microcontroller. |
| **Implement** the interfacing of 8051 micro-controller with real life applications. |
| **Examine** working of Embedded Systems in Real life, Engineering and Industrial applications. |
| **Analyze** embedded systems based on ARM architecture with its features, functions, and operational capabilities. |
| **Design** RT embedded systems using kernel features and IPC, with practical applications in communication and automation. |

**Course Contents**

| | |
|---|---|
| **Unit I** | Comparison of microprocessor & micro-controller, Introduction to 8051 micro controllers, Pin diagram, architecture, features & operation, Ports, memory organization, SFR's, Flags, Counters/Timers, Serial ports. Interfacing of external RAM & ROM with 8051. 8051 ,Interrupt structure, Instruction set of 8051; data transfer, logical, arithmetic & branching instructions, Addressing modes |
| **Unit II** | Interfacing of Switches, keyboard, LED & LCD display, ADC & DAC Interface,<br>Stepper motor Interface, DMA. |
| **Unit III** | History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System – Core Types, Memory Architecture, Memory & Its Types, RISC and CISC. |
| **Unit IV** | Introduction to ARM, features, architecture, instruction set features, Concepts of RTOS ARM processor and Architecture, Register set, instruction set, programming, interrupts, stack, timers on-chip and off chip peripherals, interfacing and programming. |
| **Unit V** | Architecture of the kernel, Task scheduler, Semaphores, Mailbox , Message queues , Pipes, Events, Timers , Memory Management, Case study- Based on Communication Embedded System, Based on Automation Embedded Systems. |

**Text Books**

| | |
|---|---|
| 1 | Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008. |

| | |
|---|---|
| 2 | Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education, Private Limited, 2 nd Edition. |
| **Reference Books** | |
| 1 | Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015. |
| 2 | Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019 |
| 3 | Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008. |
| **Useful Links** | |
| 1 | https://archive.nptel.ac.in/courses/108/105/108105102/ |
| 2 | https://archive.nptel.ac.in/courses/106/105/106105193/ |

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## B.Tech Third Year (Semester-V) Electronics and Communication Engineering

## BEC33504 : Digital Signal Processing and Application

| Teaching Scheme | |
|---|---|
| **Lectures** | 3 Hrs/week |
| **Tutorial** | 1 |
| **Total Credit** | 3 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03 Hrs 00 Min. | |

### Course Objectives:

| | |
|---|---|
| 1. | **Classify** discrete-time signals analytically and visualize them in the time domain. |
| 2. | **Apply** discrete Fourier transform on discrete time signal and Its properties. |
| 3. | **Analyze** Fast Fourier Transform algorithms on discrete signals. |
| 4. | **Design** Digital Infinite Impulse Response Filters by using analog Filter. |
| 5. | **Implement** Digital finite Impulse Response filters using windowing techniques. |

### Course Contents

| | |
|---|---|
| **Unit I** | Basic elements of DSP and its requirement, Advantages of Digital over analog signal processing, sampling theorem, sampling process and reconstruction of sampling data. Discrete time signals & systems: Discrete time signals & systems, classification of discrete time signals and systems, LTI systems |
| **Unit II** | Frequency domain sampling: definition of Discrete Fourier Transform & Properties of DFT, Inverse IDFT, DFT'S of typical time signals, linear convolution, Analytical, Graphical Cross Correlation, Auto correlation. Circular convolution using DFT & IDFT. |
| **Unit III** | Introduction to Fast Fourier Transform algorithms: Decimation in Time –FFT Algorithm , Decimation in Frequency- FFT Algorithm using radix 2 FFT – Butterfly structure for Decimation in Time –FFT and Decimation in Frequency- FFT |
| **Unit IV** | Design of IIR Filter from analog filter using Impulse Invariance, Bilinear transformation, Butterworth and Chebyshev filter, IIR filter structure: Direct form-I, Direct form-II, Parallel & Cascade form. |
| **Unit V** | Design of Finite Impulse Response filter design using various windowing techniques**:** Rectangular, Hamming, Blackman, Finite Impulse Response filter structure : Direct & Cascade form. |

### Text Books

| | |
|---|---|
| T.1 | Digital Signal Processing and applications- 4th edition, John G. Proakis McGraw-Hill |
| T.2 | Discrete time Signal Processing- 3rd edition Alan Oppenheim, Ronald Schafer pearson |

| | |
|---|---|
| T.3 | Digital Signal Processing - A computer based approach-Publication- 4th edition, Sanjit K. Mitra, McGraw-Hil |
| **Reference Books** | |
| R.1 | Digital Signal Processing- 3rd Edition S Salivahanan ,A Vallavraj ,C Gnanapriya McGraw-Hill |
| R.2 | Digital signal processing- A practical approach 2nd Edition,.E. C. Ifeachar, B. W. Jarvis Pearson |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/108/104/108104139/ |
| 2 | http://nptel.ac.in/courses/117107095 |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BIT33515 : Artificial Intelligence

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Lectures** | 4 Hrs/week | **CT-1** | 15 Marks |
| **Tutorial** | - Hrs/week | **CT-2** | 15 Marks |
| **Total Credit** | 4 | **TA** | 10 Marks |
| | | **ESE** | 60 Marks |
| | | **Total** | 100 Marks |
| | | Duration of ESE: 03 Hrs 00 Min. | |

**Course Outcomes (CO)**

Students will be able to

| |
|---|
| **Determine** the working functionality of Artificial Intelligence with intelligent agents. |
| **Describe** the structure and function of problem-solving agents. |
| **Apply** adversarial search techniques to make optimal decisions in competitive environments |
| **Illustrate** First Order Logic for Knowledge Representation |
| **Analyze** Planning approaches in terms of efficiency, scalability, and applicability. |

### Course Contents

| | |
|---|---|
| **Unit I** | **Introduction:** What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. **Intelligent Agents:** agents and environment, good behaviour, nature of environment, the structure of agents |
| **Unit II** | **Solving Problems by Searching:** Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions. **Beyond Classical Search:** local search algorithms, searching with non-deterministic action, searching with partial observations, online search agents and unknown environments. |
| **Unit III** | **Adversarial Search:** Games, optimal decisions in games, alpha-beta pruning, stochastic games, partially observable games, state-of-the-are game programs. **Logical Agents:** Knowledge base agents, The Wumpus world, logic, propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic. |
| **Unit IV** | **First Order Logic:** Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. **Inference in First Order Logic:** propositional vs. First Order, unification and lifting, forward and backward chaining, resolution. |
| **Unit V** | **Planning:** Definition of Classical Planning, Algorithms for planning as state space search, planning graphs, other classical planning approaches, analysis of planning approaches, Time, Schedules and resources, hierarchical planning, Planning and Acting in Nondeterministic Domains, multiagent planning, **Knowledge Representation:** Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world |

**Text Books**

| | |
|---|---|
| 1 | Artificial Intelligence: A Modern Approach by Stuart Russel and Peter Norvig Pearson, 3rd edition, 2015 |
| 2 | A First Course in Artificial Intelligence by Deepak Khemani , TMH, First edition, 2017 |
| 3 | Artificial Intelligence: A Rational Approach by Rahul Deva Shroff, publishers 1st edition 2018 |
| **Reference Books** | |
| 1 | Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar Nair, TMH, 3rd edition, 2009 |
| 2 | Artificial Intelligence & Soft Computing for Beginner bys Anandita Das Bhattacharjee, SPD , 1st edition, 2013 |
| **Useful Links** | |
| 1 | nptel.ac.in/shop/nptel/an-introduction-to-artificial-intelligence/?ut |
| 2 | nptel.ac.in/courses/112/103/112103280 |
| 3 | nptel.ac.in/courses/106/106/106106140 |


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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC3506: Electromagnetic Field and Antenna

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | **4** |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03 Hrs 00 Min. | |

### Course Outcomes (CO)

Students will be able to

| | |
|---|---|
| 1 | **Describe** the Cartesian coordinate system , operation of vector calculus in Electromagnetic field. |
| 2 | **Analyze** electric fields and flux using Coulomb's and Gauss's laws for charge distributions in symmetric and non-symmetric structures. |
| 3 | **Examine** electrostatic field properties using potential theory, divergence theorem, and boundary conditions to verify current flow and energy density in conductors. |
| 4 | **Explain** magneto static field concepts using Biot–Savart and Ampere's laws, to verify magnetic flux, flux density in practical current configurations. |
| 5 | **Analyze** the antenna fundamentals and its concepts of radiation mechanisms of VHF,UHF and Microwave antenna. |

### Course Contents

| | |
|---|---|
| **Unit I** | Orthogonal coordinate systems: Cartesian, cylindrical, spherical and transformations, Gradient of a Scalar Field. Divergence of a Vector Field, Curl of a Vector Field, Laplacian Operator, Irrotational and solenoidal field. |
| **Unit II** | Magnetic field: Coulomb's law, Electric field intensity for different charge distribution: point, line surface, volume, Concept of electric flux, Gauss's law and its application to field computation in symmetric structures and non-symmetric structures. |
| **Unit III** | Electrostatic field**:** Divergence Theorem, Definition of Potential Field of System of Charge, Potential Gradient, Energy Density in Electrostatic Field. Current And Current Density, Conductor Properties and Boundaries Condition. |
| **Unit IV** | Magneto static fields**:** Biot –Savart law and applications to infinite and finite current filament, Ampere's Circuital law and applications to line charge, coaxial transmission cables, uniform current sheet charge, solenoid, Stroke's Theorem Magnetic flux and magnetic flux density. |
| **Unit V** | Antenna Fundamentals Directional Properties of Dipole Antennas, Two Element Array, Linear Arrays, Antenna Parameters: Antenna gain and directivity, Antenna impedance and efficiency Transmission Loss Between Antennas, Space Communications, Antenna- The radiation mechanism, Types of Antenna : Elementary doublet, Resonant & Non-resonant antenna, Dipole arrays, Folded Dipole and Yagi-Uda Antenna (VHF), UHF and Loop antenna and Logic periodic Antenna. |

| | |
|---|---|
| **Text Books** | |
| T.1 | Engineering Electromagnetics Seventh Edition William H. Hayt Tata McGraw – Hill |
| T.2 | Field and Wave Electromagnetics Second Edition 21 Jan 2010 David K. Cheng Addison Wesley |
| **Reference Books** | |
| R.1 | Electromagnetism Theory and application 2ndEdition2009 Ashutosh Pramanik Prentice Hall. |
| R.2 | Elements of Electromagnetics M. N. O. Sadku Oxford Press. |
| **Useful Links** | |
| 1 | https://archive.nptel.ac.in/courses/108/104/108104087/ |
| 2 | https://archive.nptel.ac.in/courses/115/104/115104088/ |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33507 : (PE-I) CMOS VLSI Design

| Teaching Scheme | |
|---|---|
| **Lectures** | 4Hrs/week |
| **Tutorial** | 0 Hrs/week |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03 Hrs 00 Min. | |

### Course Outcomes (CO)

Students will be able to

| |
|---|
| **Analyze** the structure and working principle of Metal-Oxide-Semiconductor (MOS) devices, including nMOS and pMOS enhancement-type transistors. |
| **Illustrate** operation of MOS inverters, including static load and transmission gate-based designs. |
| **Examine** the design and operation of basic combinational logic circuits using CMOS gates. |
| **Analyze** CMOS circuit performance by estimating resistance, capacitance, switching characteristics, power dissipation, and charge sharing effects. |
| **Describe** the VLSI process integration steps involved in fabricating CMOS circuits. |

### Course Contents

| | |
|---|---|
| **Unit I** | Mos transistors theory:Introduction to The metal oxide semiconductor (MOS) structure, Long channel I-V characteristics, C-V characteristics. nMOS enhancement and pMOS enhancement transistor, threshold voltage, body effect, MOS effect, MOS device equations, small signal model for MOS transistor. Fabrication process flow- basic steps, the CMOS n-Well process, layout design rules, stick diagram. |
| **Unit II** | CMOS inverter : Principle of operation, dc characteristics, transient characteristics,$\beta_n/\beta_p$ ration, noise margin, static load MOS inverter, transmission gate, introduction to Bi-CMOS inverter. |
| **Unit III** | Study of CMOS logic: Study of combinational logic, gates, compound gates, multiplexers, and memory elementsusing CMOS technology. |
| **Unit IV** | Circuit characterization and performance estimation :Resistance and capacitance estimation, switching characteristics, power dissipation, chargesharing. |
| **Unit V** | VLSI design :VLSI processing integration, layout design rules, and stick diagram representationlatch up, CMOS circuits and logic design: transistor sizing, fan-in, fan-out and physical design of simple logic gates, CMOS logic structures and clockingstrategies. |

### Text Books

| | |
|---|---|
| 1 | Neil H. E. Weste, K. Eshraghian, "Principal of CMOS VLSI design", Addison Wesley VLSISeries. |
| 2 | J. M. Rabaey, A.Chandrakasan, and B. Nikolic. "Digital Interrogated circuits, A Design Perspective", , PHI Publications . |
| 3 | Pucknell & K. Eshraghain, "CMOS VLSI Design" , PHI Publications. |

| Reference Books | |
|---|---|
| 1 | S.M. Sze, “VLSI Technology”, McGraw Hill Publications. |
| 2 | Randall L Gei , “VLSI Design Technologies for Analog & Digital Circuits”, McGraw HillPublications |

| Useful Links | |
|---|---|
| 1 | http://nptel.ac.in/courses/Webcoursecontents/IITBombay/VLSI%20Design/TOC.htm |
| 2 | http://nptel.ac.in/courses/117106092/1 |

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# Third Year (Semester V) B.Tech. Electronics & Communication Engineering

## BEC3508: Instrumentation & Control System

| Teaching Scheme | |
|---|---|
| **Lectures** | 3Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 3 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE:03Hrs 00Min. | |

## Course Outcomes (CO)

Students will be able to

| | |
|---|---|
| 1 | **Illustrate** the working principles of sensors used for measuring displacement, speed, level, and temperature. |
| 2 | **Derive** the linear feedback principles & its mathematical models of control system. |
| 3 | **Implement** system models using transfer functions, block diagram algebra, and signal flow graphs. |
| 4 | **Analyze** the time response characteristics of first and second order control systems using standard test inputs. |
| 5 | **Evaluate** control system stability based on characteristic equations, Routh-Hurwitz criterion, and graphical methods. |

## Course Contents

| | |
|---|---|
| **UnitI** | Instrumentation System Elements: Displacement Sensors Potentiometer, Optical Encoders, Strain-Gauged Element, Capacitive Element, Speed Sensors, Tachogenerator, Piezoelectric Sensor, Liquid Level, Ultrasonic Level Gauge, Temperature Sensors, Resistance Temperature Detectors (RTDs), Thermistors, Thermocouples. |
| **UnitII** | Introduction to Control System: Introduction, Classification of Control system, Representation of Electrical, Mechanical, Electro mechanical with differential equation, Concept of Transfer Function and State space representation. Advantages of State Space representation over Classical representation. |
| **Unit III** | Transfer Function, Block Diagram & Signal flow graph: Representation of Transfer Function of Electrical & Mechanical, Block diagram algebra, Signal flow graph and Mason's gain formula. |
| **Unit IV** | Time Response Analysis: Time response of system, first order and second order system, standard inputs, concept of gain and time constants. Steady state errors, type of control system, approximate methods for higher order system. Types of Controllers. |
| **Unit V** | Stability & Root Locus: Stability of control systems, condition of stability, characteristics equation, Routh Hurwitz criterion, special cases for determining stability, relative stability. Graphical method. |

| | |
|---|---|
| **Text Books** | |
| 1 | I.J.Nagrath, M.Gopal, " Control System Engineering",6th Edition, New age International Publishers . |
| 2 | B.C.Kuo , "Automatic Control System", PHI. |
| 3 | B.S. Manke, "Linear Control Systems", Khanna Publishers. |
| **ReferenceBooks** | |
| 1 | A.K.Jairath, " Problems and Solutions of Control systems", CBS Publishers, New Delhi . |
| 2 | Nagrath & Gopal, "Control System Analysis". |
| 3 | Ghosh S. "Control System Theory & Application" Person Publication. |
| **UsefulLinks** | |
| 1 | https://nptel.ac.in/courses/115/108/115108104/ |
| 2 | https://nptel.ac.in/courses/107/106/107106081/ |
| 3 | https://nptel.ac.in/courses/108/103/108103007/ |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC3509 : ICT in Rural Sector

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Lectures** | 02Hrs/week | **CT-1** | 7 Marks |
| **Tutorial** | - | **CT-2** | 7 Marks |
| **Total Credit** | 02 | **TA** | 6 Marks |
| | | **ESE** | 30 Marks |
| | | **Total** | 50 Marks |
| | | Duration of ESE: 02 Hrs 00Min. | |

### Course Outcomes (CO)

Students will be able to

**Identify** key challenges in ICT in rural areas and role of ICT in global and Indian context characteristics.

**Exemplify** the major challenges affecting ICT adoption, infrastructure deficiency and digital illiteracy.

**Analyze** ICT tools and platforms used in agriculture, education, health, and governance.

### Course Contents

| | |
|---|---|
| **Unit I** | Rural Development and the Need for ICT: Definition and evolution of ICT, Components of ICT, Importance of ICT in development, Overview of ICT in global and Indian context Characteristics and challenges of rural areas, Role of ICT in poverty reduction and sustainable development, Government initiatives for rural ICT development. |
| **Unit II** | Challenges of ICT: Infrastructure Deficiency, Digital Illiteracy, Affordability, Language and Content Relevance, Resistance to Change. |
| **Unit III** | ICT tools and platforms : Use of ICT in crop planning, pest control, irrigation, Mobile apps for farmers ,Weather forecasting and agri-market information systems, Smart agriculture: IoT, drones, sensors, Digital classrooms and distance learning, E-learning platforms ,Bridging rural-urban education divide, Role of mobile technology and community radio, Telemedicine and mobile health , Health awareness campaigns through ICT, Monitoring systems for maternal and child health, Role of ICT during pandemics and emergencies |

### Text Books

| | |
|---|---|
| 1 | Michelle Jacobs"Information and Communication Technologies in Agriculture" States Academic Press states academi cpress.com,2021 |
| 2 | Maitrayee Mukerji"ICTs and Development: A Study of Telecentres in Rural India"Palgrave Macmillan. |
| 3 | Dr. Chandan Kumar Panda, Dr. Anil Paswan, Dr. Siya Ram Singh"Advances in ICT in Agriculture" |

### Reference Books

| | |
|---|---|
| 1 | Venkata Reddy, K. Agriculture and Rural Development (Emerging Trends and Right Approach to Development), Hmalaya Publshing House Pvt., Ltd. |

| | |
|---|---|
| 2 | Adivi Reddy. A. Extension education, Sri Lakshmi Press, Bapatla. |
| 3 | Dhahama O.P. & Bhatnagar, O.P., Education and Communication for Development, Oxford & IBH Publishing. |
| **Useful Links** | |
| 1 | http://kcl.digimat.in/nptel/courses/video/126104006/L44.html |
| 2 | http://tjsec.digimat.in/nptel/courses/video/126104006/L42.html |
| 3 | https://www.youtube.com/watch?v=KFAw_h0n0q0 |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33503: Microcontroller and Embedded Systems Lab

| Teaching Scheme | | | Examination Scheme | |
|---|---|---|---|---|
| **Lectures** | 2Hr/Week | | **CT** | - |
| **Tutorials** | - | | **CA** | 25 Marks |
| **Total Credits** | 1 | | **ESE** | 25 Marks |
| | | | **Total** | 50 Marks |
| | | | **Duration of ESE:** | 02Hrs |

| Course | Outcomes: |
|---|---|
| 1 | **Execute** arithmetic, logical and bit manipulation instructions of 8051 for programming. |
| 2 | **Analyze** assembly programs for HEX to ASCII conversion and square root computation using low-level programming and memory operations. |
| 3 | **Implement** serial data transfer and seven-segment display interfacing between microcontroller kits. |
| 4 | **Implement** the interfacing of DAC and ADC with Microcontroller 8051. |
| 5 | **Execute** the program of stepper motor and traffic light Controller. |

| Sr.No. | List of Experiment | CO |
|---|---|---|
| 1 | Execute a program of arithmetic operations using 8051 microprocessor. | CO1 |
| 2 | Execute an assembly Language Program for finding largest no. from a given array of 8-bit numbers. | CO1 |
| 3 | Write an assembly language program to convert a HEX number to its equivalent ASCII code and display the result in the address field. | CO2 |
| 4 | Write an assembly language program to find the square root of a given data. | CO2 |
| 5 | Implement transfer data in serial communication protocol. | CO3 |
| 6 | Implement interfacing of Seven segment LED display. | CO3 |
| 7 | Implement a program to interface DAC with Microcontroller. | CO4 |
| 8 | Implement a program to interface ADC with Microcontroller. | CO4 |
| 9 | Implement interfacing of Stepper motor with Microcontroller. | CO5 |
| 10 | Implement a program for traffic light controller using 8051 Microcontroller. | CO5 |

**Text Books**


| | |
|---|---|
| T.1 | Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008. |
| T.2 | Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education, Private Limited, 2 nd Edition. |


**Reference Books**


| | |
|---|---|
| R.1 | Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015. |
| R 2 | Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019 |
| R.3 | Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008. |

| | Useful Links |
|---|---|
| 1 | https://archive.nptel.ac.in/courses/106/105/106105193/ |
| 2 | https://elearn.nptel.ac.in/shop/iit-workshops/completed/lab-workshop-on-embedded-c-and-arm-cortex-microcontrollers/?v=c86ee0d9d7ed |
| 3 | https://nptel.ac.in/courses/117104072 |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33505: Digital Signal Processing & Applications Lab

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Lectures** | 2Hr/Week | **CT** | - |
| **Tutorials** | - | **CA** | 25 Marks |
| **Total Credits** | 1 | **ESE** | 25 Marks |
| | | **Total** | 50 Marks |
| | | **Duration of ESE:** | 02Hrs |

| **Course Outcomes:** | |
|---|---|
| 1 | **Demonstrate** Discrete-Time Signals analytically and visualize them in the time domain. |
| 2 | **Examine** Discrete Fourier Transform on discrete time signal and It's properties. |
| 3 | **Analyze** Fast Fourier Transform algorithms on discrete time signals. |
| 4 | **Design** Digital Infinite Impulse Response Filters by using analog filters. |
| 5 | **Implement** Digital finite Impulse Response filters using windowing techniques. |

| Sr.No. | List of Experiment | CO |
|---|---|---|
| 1 | Plot and represent following basic discrete time signals. : Unit impulse, unit step, ramp, real and complex exponential and its representations. | CO1 |
| 2 | Plot linear convolution of discrete time signals. | CO1 |
| 3 | Plot circular convolution of discrete time signals. | CO1 |
| 4 | Execute program to compute cross-correlation of the given sequences with corresponding plot. | CO2 |
| 5 | Execute program to compute auto-correlation of given discrete- time signals With corresponding plot. | CO2 |
| 6 | Compute DFT and IDFT of discrete time signals using Fast Fourier Transform. | CO3 |
| 7 | Design Butterworth Infinite Impulse Response filters. | CO4 |
| 8 | Design Chebyshev Infinite Impulse Response filters. | CO4 |
| 9 | Implement Finite Impulse Response filter using Hamming windowing techniques. | CO5 |
| 10 | Implement Finite Impulse Response filter using Hanning windowing techniques. | CO5 |

| **Text Books** | |
|---|---|
| T.1 | Digital Signal Processing and applications- 4th edition, 2013 John G. Proakis McGraw-Hill |
| T.2 | Discrete time Signal Processing- 3rd edition 2010 Alan Oppenheim, Ronald Schafer pearson |
| **Reference Books** | |
| R.1 | Digital signal processing- A practical approach 2nd Edition, 2002.E. C. Ifeachar, B. W. Jarvis Pearson |
| R 2 | Digital Signal Processing - A. Nagoor Kani 2nd Edition McGraw Hill. |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/108/104/108104139/ |
| 2 | http://nptel.ac.in/courses/117107095 |

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## Third Year (Semester-V) B.Tech. Electronics & Communication Engineering

## BEC33506: Analog and Digital Communication Lab

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Lectures** | 2Hr/Week | **CT** | - |
| **Tutorials** | - | **CA** | 25 Marks |
| **Total Credits** | 1 | **ESE** | 25 Marks |
| | | **Total** | 50 Marks |
| | | **Duration of ESE:** 02Hrs | |

| **Course Outcomes:** | |
|---|---|
| 1 | **Demonstrate** the concepts of analog modulation and demodulation techniques by using AM. |
| 2 | **Analyze** the Angle modulation using FM Modulation and Demodulation |
| 3 | **Illustrate** the digital modulation techniques PCM ,DM,ADM and their limitations. |
| 4 | **Analyze** the digital pass band data transmission schemes using ASK,FSK,PSK,QAM,QPSK |
| 5 | **Demonstrate** the line coding techniques and spread spectrum techniques using DSSS, FHSS and CDMA. |

| **Sr.No.** | **List of Experiment** | **CO** |
|---|---|---|
| 1 | Perform Generation of AM modulation and Demodulation | CO1 |
| 2 | Perform Generation of DSB-SC modulation and Demodulation | CO1 |
| 3 | Perform Generation of FM Modulation and Demodulation | CO2 |
| 4 | Perform Generation of PAM,PPM,PWM modulation and demodulation | CO3 |
| 5 | Perform Generation and detection of Pulse Code Modulation and Demodulation | CO3 |
| 6 | Examine the Generation of DM and ADM with analysis of step size | CO3 |
| 7 | Perform Generation and detection of ASK, FSK Modulation and Demodulation | CO4 |
| 8 | Perform Generation and detection of PSK Modulation and Demodulation | CO4 |
| 9 | Examine the Generation of QPSK Modulation and Demodulation | CO4 |
| 10 | Simulation of different line coding techniques using MATLAB | CO5 |

### Text Books


| | |
|---|---|
| T.1 | B.P. Lathi, "Modern Digital and Analog Communication System", Oxford University Press, 3rd Edition, 2005 |
| T.2 | John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008. |


### Reference Books


| | |
|---|---|
| R.1 | Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 20008. |
| R.2 | Simon Haykin and Michael Moher, "Communication Systems," 5th edition, John Wiley & Sons, 2013 |


### Useful Links

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/117/105/117105143 |
| 2 | https://nptel.ac.in/courses/117/105/117105144 |

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