Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

RANDOM SIGNAL PROCESSING

Course Code and Course Title	**0ETPC501 Random Signal Processing**			
Semester	**I**			
Prerequisites	Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10	20	10	60

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Apply the fundamental principles of probability, including axioms, conditional probability, Bayes theorem, and independence of events to solve engineering problems.	**3**
CO2	Analyze discrete and continuous random variables and compute their statistical parameters such as mean, variance, skewness, and kurtosis.	**4**
CO3	Analyze stochastic processes using auto-correlation, cross-correlation, and spectral density concepts.	**4**
CO4	Apply frequency domain techniques to estimate auto-correlation, spectral density, and coherence of stochastic signals.	**3**
CO5	Analyze Markov chains, including state classification, limiting probabilities, and system stability.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Probability** The concept of probability; the axioms of probability; sample space and events; conditional probability and Bayes theorem, independence of events, Bernoulli trails.	**7**
Unit 2	**The Concept of a Random Variable** Introduction to random variables, discrete random variable, continuous random variable, expectation of random variable, moments of random variable (mean, mode Variance, skewness, Kurtosis).	**7**
Unit 3	**Multiple Random Variables** Cumulative distribution function and probability density function of single and multiple Random Variables, statistical properties, jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, estimate of population means, Expected value and variance and covariance.	**7**
Unit 4	**Stochastic Processes I** Classification of Processes: properties, auto correlation and cross correlation function, estimate of auto correlation function. Spectral Density: Definition, Properties, white noise.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 5	**Stochastic Processes II** Estimation of auto-correlation function using frequency domain technique, estimate of spectral density, cross spectral density and its estimation, coherence.	**4**
Unit 6	**Markov Chains** Chapman Kolmogorov equation, classification of states, limiting probabilities, Stability of Markov system, reducible chains, Markov chains with continuous state space.	**5**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Solving problems on: Sample space and events, Conditional probability, Bayes theorem.
Tutorial No. 2	Solving problems on: Independence of events, Bernoulli trials, Case-based problems.
Tutorial No. 3	PMF and PDF identification, Expectation and variance calculation, Moments (mean, variance, skewness, kurtosis)
Tutorial No. 4	Graph-based interpretation of distributions, Numerical derivations
Tutorial No. 5	Joint PDF/CDF problems, Marginal and conditional distributions, Covariance and correlation calculations
Tutorial No. 6	Central Limit Theorem applications, Estimation of population parameters
Tutorial No. 7	Classification of stochastic processes, Auto-correlation and cross-correlation problems
Tutorial No. 8	Interpretation of spectral plots, Application-based problems (signal processing context)
Tutorial No. 9	Solving: Chapman-Kolmogorov equations, Transition probability matrices ,State classification (absorbing, transient, recurrent) ,Steady-state probabilities, Case studies (queue systems, reliability models)

Text Books:

1) Papoulis, S. Pillai, Probability, Random Variables and Stochastic Processes, 4th edition, Tata McGraw Hill, 2017.
2) T. Veerajan, Probability, Statistics and Random Processes, Tata Mc Graw-Hill Education (India) Pvt. Limited, Third Edition, 2008.

Reference Books:

1) R. P. Singh, S. D. Sapre, Communication Systems: Analog and Digital, Tata McGraw- Hill Education (India) Pvt. Limited, Third Edition, 2017.
2) B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, Third edition, 2010.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

RADIATION AND MICROWAVE TECHNIQUES

Course Code and Course Title	**0ETPC502 Radiation and Microwave Techniques**			
Semester	**I**			
Prerequisites	Analog Communication Engg. , Digital Communication Engg.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Analyze EMT transmission characteristics of waveguide.	**4**
CO2	Analyze Transmission line circuit at microwave frequency.	**4**
CO3	Demonstrate use of smith chart for solving transmission line problem.	**2**
CO4	Analyze various micro stripline integrated networks and their parameters.	**4**
CO5	Demonstrate different applications of RF and Microwave.	**2**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Review of EM Theory** Introduction, Maxwell's equations, Wave equations, TEM/TE/TM/HE Wave definitions.	**6**
Unit 2	**Microwaves** Introduction to microwaves, Microwave transmission lines, Smith chart and its applications at microwaves, Microwave measurements.	**6**
Unit 3	**Microstrip lines and Antennas** Microstrip Lines: Types of microstrip lines, microwave components using striplines, Methods of analysis, Design considerations, Microstrip arrays. Microstrip Antennas: Principle of operation, Methods of analysis, feeding techniques, Polarization, Design considerations.	**7**
Unit 4	**Microwave Elements** Microwave integrated circuits, Active and passive microwave elements.	**5**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 5	**Microwave Communication Systems** Introduction, Analog and digital microwave communication systems, Satellite communication, Microwave antennas.	**5**
Unit 6	**Radar** Introduction, Classifications, Radar range equation, Modulators, Displays, Scanning and tracking, Doppler Effect, Blind speeds, FMCW radars, radar antennas.	**7**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Review of EM Theory – Maxwell's Equations: Conceptual understanding and derivations
Tutorial No. 2	Wave Propagation and Modes: Field analysis and classification
Tutorial No. 3	Introduction to Microwaves & Transmission Lines: Fundamentals and transmission behavior
Tutorial No. 4	Smith Chart and Applications: Graphical analysis and impedance matching
Tutorial No. 5	Microstrip Lines: Structure and design
Tutorial No. 6	Microstrip Antennas: Antenna theory and design
Tutorial No. 7	Microwave Elements & MIC: Components and integration
Tutorial No. 8	Microwave Communication Systems

Text Books:

1) Guro, Hijiroglu, Electromagnetic Field Theory fundamentals; Thomson Publication, 2nd Edition, 2005.

Reference Books:

1) Annapurna Das, Sisir Das, Microwave Engineering; TMH Publication, 2009.
2) M. Kulkarni, Microwave and Radar Engineering; Umesh Publications,5th Edition, 2016.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

ARTIFICIAL NEURAL NETWORKS AND APPLICATIONS

Course Code and Course Title	**0ETPE503 (A)** **Artificial Neural Networks and Applications**			
Semester	I			
Prerequisites	Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Articulate analogy of human neurals.	**3**
CO2	Analyze radial basis function network.	**4**
CO3	Analyze neural network architecture &basic learning algorithms.	**4**
CO4	Understand mathematical modeling of neurons, neural networks.	**2**
CO5	Analyze training ,verification, and validation of neural models	**4**
CO6	Design engineering applications that can learn using neural networks.	**3**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Fundamentals of Brain-Inspired Computing:** Brain Style Computing: Origins and Issues, Biological neural networks, Neuron Abstraction, Neuron Signal.	**5**
Unit 2	**Neural Network Models and Learning Principles:** Functions, Mathematical Preliminaries, Artificial Neurons, Neural Networks and Architectures Pattern analysis tasks: Classification, Clustering, mathematical models of neurons, Structures of neural networks, learning principles.	**7**
Unit 3	**Feed Forward Neural Networks:** Pattern classification using perceptron, Multilayer feed forward neural networks (MLFFNNs), Pattern classification and regression using MLFFNNs, Error back-propagation learning, Fast learning methods: Conjugate gradient method.	**7**
Unit 4	**Recurrent and Associative Neural Networks:** Auto-associative neural networks, Pattern storage and retrieval, Hopfield model, recurrent neural networks, Bayesian neural networks,	**5**
Unit 5	**Recurrent and Associative Neural Networks:** Radial basis function networks: Regularization theory, RBF networks for function approximation, RBF networks for pattern classification.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Unit 6	**Self-Organizing and Advanced Neural Network Models:** Self-organizing maps: Pattern clustering, Topological mapping, Kohonen's self-organizing map Introduction to cellular neural network, Fuzzy neural networks, and Pulsed neuron models recent trends in Neural Networks	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Fundamentals of Brain-Inspired Computing: Basic concepts and biological foundation
Tutorial No. 2	Mathematical Preliminaries and Artificial Neurons: Mathematical foundation
Tutorial No. 3	Neural Network Architectures & Learning Principles: Structure and learning
Tutorial No. 4	Perceptron and Pattern Classification: Basic feedforward model
Tutorial No. 5	Multilayer Feed Forward Neural Networks (MLFFNN): Advanced feedforward networks
Tutorial No. 6	Backpropagation and Fast Learning Methods: Learning algorithms
Tutorial No. 7	Recurrent and Associative Neural Networks: Memory and dynamic networks
Tutorial No. 8	Radial Basis Function (RBF) Networks: Function approximation and classification

Text Books:

1) Satish Kumar, Neural Networks, A Classroom Approach, Tata McGraw-Hill, 2003
2) Jacek Zurada, Introduction to Artificial Neural Networks, Jaico Publishing House, 1997.
3) S. Haykin, Neural Networks, A Comprehensive Foundation, Prentice Hall,1998.

Reference Books:

1) C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2) B. Yegnanarayana, Artificial Neural Networks, Prentice Hall of India,1999.
3) L. O. Chuaand T. Roska, Cellular Neural Networks and Visual Computing
4) Foundation and Applications, Cambridge Press, 2002.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

MOBILE SECURITY

Course Code and Course Title	**0ETPE503B Mobile Security**			
Semester	I			
Prerequisites	Mobile Communication, Computer Network.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	03	01	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the evolution of mobile communication systems from 1G to 5G, including standards like 3GPP/3GPP2 and modern mobile services.	**2**
CO2	Describe smartphone operating systems with focus on Android architecture, components, IPC mechanisms, and iOS fundamentals.	**2**
CO3	Apply concepts of Android application development including intents, services, broadcast receivers, content providers, and runtime environment.	**3**
CO4	Analyze the Android security model, permission mechanisms, and identify vulnerabilities using appropriate security tools and techniques.	**4**
CO5	Evaluate security challenges and solutions in mobile networks such as Wi-Fi, Bluetooth, NFC, and telecom systems.	**5**
CO6	Assess and compare security features of Android and iOS platforms, including application security, authentication, encryption, and attack mitigation strategies.	**5**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction** History of mobile cellular systems, First Generation, Second Generation, Generation 2.5, Overview of 3G & 4G, 3GPP and 3GPP2 standards, 5G Networks: Evolution from GSM, 5G Services & Applications.	**6**
Unit 2	**Android and Operating System** History of smart phones, Smart phone application, Android Hardware Development and debugging on android, Android IPC mechanism, Android OS ,Android security model, Android permission review, manifest permission, Intents, Broadcasts, Services, content providers, Android security tools .Introduction of Apple IOS.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 3	**Security of Mobile Networks** Security for Wi-Fi, Telecom, Personal Area Networks, Near Field Communications- Bluetooth, NFC .Android Application development, Development Tools, Application Runtime, Application. Basics, Authentication on WAP/Mobile HTML sites, Encryption, Application attacks, Browser weakness.	**6**
Unit 4	**Apple IOS security** Breaking out, Breaking In, Security testing, Application format, Permissions and user control, Local data storage, Networking, Push notification, copy/paste their IPC.	**5**
Unit 5	**4G LTE NETWORKS** 4G Vision, 4G features and challenges, Applications of 4G, 4G Technologies- Multi carrier modulation, Smart Antenna Techniques, OFDM- MIMO Systems, Adaptive Modulation and Coding with Time-Slot Scheduler, Bell Labs Layered Space Time (BLAST) System, Software-Defined Radio, Cognitive Radio.	**7**
Unit 6	**WiMAX Networks Wi Max** Introduction–IEEE802.16,OFDM, MIMO,IEEE802.20	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Evolution of Mobile Systems: Understand evolution from 1G to 5G
Tutorial No. 2	5G Networks & Applications: Analyze modern mobile communication
Tutorial No. 3	Android OS & Architecture: Understand Android system
Tutorial No. 4	Android IPC & Components: Apply Android communication concepts
Tutorial No. 5	Android Security Model: Analyze Android security
Tutorial No. 6	Mobile Network Security: Evaluate network security
Tutorial No. 7	Android Application Security: Understand application-level threats
Tutorial No. 8	iOS Security: Compare iOS security with Android

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Text Books:
1) John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition Pearson Publication.
2) Rajeev Ramaswamy and Kumar N Sivarajan,"Optical Networks: A Practical Perspective",2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An imprint of Elsevier).
3) Pallapa Venkataram, Satish Babu, Wireless and Mobile Network Security, First Edition, Tata McGraw Hill, 2010.
Reference Books:
1) Harold Kolimbris,"Fiber Optic Communication", 2nd Ed, 2004.
2) Uyless Black, "Optical Networks: Third Generation Transport Systems", 2nd Ed, 2009.
3) Govind Agarwal, "Optical Fiber Communications", 2nd Ed, 2004,TMH.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

SIGNAL PROCESSING ALGORITHMS & APPLICATIONS

Course Code and Course Title	**OETPE503C Signal Processing Algorithms & Applications**			
Semester	I			
Prerequisites	Engineering Mathematics I & II, Signal & Systems.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Analyze the time and frequency response of discrete time system.	**4**
CO2	Design digital filters for various applications.	**3**
CO3	Design FIR and IIR filters for various applications.	**3**
CO4	Understand the fundamentals of multirate signal processing and its application.	**2**
CO5	Understand signal representation in terms of dimension, orthogonality etc.	**2**
CO6	Analyze least square method for power spectrum estimation.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction** Review of discrete time signals and systems, Different transforms, Filtering, Use of DFT in linear filtering, Filtering of long data sequences, Spectrum, Algorithm for convolution and DFT.	**7**
Unit 2	**LTIDT System in Transform Domain and Digital Filter Structures** Simple Digital Filters, All Pass, Linear Phase and Minimum & Maximum phase and complementary transfer Functions. Basic FIR and IIR Digital Filter Structures, Linear Phase Structure IIR, FIR and All pass Lattice Structure.	**7**
Unit 3	**Design of Digital Filters** General consideration, Design of FIR filters, Design of IIR filters from Analog filters, Frequency transformations, Design of Digital Filters Based on Least-square Method. Spectral transformation of IIR Filters.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN0626901

Dr. S. S. Mohite
Director

Unit 4	**Multi-rate Signal Processing** Filter banks, Interpolators, Decimators, Polyphase decomposition, Analysis and synthesis, Orthogonal and orthonormal filter banks.	**6**
Unit 5	**Signal Representation** Representation of deterministic signals, orthogonal representation of signals, Dimensionality of signal spaces, Construction of orthogonal basis functions, Time bandwidth relationship, RMS duration and bandwidth, Uncertainty relations, Multi resolution Analysis and Wavelet Transform.	**5**
Unit 6	**Linear Prediction and Optimum Filter Design** Least square methods for system modelling, Adaptive filters, Power spectrum estimation.	**5**
	Total Hours	**36**

Tutorials	
Studcnts should complete minimum Eight Tutorials	
Tutorial No. 1	Discrete-Time Signals & Systems: Understand fundamentals of discrete-time signals and systems
Tutorial No. 2	Transforms & DFT: Apply transforms for signal analysis
Tutorial No. 3	Convolution & Filtering: Understand filtering techniques
Tutorial No. 4	Digital Filter Structures: Analyze filter structures
Tutorial No. 5	Design of FIR & IIR Filters: Design digital filters
Tutorial No. 6	Multirate Signal Processing: Understand sampling rate conversion
Tutorial No. 7	Signal Representation: Analyze signal space concepts
Tutorial No. 8	Linear Prediction & Adaptive Filters: Apply optimal filtering techniques

Text Books

1) Sanjit Mitra, Digital Signal Processing A Computer-Based Approach, Mc Graw Hill Education; 4th edition (1 July 2013).

2) Sanjit Mitra, Digital Signal Processing A Computer-Based Approach, Mc Graw Hill Education; 4th edition (1 July 2013).

Reference Books:

1) John G. Proakis, Dimitris G. Manolakis, Advanced Digital Signal Processing, Pearson Education India; 4th edition (1 January 2007).

2) P. Vaidyanathanm, Multi-rate systems and Filter Banks, Prentice Hall;1st edition (1 February 1993).

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

3) John D Proakis, Digital Signal Processing: Principles, Algorithms and Applications, Pearson Education; 4th edition (1 January 2014).
4) Simon O. Haykin, Adaptive Filter Theory, Pearson; 5th edition (June2, 2013).

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

ANALOG AND MIXED SIGNAL PROCESSING

Course Code and Course Title	**0ETPE503D Analog and Mixed Signal Processing**			
Semester	I			
Prerequisites	Engg. Mathematics I & II , Signal Processing			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes(COs): After completion of course student will be able to		**BL**
CO1	Distinguish between fundamental concepts of Analog and discrete time signal processing.	**4**
CO2	Design switched capacitor filters.	**3**
CO3	Demonstrate basics of Analog to digital data conversion.	**3**
CO4	Design Analog and digital PLLs.	**5**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Switched Capacitor Filters:** Introduction to Analog and Discrete Time signal processing, sampling theory, Nyquist and over sampling rates, Analog filters, analog amplifiers, lock in amplifiers.	**7**
Unit 2	**Switched Capacitor Circuits and Filters:** Analog integrated and discrete time switched capacitor filters, non-idealities in switched capacitor filters, architectures for switched capacitor filters and their applications and design. Switched capacitor amplifiers.	**6**
Unit 3	**Data converters:** Basics of data converters, Types of data converters, types of ADCs, Successive approximation, dual slope, Flash type, pipelined ADCs, hybrid ADCs, high resolution ADCs, parallel path ADCs like time-interleaved and multi-channel converters.	**7**
Unit 4	**Digital-to-Analog Converters and Performance Metrics :** Types of DACs and their architectures, binary weighted DACs. Performance metrics of data converters, SNR, SFDR, SNDR.	**5**
Unit 5	**Performance Enhancement Techniques in Data Converters:** Background and foreground techniques to improve performance of data converters, Green data converters (low power design).	**5**
Unit 6	**Frequency synthesizers and synchronization:** Analog PLLs, Digital PLLs design and architectures, Delay locked loops design and architectures. Direct Digital Synthesis.	**6**
	Total Hours	**36**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Basics of Signal Processing & Sampling: Understand analog and discrete-time signal fundamentals
Tutorial No. 2	Analog Filters and Amplifiers: Analyze analog signal processing components
Tutorial No. 3	Switched Capacitor Circuits: Understand SC circuits and operation
Tutorial No. 4	Switched Capacitor Filters & Non-Idealities: Analyze SC filter design
Tutorial No. 5	Analog-to-Digital Converters (ADC):Understand ADC types and working
Tutorial No. 6	Performance Enhancement & Low Power Design: Evaluate advanced design techniques
Tutorial No. 7	Digital-to-Analog Converters & Metrics:Analyze DAC and performance
Tutorial No. 8	Frequency Synthesizers & Synchronization: Understand PLL and DDS systems

Text Books:

1) R.Jacob Baker,CMOS mixed-signal circuit design, Wiley-IEEE Press;1st edition (May 1, 2002)
2) R. Jacob Baker, Switched-Current Signal Processing and A/D Conversion Circuits: Design and Implementation, Wiley India IEEE press 2008.
3) Andrzej Handkiewicz, Mixed Signal Systems: a guide to CMOS circuit design, Wiley-IEEE Press; 1st edition (23 August 2002).

Reference Books:

1) Walt Kester, Mixed Signal and DSP Design techniques, Engineering Analog Devices Inc, Engineering Analog Devices Inc, Publisher Newnes.
2) Bar-Giora Goldberg, Digital Frequency Synthesis Demystified, Published by Elsevier.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

MULTIRATE DIGITAL SIGNAL PROCESSING

Course Code and Course Title	**0ETPE504A Multirate Digital Signal Processing**			
Semester	I			
Prerequisites	Signal & Systems			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COS): After completion of course student will be able to		**BL**
CO1	Develop efficient realizations for up sampling and down sampling of signals using the poly phase decomposition.	**3**
CO2	Design and implement Finite Impulse Response(FIR) and Infinite Impulse Response (IIR) digital filters to meet specifications.	**3**
CO3	Design digital filter banks based on the techniques presented.	**3**
CO4	Analyze fundamental concepts of wavelets.	**4**
CO5	Distinguish between wavelets and multirate filter banks, from the point of view of implementation.	**2**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Fundamentals of Multi-rate Systems** Introduction, Basic multi-rate operations, Interconnection of building blocks, Polyphase representation, Multistage implementation, Some application of multi-rate systems, Special filter, and filter banks.	**7**
Unit 2	**Maximally Decimated Filter Banks** Introduction, Errors created in the QMF bank, a simple alias free QMF system, Power symmetric QMF banks, M-channel filter banks, Polyphase representation, Perfect reconstruction system, alias free filter banks, Tree structured filter banks, Trans multiplexer.	**7**
Unit 3	**Para unitary Perfect Reconstruction Filter Banks** Introduction, Lossless transfer matrices, Filter banks properties induced by paraunitariness, Two channel FIR paraunitary QMF banks, Two channel paraunitary QMF lattice, M-channel FIR paraunitary filter banks, Transform coding and LOT.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 4	**Linear Phase and Cosine Modulated Filter Banks** Introduction, Some necessary conditions, Lattice structure for linear phase FIR PR banks, formal synthesis of linear phase FIR PR QMF Lattice. Pseudo QMF banks, Design of the pseudo QMF bank, Efficient polyphase structure, Cosine modulated perfect reconstruction system.	**6**
Unit 5	**The Wavelet Transform and its Relation to Multi-rate Filter Banks** Introduction, Background and outline, Short time Fourier transform, The Wavelet transform, DT orthonormal Wavelets, Continuous time orthonormal Wavelet basis.	**5**
Unit 6	**Multidimensional, Multivariable and Lossless Systems** Introduction, Multidimensional signals, Sampling multidimensional Signals, Multi-rate fundamentals. Review of discrete time multi-input multi-output LTI System, Paraunitary and lossless system.	**5**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Fundamentals of Multi-rate Systems: Understand basic multi-rate operations
Tutorial No. 2	Polyphase Representation & Multistage Implementation: Analyze efficient structures
Tutorial No. 3	Filter Banks Basics: Understand filter bank concepts
Tutorial No. 4	Maximally Decimated Filter Banks (QMF): Analyze QMF systems
Tutorial No. 5	Perfect Reconstruction & Polyphase Systems: Study PR filter banks
Tutorial No. 6	Paraunitary Filter Banks: Understand paraunitary systems
Tutorial No. 7	Linear Phase & Cosine Modulated Filter Banks: Analyze advanced filter banks
Tutorial No. 8	Wavelets & Multidimensional Systems: Understand wavelets and advanced systems

Text Books:

1) P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson College Div;1st edition (January 1, 1992).
2) N. J. Fliege, Multirate Digital Signal Processing, Wiley (January13,2000).

Reference Books:

1) Raghuveer Rao, Ajit Bopardikar, Wavelet Transforms Introduction to Theory and Application, Longman Pub Group; Har/Dskt edition (January 1, 1998).
2) C. Sidney Burrus, R.A. Gopianath, Introduction to wavelet and wavelet Transform, Pearson; 1st edition (August 14, 1997).

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

SYSTEM ON-CHIP

Course Code and Course Title	**0ETPE504B System On-Chip**			
Semester	I			
Prerequisites	Embedded Systems			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Interpret nature of hardware and software, its dataflow modelling and implementation techniques.	**3**
CO2	Analyze the micro-programmed architecture of cores and processors.	**4**
CO3	Demonstrate system on chip design models.	**2**
CO4	Hypothesize and synthesize working of advanced embedded systems.	**3**
CO5	Develop sign SOC controller.	**4**
CO6	Design, implement and test SOC model.	**3**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Basic Concepts:** The nature of hardware and software, data flow modelling and implementation, the need for concurrent models, analyzing synchronous data flow graphs, control flow modelling and the limitations of data flow models, software, and hardware implementation of data flow, analysis of control flow and data flow, Finite State Machine with data-path, cycle-based bit parallel hardware, hardware model, FSMD data-path, simulation and RTL synthesis, language mapping for FSMD.	**7**
Unit 2	**Micro-programmed Architectures:** Limitations of FSM, Micro-programmed: control, encoding, data-path, Micro-programmed machine implementation, handling Micro-program interrupt and pipelining, General purpose embedded cores, processors, The RISC pipeline, program organization, analyzing the quality of compiled code.	**7**
Unit 3	**System on Chip:** Concept, design principles, portable multimedia system, SOC modelling, hardware/software interfaces, synchronization schemes, memory mapped Interfaces, coprocessor interfaces, coprocessor control shell design, data, and control design, Programmers model.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Unit 4	**RTL Intent:** Simulation race, simulation-synthesis mismatch, timing analysis, timing parameters for digital logic, factors affecting delay and slew, sequential arcs, clock domain crossing, bus synchronization, preventing data loss through FIFO, Importance of low power, causes and factors affecting power, switching activity, simulation limitation, implication on synthesis and on backend.	**6**
Unit 5	**Research Topics in SOC Design:** A SOC controller for digital still camera, multimedia IP development image and video CODECS	**5**
Unit 6	**SOC Memory System Design:** Embedded software, and energy management techniques for SOC design, SOC prototyping, verification, testing and physical design.	**5**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Hardware–Software Concepts & Data Flow Modeling: Understand interaction between hardware and software
Tutorial No. 2	Control Flow & FSMD Modeling: Analyze FSMD and control flow
Tutorial No. 3	RTL Design & Simulation: Understand RTL modeling and synthesis
Tutorial No. 4	Micro-programmed Architectures: Understand micro-program control
Tutorial No. 5	Embedded Processors & RISC Pipeline: Analyze processor architecture
Tutorial No. 6	System-on-Chip (SoC) Design: Understand SoC concepts and interfaces
Tutorial No. 7	RTL Issues, Timing & Power: Analyze practical RTL design challenges
Tutorial No. 8	Advanced SoC Topics & Research: Explore advanced and research-level concepts

Text Books:

1) Patrick R. Schaumont, A Practical Introduction to Hardware/Software Co-design, Springer; 1st Edition. (9 September 2010).
2) Sanjay Churiwala, Sapan Garg, Principles of VLSIRTL Design a Practical Guide, Springer; 2011th edition (1 October 2014).

Reference Books:

1) Youn Long Steve Lin, Essential Issues in SOC Design, Designing Complex Systems-on-Chip, Springer; 2006th edition (31 May 2007).

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON, An Autonomous, EN06269, Institute

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

OPTICAL NETWORKS

Course Code and Course Title	**0ETPE504C Optical Networks**			
Semester	I			
Prerequisites	Engg. Physics, Computer Networking.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the fundamentals of optical fiber technology including ray propagation, numerical aperture, and basic dispersion mechanisms.	**2**
CO2	Analyze the propagation of light in optical fibers using ray theory and electromagnetic (modal) analysis, including TE, TM, and hybrid modes.	**4**
CO3	Evaluate the characteristics of single-mode and multimode fibers, including V-parameter, mode cutoff, and power confinement.	**5**
CO4	Explain and compare step-index and graded-index fibers, including modal analysis, WKB approximation, and optimum refractive index profiles.	**4**
CO5	Describe various fiber fabrication techniques (OVD, VAD, MCVD, etc.) and components such as splices, connectors, and fiber cables.	**2**
CO6	Analyze different loss mechanisms and dispersion effects in optical fibers and their impact on signal transmission and bandwidth.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction and Importance of Fiber Optics Technology:** Ray analysis of optical fiber: Propagation mechanism of rays in an optical fiber, Meridional rays, Skew rays, Fiber numerical aperture, dispersion.	**5**
Unit 2	**Electromagnetic (modal) Analysis of Step Index Multimode Fibers:** Wave equation and boundary conditions, Characteristics equation, TE, TH and Hybrid modes, Weakly guiding approximation, linearly polarized modes, Single mode fiber, V parameter, Power confinement and mode cutoff, Mode field diameter.	**7**
Unit 3	**Graded-Index Fiber & Fiber Fabrication:** Modal analysis of graded index fiber, WKB analysis, Optimum profile. Experimental techniques in fiber optics: Fiber fabrication (OVD, VAD, CVD, MCVD, PMCVD etc.) and characterization, Splices, Connectors, and fiber cable.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 4	**Loss Mechanism in Optical Fiber:** Absorption loss, scattering loss, bending loss, splice loss. Pulse propagation, Dispersion and chirping in single mode fibers: Pulse propagation in nondispersive and dispersive medium, Pulse broadening and chirping, Group, and phase velocity, Intermodal and intramodal dispersion, Group velocity (material and waveguide) dispersion, Higher order dispersion, Fiber bandwidth.	**6**
Unit 5	**Dispersion Compensation Mechanism:** Dispersion tailored and dispersion compensating fibers, Fiber Birefringence and polarization mode dispersion, Fiber bandwidth, Nonlinear effects in optical fiber: Stimulated Raman Scattering, Stimulated Brillouin Scattering, Self-Phase Modulation, Cross Phase Modulation, Optical Solutions.	**6**
Unit 6	**Fiber Based Devices:** Erbium-doped fiber amplifiers and lasers, Fiber Bragg gratings, Optical Fiber Sensors. Photonic Crystal fibers.	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Fundamentals of Optical Fiber: Understand basics of fiber optics
Tutorial No. 2	Ray Analysis in Optical Fiber: Analyze ray propagation
Tutorial No. 3	Modal Analysis of Step Index Fiber: Understand electromagnetic theory
Tutorial No. 4	Single Mode Fiber & V-Parameter: Analyze single-mode operation
Tutorial No. 5	Graded Index Fiber & Fabrication: Understand fiber types and manufacturing
Tutorial No. 6	Loss Mechanisms & Dispersion: Analyze losses and signal distortion
Tutorial No. 7	Dispersion Compensation & Nonlinear Effects: Evaluate advanced fiber effects
Tutorial No. 8	Fiber-Based Devices: Understand optical devices and applications

Text Books:
1) G. P. Agarwal, Fiber Optic Communication Systems, John Wiley Sons (1997).
2) John A. Buck, Fundamentals of Optical Fibers, Wiley Interscience, (2004).
3) J. M. Senior, Optical Fiber Communication, Prentice Hall (1999).

Reference Books:
1) G .Keiser, Optical Fiber Communications, McGraw Hill (2000).
2) K. Okamoto, Fundamentals of Optical Waveguides, Academic Press,(2000).
3) K. Iizuka, Elements of Photonics Vol I&II, Wiley-Interscience(2002).
4) D. W. Prather et.al, Photonic Crystal, Wiley (2009).

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

STATISTICAL SIGNAL PROCESSING

Course Code and Course Title	**0ETPE504D Statistical Signal Processing**			
Semester	I			
Prerequisites	Signals & Systems, Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the fundamentals of random signals, random variables, stochastic processes, and estimation principles.	**2**
CO2	Analyze discrete-time stochastic processes and develop statistical models such as AR, MA, and ARMA, including correlation and power spectral density.	**4**
CO3	Apply concepts of optimum linear filtering and linear prediction for signal estimation and system modeling.	**3**
CO4	Analyze algorithms and structures for optimum filters including Levinson-Durbin, lattice structures, and Kalman filtering techniques.	**4**
CO5	Apply least squares estimation techniques using normal equations, orthogonalization, and SVD methods for signal processing problems.	**3**
CO6	Evaluate adaptive filtering techniques such as LMS, RLS, and sub-band adaptive filters for real-time signal processing applications.	**5**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction:** Random Signals, Spectral Estimation, Adaptive Filtering, Random Variables, Distribution and Density Functions, Random Vectors: Definition, Transformation and Linear Combination of Random Vectors Linear System with Stationary Input, Innovations and Representation of Real Vectors, DT Stochastic Process: Stationary, Ergodicity and Frequency Domain Representation of SP, Principles of Estimation.	**6**
Unit 2	**Stochastic Processes and Models:** Characterization of DT Stochastic Process, Correlation Matrix, Properties of Correlation Matrix, Stochastic Models: MA and AR Models, ARMA Models Hold Decomposition, Asymptotic Stationarity of AR Process, Yule Walker Equations, Power Spectral Density, Properties of Power Spectral Density Transmission of Stationary Process Through a Linear Filter, Other Statistical Characteristics of Stochastic Process Power Spectral Estimation, Spectral Correlation Density, Polyspectra.	**7**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 3	**Optimum Linear Filters:** Optimum Signal Estimation, Linear Mean Square Estimation, Solution of Normal Equations, Optimum FIR Filters, Linear Prediction: Linear Signal Estimation, Forward Linear Estimation, Backward Linear Estimation, Stationary Processes and Properties, Optimum IIR Filters, Inverse Filtering and Deconvolution.	**6**
Unit 4	**Algorithms and Structures for Optimum Filters:** Fundamentals of Order-Recursive Algorithms, Interpretation of Algorithmic Quantities, Order-Recursive Algorithms for Optimum FIR Filters, Algorithms of Levinson and Levinson-Durbin, Lattice Structure for Optimum Filters, Schur Algorithm, Triangular-zation and Inverse of Toeplitz Matrices, Kalman Filter Algorithm.	**6**
Unit 5	**Least Square Filtering:** Principle of LS, Linear Least Square Error Estimation, Least Square Filter, Linear Least Square Signal Estimation, LS Computation using Normal Equations, LS Computation using Orthogonalization Techniques, LS Computation using Singular Value Decomposition Techniques, Problems.	**5**
Unit 6	**Adaptive Filtering:** Introduction, Typical Applications, Principles of Adaptive Filters, Method of Steepest Decent, LMS Algorithm, RLS Adaptive Filter, Fast RLS Algorithms for FIR Filtering, Frequency Domain and Sub-band Adaptive Filters.	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Random Variables & Random Signals: Understand fundamentals of randomness in signals
Tutorial No. 2	Stochastic Processes: Analyze stochastic processes
Tutorial No. 3	Correlation & Spectral Analysis: Understand correlation and PSD
Tutorial No. 4	Stochastic Models (AR, MA, ARMA): Develop signal models
Tutorial No. 5	Optimum Linear Filtering: Apply estimation techniques
Tutorial No. 6	Algorithms for Optimum Filters: Understand efficient algorithms
Tutorial No. 7	Least Square Estimation: Apply LS methods
Tutorial No. 8	Adaptive Filtering: Evaluate adaptive algorithms

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Text Books:
1) S. Haykin, Adaptive Filter Theory, 4th edition, Pearson Education India (1 January 2008).
Reference Books:
1) D. G. Manolakis, V.K. Ingle, S.M. Kogon; Statistical and Adaptive Signal Processing; Artech House Publishers (31 May 2005).

PVP INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. M. S. Chavan	**Dr. K. K. Pandyaji**	**Dr. S. S. Mohite**
HoD	**Dean Academics**	**Director**

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

SEMINAR I

Course Code and Course Title	**0ETEL552 Seminar I**		
Semester	I		
Prerequisites	-		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	4
Credits	02		
Evaluation Scheme	**ISE**	**ESE**	
	50 Marks	-	

	Course Outcomes (COs): - After completion of course student will be able to	**BL**
CO1	Identify and select a recent research topic in the relevant domain through comprehensive literature survey.	**4**
CO2	Analyze and synthesize information from research papers, journals, and technical resources to understand current trends and challenges.	**4**
CO3	Prepare a structured technical report and presentation following standard scientific writing formats.	**3**
CO4	Demonstrate effective oral communication and presentation skills using appropriate tools (PPT, graphs, visuals).	**3**
CO5	Critically evaluate research work and answer technical queries with logical reasoning.	**5**
CO6	Exhibit professional ethics, independent learning, and ability to engage in lifelong learning.	**3**

Contents	**Hrs.**
1. Identify emerging topics in Electronics & Telecommunication. 2. Analyse research literature in E&TC domains. 3. Prepare technical reports and presentations using standard formats. 4. Demonstrate effective technical communication skills. 5. Evaluate and defend research findings. 6. Develop research aptitude, ethics, and lifelong learning skills.	-

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

PVP Institute of Technology, Budhgaon, An Autonomous Institute, EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's
PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI
An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M.Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

YOGA FOR STRESS MANAGEMENT

Course Code and Course Title	**0ETAC553 YOGA for Stress Management**			
Semester	I			
Prerequisites	-			
Teaching Scheme(hours per week)	**Lecture**	**Tutorial**	**Practical**	
	-	-	2	
Credits	**Audit**			
Evaluation Scheme	**ISE1**	**MSE**	**ISE2**	**ESE**
	-	-	-	-

Course Outcomes(COs): After completion of course student will be able to		**BL**
CO1	Recognize the signs and sourcesof stress, understanding its effects on mental and physical well-being.	**3**
CO2	Master a variety of yoga techniques, including postures, breathing, and meditation to Effectively manage stress.	**3**
CO3	Acquire relaxation strategies that promote calmness, reduce anxiety, and enhance overall mental clarity.	**3**
CO4	Incorporate healthy habits inspired by yoga principles to foster better sleep, nutrition, and self-care routines.	**2**
CO5	Develop practical skills to navigate and cope with stress, enhancing emotional balance And promoting a more harmonious life.	**3**

Course Contents

Practical No.	**Contents**	**Hrs.**
Practical 1	**Introduction to Yoga for Stress Management** 1. Introduction toYoga for Stress Management 2. Stress according toWestern perspective,Stress Eastern Perspective Developmental process: Western and Eastern Perspective, Stress Hazards and Yoga.	**2**
Practical 2	**Meeting the challenges of Stress** 1. Meeting the challenges of Stress 2. Introduction to Stress Physiology: Stress, Appetite and Dietary management- Modern and Yogic perspective. Sleep and Stress: Understanding the relationship for effective management of stress.	**2**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Practical 3	**Stress Assessment methods-a valuable tool toward stress management** Role of Yoga in prevention and management of stress related disorders-asummary of research evidence. Concept of stress and its management-perspectives from PatanjaliYogaSutra-Part1 Concept of stress and its management-perspectives from Patanjali YogaSutra- Part 2 Concept of stress and its management-perspectives from Patanjali Yoga Sutra- Part 3	2
Practical 4	Concept of stress and its management-perspectives from Bhagavad Gita–Part1 Concept of stress and its management-perspectives from Bhagavad Gita-Part2 Concept of stress and its management- perspectives from Bhagavad Gita- Part 3	2
Practical 5	**Bio-Psycho-Socio-Spiritual model of stress management Yoga Practices for Stress Management** Breathing practices–1 Hands in and oubt breathing, Hands stretch breathing, Ankle stretch breathing Breathing practices – 2 Dog Breathing, Rabbit breathing, Tiger breathing,Sashank asana breathing Breathing practices – 3 Bhujangasana breathing, ArdhaShalabhasana breathing(alternatelegs), Straightleg raising (alternate legs), Straight leg raising (bothlegs), Set hub and hasanalumbar stretch, Instant Relaxation Technique (IRT). Loosening Practices–1 Shoulder Rotation, Sidebending, standingtwist, Hiprotation, Thighstrengthening Loosening practices – 2 Chakkichalan, Bhunamasana Chalana, Alternative to etouching Loosening practices – 3 Sidelegraising, Pavanamuktasanakriya: Windre leasing pose movements,Quick Relaxation Technique (QRT)	2
Practical6	**Asanapractices** Asanapractices–1 Tadasana,ArdhakatiChakrasana,ArdhaChakrasana,Trikonasana,Vrikshasana Asana practices – 2 Vakarasana, JanuSirshasana, Ushtrasana, Sashankasana, Asana practices – 3 Ardhamatseyndrasana, Paschimottanasana, Poor vottanasana, Gomukhasana Asanapractices–4 Makarasana, Bhujangasana, SalambhaShalabahasana, Dhanurasana Asana practices – 5 Setubandhasana,Sarvangasana,Mastyasana,DeepRelaxationTechnique(DRT) Soorya Namaskar Pranayama–1 Kapalbhati kriya and Sectional Breathing Pranayama – 2 Nadishuddhi Pranayama Pranayama – 3 Bhramari, Sheetali, Sitkariand UjjayiOmMeditation Cyclic Meditation Integrated Yoga Module I IntegratedYogaModule II IntegratedYogaModuleIII	2
	Total Hours	12

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

TextBooks:
1) HRNA gendra and R. Nagarathna.Yoga for Promotion of Positive Health. Swami Vivekananda Yoga Prakashana. 2011.
2) Contrada, R.,&Baum, A.(Eds.), The handbook of stress science: Biology, psychology, and health. Springer Publishing Company. 2010
3)Al'Absi,M.(Ed.). Stress and addiction: Biological and psychological mechanisms. Elsevier.2011.
ReferenceBooks:
1)VandenBergh, O.Principles,and practiceof stress management.Guilford Publications. 2021.
2)Swami Mukti bodhananda, HathaYoga Pradipika,Bihar Scool of Yoga,1998.
3)Swami Satyananda Saraswati, Four Chapter sonFreedom, Bihar School of Yoga,1975.
4)Swami Tapasyananda,Srimad Bhagavat Gita, Sri Ramakrishna Math,2012.

NPTELPlatform:

NPTELCourse	Nameof Instructor	HostInstitute	Link
Yoga for Stress Management	Dr.H.R.Nagendra, Dr.Mithila M V, Dr. Rajesh Nair	Swami Vivekananda Yoga Anusandhana Samsthana	https://onlinecourses.swayam2.ac.in/aic23_ge10/preview#:~:text=In%20this%20course%20we%20intend,meeting%20the%20challenges%20of%20stress

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

ESTIMATION AND DETECTION THEORY

Course Code and Course Title	**0ETPC505 Estimation and Detection Theory**			
Semester	**II**			
Prerequisites	Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Apply concepts of linear algebra including vector spaces, linear transformations, eigenvalues, and orthogonalization methods in engineering problems.	**3**
CO2	Analyze inner product spaces, orthonormal bases, and matrix transformations, including change of basis and unitary/orthogonal transformations.	**4**
CO3	Interpret and model stochastic processes and Gauss-Markov models for signal representation and system analysis.	**4**
CO4	Apply binary decision theory using criteria such as Maximum Likelihood, Neyman-Pearson, Bayes risk, and Minimax for single observation problems.	**3**
CO5	Analyze decision-making with multiple observations, including Gaussian models and signal detection in noise.	**4**
CO6	Evaluate multiple decision and composite hypothesis testing techniques, including nonparametric tests such as Sign test and Wilcoxon test.	**5**
Unit No.	**Contents**	**Hrs.**
Unit 1	**Linear Algebra:** Vector space : linear dependence, Basis and dimension, vector subspace, inner product spaces, orthonormal basis and Gram- Schmidt Process of orthogonalisation, computation of linear dependence, linear transformation and matrices, change of basis, orthogonal and unitary transformation, Eigen value, Eigen vectors and characteristics equation. Systems theory, stochastic processes, Gauss Markov models, representation of stochastic processes, likelihood and sufficiency.	**8**
Unit 2	**Binary Decision: Single Observation:** Introduction to structure of decision and estimation problems. Maximum Likelihood decision criteria, Neyman-person criterian, Probability of error criterian, Bays risk Criteria, Min Max criteria, problems.	**7**
Unit 3	**Binary Decision: Multiple Observations:** Vector observation, The general Gaussian problem, Waveform observations and additive Gaussion noise, problems.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Unit 4	**Multiple Decisions: Multiple Decision:** Bays risk, Probability of error: General case, Probability of error: Gaussian case, Ensure decision problems.	**5**
Unit 5	**Composite and Nonparametric Decision Theory:** Composite decisions Sign test, Wilason test, problems.	**5**
Unit 6	**Fundamentals of Estimation:** Maximum likelihood method, Bays cost method, Relationship of Estimation, Linear minimum Variance and Least-square methods. Properties of Estimations: Unbiased estimators, efficient estimators, Asymptotic properties.	**5**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Vector Spaces & Linear Dependence: Understand fundamentals of vector spaces
Tutorial No. 2	Inner Product Spaces & Orthogonalization: Apply orthogonalization techniques
Tutorial No. 3	Linear Transformations & Eigen Analysis: Analyze transformations and eigen properties
Tutorial No. 4	Stochastic Processes & Gauss-Markov Models: Understand probabilistic signal models
Tutorial No. 5	Binary Decision Theory (Single Observation): Apply decision criteria
Tutorial No. 6	Binary Decision (Multiple Observations): Analyze detection with multiple inputs
Tutorial No. 7	Multiple Decision Theory: Evaluate multi-hypothesis problems
Tutorial No. 8	Composite & Nonparametric Decision Theory: Apply advanced decision techniques

Text Books
1) James Melsa and David Cohn, Decision and Estimation Theory, Mc-Graw Hill
Reference Books:
1) Harry L,Van Trees, Detection, Estimation, and Modulation Theory, John Wiley and Sons Inc.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

INFORMATION THEORY AND CODING

Course Code and Course Title	**0ETPC506 Information Theory and Coding**			
Semester	**II**			
Prerequisites	Engg. Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO): After completion of course student will be able to		**BL**
CO1	Apply concepts of probability theory and random variables to analyze statistical properties of communication signals.	**3**
CO2	Analyze random processes, including power spectral density and transmission through linear systems for signal modeling.	**4**
CO3	Evaluate the impact of noise in analog and digital communication systems and apply appropriate noise analysis techniques.	**5**
CO4	Apply principles of information theory, including entropy, mutual information, and channel capacity in communication systems.	**3**
CO5	Analyze and design error detecting and correcting codes such as block, cyclic, and convolutional codes for reliable communication.	**4**
CO6	Evaluate various speech coding techniques including LPC, vocoders, and mobile codecs for efficient transmission of speech signals.	**5**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Theory of Probability and Random Processes:** Concept of probability, Random variables, Probability models, Statistical averages, Central limit theorem, Correlation, Linear mean square estimation.	**7**
Unit 2	**Random Processes:** Random variable and random process, Power spectral density of a random process, Multiple random processes, Transmission of random processes through linear systems, Band-pass random processes, Optimum filtering.	**7**
Unit 3	**Noise in Communication Systems:** Behaviour of analog and digital communication systems in the presence of noise, Sources of noise, Noise representation, Noise filtering, Noise bandwidth, Performance of analog and digital communication systems in the presence of noise.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. Institute of Technology, Budhgaon, An Autonomous Institute, EN06269

Dr. S. S. Mohite
Director

Unit 4	**Information Theory:** Measure of information, Joint entropy and conditional entropy, Relative entropy and mutual information, Markov sources, Source encoding, Shannon-Fano coding and Huffman coding, Shannon's first and second fundamental theorems, Channel capacity Theorem.	**6**
Unit 5	**Error Correcting Codes:** Galois fields, Vector spaces and matrices, Block codes, Cyclic codes, Burst-error Detecting and correcting codes, Multiple error correcting codes, Convolutional codes, ARQ Performance of codes, Comparison of coded and un-coded systems.	**5**
Unit 6	**Speech Coding:** Characteristics of speech signal, Quantization techniques, Frequency domain coding, Vocoders, Linear predictive coders, Codecs for mobile communication, GSM codec, USDC codec, Performance evaluation of speech coders	**5**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Probability & Random Variables: Understand fundamentals of probability
Tutorial No. 2	Statistical Measures & Estimation:
Tutorial No. 3	Random Processes: Analyze random processes
Tutorial No. 4	Noise in Communication Systems: Understand noise effects
Tutorial No. 5	Information Theory: Apply information measures
Tutorial No. 6	Source Coding Techniques: Understand data compression
Tutorial No. 7	Error Control Coding: Analyze coding techniques
Tutorial No. 8	Speech Coding: Evaluate speech processing techniques

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Text Books
1) B. P. Lathi; Modern Digital and Analog Communication Systems; Oxford Publication.
2) Das, Mullick, Chaterjee; Principles of Digital Communication; New Age International.
3) Taub, Schilling, Principles of Communication Engineering (2nd Edition); TMH.
Reference Books:
1) Thomas M. Cover, Joy A. Thomas, Elements of Information Theory; Wiley Inter science.
2) R. P. Singh, S. D. Sapre; Communication systems: Analog and Digital; TMH.
3) Theodore S. Rappaport; Wireless Communication: Principles and Practice (2nd Edition); Pearson India.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

EMBEDDED SYSTEM DESIGN

Course Code and Course Title	**0ETPE507A Embedded System Design**			
Semester	**II**			
Prerequisites	**Digital Design, Microprocessor**			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Understand fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.	**2**
CO2	Analyze a wide competence from different areas of processor for deep understanding analyze case study of Pentium processor.	**4**
CO3	Demonstrate architecture of 8051, Instruction set, addressing modes.	**4**
CO4	Analyze deep state-of-the-art theoretical knowledge in the areas of real-time systems, artificial intelligence.	**4**
CO5	Analyze a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Fundamentals of Embedded System:** Embedded System overview, Design challenges, Processor Technology, IC Technology, Design Technology.	**6**
Unit 2	**Embedded System Hardware:** Evaluation of Processors, Microprocessor architecture overview- CISC and RISC, Case study of Pentium processor architecture.	**5**
Unit 3	**Microcontroller Architecture and Interfacing:** Architecture of 8051, Instruction set, Addressing modes, Programming Examples. Interfacing of LED/LCD, keyboard, stepper motor, ADC/DAC and sensors, RTC, serial communication with micro-controller.	**6**
Unit 4	**Study of Semiconductor Memory:** Memory device characteristics, SRAM, DRAM, SSRAM, SDRAM, RDRAM,FLASH, Smart card memory and interfacing of memory with micro-controller.	**6**

Dr. M. S. Chavan	**Dr. K. K. Pandyaji**	**Dr. S. S. Mohite**
HoD	**Dean Academics**	**Director**

Unit 5	**Introduction to DSP Processors:** Architecture, features, instruction set, typical applications (TMS320XXorADSP21010).	**6**
Unit 6	**Embedded Software and Applications:** Introduction to software Engineering, C cross compiler, Computational models, FSM, Concurrent state model, Concurrent Processes, Communication among processes, synchronization among processes. Introduction to RTOS: Windows CE, VX works. Applications: Network protocols- TCP/IP, Embedded Ethernet, CANBUS,I2C bus, Mod Bus, Digital Camera.	**7**
	Total Hours	**36**

Text Books :

1) Frank Vahid and Tony Givargis, Embedded System Design A Unified Hardware/Software Introduction‖, Wiley; 1. Edition (24 Oct. 2001).
2) M. A. Mazidi andJ.G.Mazidi,The 8051Microcontroller and Embedded System‖ Pearson Education Asia, 2000

Reference Books:

1) K. J. Ayala, The 8051 Micro-controllers‖, Cengage India; 3rd edition (8 Nov.2007).
INTEL Microcontroller Manual
2) J. Zimmermann: Fuzzy set theory and its applications, second edition, Allied Publishers limited, New Delhi, 1996.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

RF AND MILLIMETER WAVE CIRCUIT DESIGN

Course Code and Course Title	**0ETPE507B RF And Millimeter Wave Circuit Design**			
Semester	II			
Prerequisites	Antenna Wave Propagation, Engg. Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Apply fundamentals of RF systems, transmission media, and impedance matching techniques using passive RLC networks.	**3**
CO2	Analyze passive IC components and MOS device characteristics, including effects such as interconnect parasitic and skin effect in RF design.	**4**
CO3	Analyze distributed systems and transmission line behavior, including reflection coefficient, wave propagation, and Smith chart applications.	**4**
CO4	Evaluate noise performance in RF circuits and design low noise amplifiers (LNA) and mixers considering noise figure and matching conditions.	**5**
CO5	Design RF power amplifiers, oscillators, and phase-locked loops (PLLs) for communication systems.	**3**
CO6	Analyze and evaluate frequency synthesis techniques, phase noise, and radio architectures (GSM, CDMA, UMTS) for modern wireless systems.	**5**

Course Contents

Unit No.	**Contents**	**Hrs**
Unit 1	**RF Systems:** Basic architectures, Transmission media and reflections, Maximum power transfer. Passive RLC Networks: Parallel RLC tank, Q, Series RLC networks, Matching, Pi match, T match.	**7**
Unit 2	**Passive IC Components:** Interconnects and skin effect, Resistors, capacitors, Inductors. Review of MOS, Device Physics: MOS device review.	**6**
Unit 3	**Distributed Systems:** Transmission lines, reflection coefficient, The wave equation, Examples Lossy transmission lines, Smith charts – plotting, gamma.	**6**
Unit 4	**Noise:** Thermal noise, flicker noise review, Noise figure, LNA Design: Intrinsic MOS noise, Parameters Power match versus noise match, large signal performance, design examples & Multiplier based mixers, Mixer Design: Sub sampling mixers	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 5	**RF Power Amplifiers**: Class A, AB, B, C, Amplifiers Class D, E, F amplifiers RF Power amplifier design examples. Voltage controlled oscillators: Resonators, Negative resistance oscillators, Phase locked loops: Linearized PLL models, Phase detectors, charge pumps, Loop filters, PLL design examples.	**6**
Unit 6	**Frequency synthesis and oscillators:** Frequency division, integer-N synthesis Fractional, frequency synthesis. Phase noise: General considerations, Circuit examples. Radio Architectures GSM radio architectures: CDMA, UMTS radio architecture.	**5**
	Total Hours	**36**

Text Books:
1) The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge University Press, 2004.
Reference Books:
1) RF Microelectronics by Behzad Razavi. Pearson PrenticeHall;2ndedition(22 September 2011).

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

WIRELESS SENSOR NETWORK

Course Code and Course Title	**0ETPE507C Wireless Sensor Network**			
Semester	**II**			
Prerequisites	Computer Network, Communication Engineering			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COS): After completion of course student will be able to		**BL**
CO1	Understand the fundamentals of Wireless Sensor Networks, including architecture, hardware components, characteristics, and enabling technologies.	**2**
CO2	Analyze WSN network architectures, design principles, and physical layer considerations for efficient communication.	**4**
CO3	Evaluate various MAC protocols and routing techniques (e.g., SMAC, BMAC, IEEE 802.15.4, ZigBee) for energy-efficient sensor networking.	**5**
CO4	Analyze operating systems and execution environments for WSN such as TinyOS, Contiki, SOS, and LiteOS, including their functional aspects.	**4**
CO5	Apply infrastructure establishment techniques including topology control, clustering, synchronization, localization, and sensor tasking in WSNs.	**3**
CO6	Analyze and implement WSN platforms and tools, including sensor node hardware, programming models, and simulation environments.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Overview of Wireless Sensor Networks:** Single Node Architecture, Hardware Components, Network Characteristics, unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks, Types of wireless sensor networks.	**7**
Unit 2	**Architectures:** Network Architecture, Sensor Networks-Scenarios-Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments introduction to Tiny OS and Nes C Internet to WSN Communication.	**7**
Unit 3	**Networking Sensors:** MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts- SMAC,BMAC Protocol, IEEE 802.15.4 standard and Zig Bee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy Efficient Routing, Geographic Routing.	**6**
Unit 4	**Operating Systems:** Functional and non-functional Aspects short overview of prototypes-Tiny OS, SOS	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

	Contiki, Lite OS, sensor grid.	
Unit 5	**Infrastructure Establishment:** Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.	**5**
Unit 6	**Sensor Network Platforms And Tools:** Sensor Node Hardware- Berkeley Motes, Programming Challenges, Node level software platforms, Node level Simulators, State centric programming.	**5**
	Total Hours	**36**

Text Books:

1) Holger Karl & Andreas Willing, "Protocols And Architectures for Wireless Sensor Networks", John Wiley,2005.
2) Feng Zhao & Leonidas J.Guibas, "Wireless Sensor Networks An Information Processing Approach", Elsevier, 2007.
3) Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley & Sons Publications,2011

Reference Books:

1) Kazem Sohraby, Daniel Minoli, &Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", JohnWiley, 2007.
2) Anna Hac, "Wireless Sensor Network Designs",John Wiley, 2003.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

NUMERICAL METHODS IN ELECTROMAGNETICS

Course Code and Course Title	**0ETPE507D Numerical Methods in Electromagnetics**			
Semester	**II**			
Prerequisites	Engg. Physics, Engg. Mathematics I & II, EME			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Apply analytical and numerical techniques such as finite difference methods, interpolation, and numerical integration to solve electromagnetic boundary value problems.	**3**
CO2	Analyze discretization techniques including shape functions, basis functions, and weighted residual methods for modeling electromagnetic systems.	**4**
CO3	Apply variational methods such as Euler–Lagrange equations and Rayleigh–Ritz technique for solving field problems.	**3**
CO4	Analyze the Finite Element Method (FEM) for one- and two-dimensional electromagnetic problems including boundary condition handling.	**4**
CO5	Apply finite difference and finite difference time domain (FDTD) methods for field computation, including stability analysis and absorbing boundary conditions.	**3**
CO6	Analyze integral equation methods for electromagnetic field computation, including capacitance and inductance calculations.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Review of Analytical Methods:** Separation of variables, conformal transformation- Green's function. Finite difference method- iterative solution, relaxation, and acceleration processes: different boundary conditions. Review and Introduction to Numerical Analysis: example boundary value problems; numerical tessellation, interpolation, and shape functions; splines, extrapolation method; numerical Integration and differentiation; linear system solutions (direct and iterative); sparse system storage schemes.	**8**
Unit 2	**Discretization of Solution Region:** Shape functions, element matrices and global matrix, method of solution, Method of moments, Basis functions; weighted residuals, method of least squares, numerical integration.	**5**
Unit 3	**Variational Method:** Derivation of Variational expression, Euler-Lagrange equation, Rayleigh- Ritz method.	**5**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Unit 4	**Finite Element Method:** Discretization of solution region: Shape functions, element matrices and global matrix, method of solution, Method of moments, Basis functions; weighted residuals, method of least squares, numerical integration. One- and two- dimensional finite element method: linear and quadratic shape functions, meshing; system construction and assembly; element matrix for the wave equation; boundary condition enforcement/condensation of boundary conditions; absorbing boundary conditions; perfectly matched layers(PML); boundary integral truncation; mesh generation issues; capacitance, inductance, propagation constant computations; shielded and open transmission lines; Inhomogeneous guides and cavities; magnetic circuits (permanent magnets, windings).	**7**
Unit 5	**One- And Two-Dimensional Finite Differences**: iterative solution; cavity field computations; field mapping, equipotential; capacitance computations for shielded transmission lines Microsoft Excel (spreadsheet); microstrip line analysis and material interface treatment; magnetic fields in motor windings; Finite difference time domain method and the Yee marching scheme (2D); gridding and stability conditions; absorbing boundary conditions.	**5**
Unit 6	**Integral Equation Methods:** boundary integral equations (2D and 3D); weighted residual method and system construction; capacitance computations using a supplied PC program; modeling various transmission lines; magnetic field and inductance computations	**6**
	Total Hours	**36**

Text Books:

1) G.G. Skitek, S.V. Marshall, Electromagnetic concepts and applications, Prentice Hall (1 Jan. 1982).

2) Adder R.B., Electromagnetic energy transmission and radiation, MITpress, Cambridge, 1969.

Reference Books:

1) SAADT and Hansen, Microwave Engineers handbook,Vol.I, Artechhouse,1971. Space charge waves and slow EM waves, Beck, A.H.U., Pergamon press, 1950.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's
PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI
An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

COMPONENTS AND APPLICATIONS OF INTERNET OF THINGS

Course Code and Course Title	**0ETOE508A Components and Applications of Internet of Things**			
Semester	**II**			
Prerequisites	Digital Electronics, Computer Networks			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

	Course Outcomes (COs): After completion of course student will be able to	**BL**
CO1	Understand the fundamentals of Internet of Things (IoT), including sensors, sensing techniques, architectures, and application domains.	**2**
CO2	Apply concepts of embedded systems, ARM architecture, and interfacing techniques for designing IoT devices.	**3**
CO3	Analyze various localization and tracking techniques (TOA, TDOA, AOA, RSS, RFID, Kalman filtering) in IoT networks.	**4**
CO4	Apply deep learning techniques including neural networks and backpropagation for IoT data analysis and prediction.	**3**
CO5	Evaluate IoT-based smart grid and smart home systems, including integration with cloud computing, big data, and cyber-physical systems.	**5**
CO6	Analyze the architecture and applications of Internet of Robotic Things (IoRT), including robotics, cloud integration, and real-world challenges.	**4**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Basics of IoT:** Introduction to Internet of things, Various sensors, and sensing techniques. Technological trends in IoT. Impact of IoT on society. Review of various IoT application domain including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices.	**4**
Unit 2	**Microcontroller and Interfacing Techniques for IoT Devices:** Introduction to IoT and architecture layers, IoT smart devices, Typical embedded computing systems, Introduction to ARM architecture and programming method, Embedded system development: a case study, Introduction to interfacing techniques.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 3	**Location Tracking:** Introduction to device localization and tracking; different types of localization techniques: time-of-arrival (TOA) based, time-difference-of-arrival (TDOA) based, angle-of-arrival (AOA) based, received signal strength (RSS) based, Radio- Frequency Identification (RFID) based and fingerprinting based; Monte-Carlo tracking; Kalman filter based tracking; Cramer- Rao lower bound (CRLB) for device location estimator; Device diversity/heterogeneity issue in IoT networks.	**6**
Unit 4	**Deep learning for IoT:** This topic will focus how to build good model from the past data to predict correctly when the system is provided with a data-point. In this course mostly, supervised learning will be considered. Basics of neural network, activation functions, back-propagation, etc. will be covered. At the end some of the challenges in the context of IoT will be mentioned.	**6**
Unit 5	**IoT Applications Smart grid:** Introduction to smart grid, Integration of IoT into smart grid, Standardization activities for IoT aided smart grid, Applications of IoT aided smart grid, Architectures for IoT sided smart grid, Prototypes, Applications of big data and cloud computing, Open Issues, and challenges. IoT-based Smart Home and Nano-grid Monitoring System Sensor-Controller Coordination of a DC Microgrid in IoT Platform, Cyber physical system, dc microgrid, dc–dc power converter, distributed energy generator, sensor control and controller design. Low-Cost DC Nano-grid with Smart Remote Monitoring Unit, DC-DC converter modelling, closed loop control, placement of IoT devices, sensors, micro grid, solar energy, low-cost communication system design. Introduction, objective, components of home monitoring system, control, and management, Zigbee, Wireless Sensor Network (WSN), Internet of Things (IoT).	**8**
Unit 6	**Internet of Robotic Things (IoRT):** Introduction to stationary and mobile robots; Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IoT in robotics; Architectures for IoRT; Examples and case studies; Open issues and challenges.	**6**
	Total Hours	**36**

Text Books:

1) Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, *Universities Press, 2015.*
2) Raj Kamal, Internet of Things: Architecture and Design Principles, *McGraw-Hill Education, 2017.*
3) Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, *Wiley, 2013.*

Reference Books:

1) Olivier Hersent, David Boswarthick, and Omar Elloumi, The Internet of Things: Key Applications and Protocols, *Wiley, 2012.*
2) Jan Holler et al., From Machine-to-Machine to the Internet of Things, Academic Press, 2014.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

NPTEL Platform:

NPTEL Course	Name of Instructor	Host	Institute Link
Components And Applications of Internet of Things	Dr. Sanjoy Kumar Parida	Indian Institute of Technology Patna	https://onlinecourses.swayam2.ac.in/arp20_ap03/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

RESEARCH METHODOLOGY

Course Code and Course Title	**0ETOE508B**	**Research Methodology**		
Semester	**II**			
Prerequisites	Engg. Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the fundamental concepts of philosophy of science, including subjective vs objective approaches, materialism vs idealism, and causality.	**2**
CO2	Apply principles of logical reasoning (inductive, deductive, and syllogistic logic) in scientific problem solving and research analysis.	**3**
CO3	Analyze the historical development of science and the role of scientific practices in real-world research.	**4**
CO4	Evaluate research methods including hypothesis testing and theoretical approaches for scientific investigations.	**5**
CO5	Apply various data collection methods (primary and secondary) such as observation, interviews, questionnaires, and schedules.	**3**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Philosophy of Science and Scientific Thinking:** Introduction to Philosophy of Science , Subjective vs Objective approaches in science, Materialism vs Idealism, Concept of causality in scientific research, Nature and scope of scientific knowledge, Role of philosophy in scientific inquiry	**6**
Unit 2	**Logical Reasoning in Research:** Introduction to logical reasoning , Inductive logic and its applications, Deductive logic and reasoning , Syllogistic logic and argument structure , Logical fallacies and critical thinking , Application of logic in scientific problem solving	**6**
Unit 3	**Evolution of Science and Research Process:** Historical development of science, Influence of philosophy on scientific progress, What scientists actually do (research practices) , Scientific method and research process , Identification of research problems , Formulation of research objectives	**6**
Unit 4	**Hypothesis Formulation and Research Methods:** Concept and types of hypotheses , Techniques of scientific measurement, Testing of hypothesis, Methods of theoretical research, Experimental vs theoretical approaches , Validity and reliability in research	**6**
Unit 5	**Scientific Communication and Research Ethics:** Art of scientific communication , Technical report writing , Presentation skills for seminars	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

	and conferences , Sponsored research and funding agencies ,Intellectual property rights (IPR) basics, Ethical conduct in research and plagiarism	
Unit 6	**Methods Of Data Collection:** Collection of primary data, Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Some other methods of data collection, Collection of secondary data.	**6**
	Total Hours	**36**

Text Books:
1) Soumitro Banerjee, Research Methodology for Natural Sciences, IISc Press, 2022.
Reference Books:
2) C.R.Kothari, Research Methodology Methods and Techniques, New age International (P Ltd.)

NPTEL Platform:

NPTEL Course	Name of Instructor	Host	Institute Link
Research Methodology	Prof. Soumitro Banerjee	IISER Kolkata	https://onlinecourses.nptel.ac.in /noc22_ge08/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

ENVIRONMENT AND DEVELOPMENT

Course Code and Course Title	**0ETOE508C Environment and Development**			
Semester	**II**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the concepts of environmentalism, ecosystem ecology, and the relationship between development, economic growth, and sustainable development.	**2**
CO2	Analyze the role of environmental movements and environmentalism in the global south, including socio-cultural and political dimensions.	**4**
CO3	Analyze natural resource management issues including common vs. private property, displacement, environmental impact assessment, and rehabilitation policies.	**4**
CO4	Apply gender perspectives and climate change frameworks to understand sustainable development challenges and policy interventions.	**3**

Course Contents

Unit No.	Contents	Hrs.
Unit 1	**Environmental movement:** Introduction: Development, economic growth and sustainable development, Basic ecosystem ecology, Environmentalism, Environmental Movement, Environmentalism in the global south,	**7**
Unit 2	**Impact of Religion on Environment:** Religion, environment, and conservation: Religion, environment and historical roots of ecological crisis, Biodiversity conservation ethics in Buddhism and Hinduism, Christian religion in the age of ecological crisis	**5**
Unit 3	**Impact of Religion on Environment:** Religion, environment, and conservation: Religion, environment and historical roots of ecological crisis, Biodiversity conservation ethics in Buddhism and Hinduism, Christian religion in the age of ecological crisis	**6**
Unit 4	**Natural Resources & Development:** Natural resource management, Common property vs. private property, Livelihoods, forests, and conservation, Displacement, dispossession, and development: Conservation-induced displacement, Environment impact assessment and national rehabilitation & amp; resettlement policy, Dispossession, and land acquisition.	**6**
Unit 5	**Gender & Development, Climate Change:** Development theory and gendered approach to development, Gender, environment & amp; sustainable development. Environment and climate change: Climate change interventions and policy framework, Eastern Himalayas, and climate change.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 6	**Belief and Local Knowledge of Environment** Belief and knowledge systems, biodiversity conservation and sustainability: Ecological knowledge, biodiversity conservation and sustainability, Traditional religion and conservation of nature in Northeast India: Case study Local knowledge in the environment-development discourse: Indigenous knowledge, environment and development, Relevance of indigenous knowledge: case study.	**6**
	Total Hours	**36**

Text Books:
1) Arnold, David, and Guha, Ramchandra, (eds.), 1997. Nature, Culture and Imperialism, New Delhi: Oxford University Press.
2) Baviskar, Amita. 1997. In the Belly of the River: Tribal Conflicts over Development in the Narmada Valley, OUP, Delhi.
3) Barnhill, David Landis & Roger S. Gottlieb. (eds.) 2001. Deep Ecology and World Religions: New Essays on Sacred Grounds. State Univ. of New York Press, Albany.
4) Bicker, Alan, Paul Sillitoe and Johan Pottier. 2004. Development and Local Knowledge: New Approaches to Issues in Natural Resources Management, Conservation and Agriculture. Routledge, London & New York.
Reference Books:
1) Esteva, G. 1997. _Development' in W. Sachs, ed., The Development Dictionary, Orient Longman, pp. 8-34.
2) Gadgil, Madhav and Guha, Ramchandra. 1995. Ecology and Equity: The use and Abuse of Nature in Contemporary India, New Delhi: Oxford University.
3) Gottlieb, Roger S. 2004. This Sacred Earth: Religion, Nature, Environment. Routledge, New York, and London.
4) Merchant, Carolyn. 1994. Ecology: Key Concepts in Critical Theory, Humanities Press, New Jersey.
5) Ramakrishnan, P.S. 1992. Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from North-Eastern India, Man and the Biosphere Series, Volume 10, UNESCO.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Environment and Development	Prof. Ngamjahao Kipgen	IIT Guwahati	https://onlinecourses.nptel.ac.in/noc21_hs83/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

ENTREPRENEURSHIP

Course Code and Course Title	**0ETOE508D Entrepreneurship**			
Semester	**II**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the entrepreneurial journey, discovery process, and key characteristics of successful entrepreneurs.	**2**
CO2	Apply ideation techniques and develop innovative solutions using prototyping and design thinking approaches.	**3**
CO3	Analyze market conditions, validate business ideas, and design viable business models for commercialization.	**4**
CO4	Examine the role of entrepreneurial ecosystems, culture, and education in fostering startups and employment generation.	**4**

Course Contents

Unit No.	Contents	Hrs.
Unit 1	**Entrepreneurial Journey and Discovery:** Concept and evolution of entrepreneurship, Characteristics, competencies, and mindset of entrepreneurs, Stages of the entrepreneurial journey: idea → launch → growth → scaling , , Entrepreneurial discovery process: opportunity recognition and evaluation, Sources of business opportunities (market gaps, technology, social needs), Role of creativity and innovation in entrepreneurship, Entrepreneurial ecosystems (incubators, accelerators, mentors)	**6**
Unit 2	**Ideation, Prototyping, and Innovation:** Idea generation techniques (brainstorming, SCAMPER, design thinking), Problem identification and solution mapping, Concept development and feasibility analysis, Prototyping methods (low-fidelity and high-fidelity prototypes), Minimum Viable Product (MVP) concept, Technological innovation fundamentals, Technological Innovation and Entrepreneurship – I: Role of R&D and emerging technologies (AI, IoT, Blockchain) , Innovation life cycle	**6**
Unit 3	**Testing, Validation, and Commercialization:** Market research techniques (primary and secondary research), Customer validation and feedback loops, Product-market fit assessment, Business model development (Business Model Canvas), Go-to-market strategies, Commercialization process and scaling strategies , Intellectual Property Rights (IPR): patents, copyrights, trademarks Technological Innovation and Entrepreneurship – II:Technology transfer and commercialization models	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 4	**Financial Resources and Entrepreneurial Systems:** Sources of finance: bootstrapping, angel investors, venture capital, crowdfunding , Financial planning and budgeting for startups, Cost structures and revenue models , Government schemes and funding initiatives in India (Startup India, MSME schemes) , Role of education in entrepreneurship development, Entrepreneurship education models and skill development, Concept of entrepreneurial thermodynamics (energy, effort, and sustainability analogy in business growth)	**6**
Unit 5	**Entrepreneurship Ecosystem and Culture:** India as a startup nation: growth trends and challenges, National entrepreneurial culture and policy environment, Role of institutions, government, and private sector, Beyond founders: role of teams, professionals, and stakeholders, Family businesses vs professional start-ups, Entrepreneurship and employment generation , Social entrepreneurship and inclusive growth	**6**
Unit 6	**Disruption, Case Studies, and Future Trends:** Disruption as a success driver (disruptive innovation theory) , Case studies of successful start-ups (Indian and global) , Failure case analysis and lessons learned , Scaling challenges and sustainability, Future trends in entrepreneurship (digital economy, green start-ups) Ethical issues in entrepreneurship	**6**
	Total Hours	**36**

Text Books:
1) Zero to One: Notes on Startups, or How to Build the Future by Peter Thiel.
2) The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries.
3) India as Global Start-up Hub: Mission with Passion by C. B. Rao.
Reference Books:
1) Elon Musk: Tesla, SpaceX, and the Quest fora Fantastic Future by Ashlee Vance.
2) Steve Jobs by Walter Isaacson.
3) Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Entrepreneurship	Prof. C. Bhaktavatsala Rao	IIT Madras	https://onlinecourses.nptel.ac.in/noc20_mg35/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

SEMINAR - II

Course Code and Course Title	**0ETEL555 Seminar II**		
Semester	II		
Prerequisites	-		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	4
Credits	02		
Evaluation Scheme	**ISE**	**ESE**	
	50 Marks	-	

Course Outcomes (COs): - After completion of course student will be able to		**BL**
CO1	Identify and select a recent research topic in the relevant domain through comprehensive literature survey.	**4**
CO2	Analyze and synthesize information from research papers, journals, and technical resources to understand current trends and challenges.	**4**
CO3	Prepare a structured technical report and presentation following standard scientific writing formats.	**3**
CO4	Demonstrate effective oral communication and presentation skills using appropriate tools (PPT, graphs, visuals).	**3**
CO5	Critically evaluate research work and answer technical queries with logical reasoning.	**5**
CO6	Exhibit professional ethics, independent learning, and ability to engage in lifelong learning.	**3**

Contents	**Hrs.**
1. Identify emerging topics in Electronics & Telecommunication. 2. Analyse research literature in E&TC domains. 3. Prepare technical reports and presentations using standard formats. 4. Demonstrate effective technical communication skills. 5. Evaluate and defend research findings. 6. Develop research aptitude, ethics, and lifelong learning skills.	-

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

MINI PROJECT

Course Code and Course Title	**OETEL556 Mini Project**		
Semester	**II**		
Prerequisites	-		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	4
Credits	02		
Evaluation Scheme	**ISE**	**ESE**	
	25	25	

The mini project shall be based on the recent trends in the industry, research and open problems from the industry and society. This may include mathematical analysis, modelling, simulation, and hardware implementation of the problem identified. The mini project shall be of the student's choice and approved by the guide. The student has to submit the report of the work carried out in the prescribed format signed by the guide and head of the department/institute.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

DISASTER MANAGEMENT

Course Code and Course Title	**0ETAC557 Disaster Management**			
Semester	**II**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	-	-	2	
Credits	Audit Course			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	-	-	-	-

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Understand the basic concept of disaster(s) and disaster management, their significance, and types.	**2**
CO2	Develop the analytical skills to study relationship between vulnerability, disasters, disaster prevention and risk reduction.	**3**
CO3	Gain a preliminary understanding of approaches to Disaster Risk Reduction (DRR).	**2**
CO4	Empowered with the awareness of institutional processes in the country for Disaster Management.	**2**

Course Contents

Unit No.	**Contents**	**Hrs.**
Practical 1	**Disaster Management:** Disaster and Disaster Management- Concepts, Issues Concerned with Disaster Management. Phases of Disaster Management, Types of Disasters: Bhopal Disaster: A Case Study, Types of Disasters- An Introduction, Natural Disaster, Man-made Disaster.	**2**
Practical 2	**Types of Disasters:** Slow onset Disasters & Rapid onset Disasters, Simple and Complex, Tsunami: A Case Study Disasters, Tsunami: A Case Study, Cyclone Phall in 2013: A Case Study.	**2**
Practical 3	**Disaster Management in India-An Over View:** Evolution of Disaster Management in India, Disaster and Disaster Management in India, National institute of Disaster Management, National Disaster Management Act 2005.	**2**
Practical 4	**Disaster Management in India- An Over View:** The National Policy on Disaster Management, 2009. Refugee Problem: National Plan on Disaster Management 2016, Refugee Problems, Impact of Disaster on the lives of Refugees. Refugee Problem: Problems of Women and Children during disasters, Principles Of Psychosocial Care, Issues And Recovery During Emergency. Refugee Problem: Relationship between Disasters, Development and Vulnerabilities, Relationship between Disasters, Development and Vulnerabilities.	**2**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

PVP Institute of Technology, Budhgaon, An Autonomous Institute, EN06269

Unit 5	**Refugee Problem: Equity Issues in Disaster**: Refugee Problem: Issues of Rehabilitation and Resettlement among the Disaster Survivors, Stakeholders in Disaster Relief Management - An Introduction. Stakeholders in Disaster Relief Management: Central Government. Stakeholders in Disaster Relief Management: State Government, District administration. Armed Forces.	2
Unit 6	**Stakeholders in Disaster Relief Management:** Para-Military Forces, Fire Services. Disaster Risk Reduction: Disaster Risk Reduction Strategies, Risk Reduction Preparedness Plans. Disaster Risk Reduction: Action Plans and Procedures, Early Warning Systems, Components of Disaster Relief, Factors contributing to Vulnerability. Disaster Risk Reduction: Disaster Risk Reduction-Master Planning for the Future, Capacity Building rehabilitation measures and long-term reconstruction, Understanding Kerala Disaster 2018.	2
	Total Hours	**12**

Text Books:

1) Coppola D. P., 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2) Manual on natural disaster management in India, MC Gupta, NIDM, New Delhi
3) An overview on natural& man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi.
4) World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland.
5) Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006

Reference Books:

1) Encyclopaedia of Disasters–Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
2) Disasters in India Studies of grim reality, Anu Kapur & others,2005,283pages, Rawat Publishers. Jaipur.
3) Management of Natural Disasters in developing countries, H. N. Srivastava &G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
4) Natural Disasters, David Alexander ,Kluwer AcademicLondon,1999, 632 pages.
5) Disaster Management Act2005, Publisher by Govt. of India
6) Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management.
7) NIDM Publications.
8) High Power Committee Report, 2001, J. C. Pant.
9) Disaster Mitigation in Asia &Pacific, Asian Development Bank.
10) National Disaster Management Policy, 2009, GOI.

Dr. M. S. Chavan	**Dr. K. K. Pandyaji**	**Dr. S. S. Mohite**
HoD	**Dean Academics**	**Director**

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

11) Disaster Preparedness Kit, American Red Cross.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Disaster Management	Naveen Kumar Nanjundan	University of Hyderabad	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

DESIGN OF MECHATRONIC SYSTEMS

Course Code and Course Title	**0ETPE601A Design of Mechatronic Systems**			
Semester	**III**			
Prerequisites	Basic Electronics & Electrical Engg., Basic Mechanical Engg.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

	Course Outcomes (COs): After completion of course student will be able to	**BL**
CO1	Apply knowledge to select appropriate sensors and actuators based on system requirements, considering factors such as accuracy, range,	**2**
CO2	Analyze and process sensor data using signal processing techniques, demonstrating the capability to extract meaningful information from noisy sensor measurements.	**4**
CO3	Proficiently program microcontrollers and embedded systems to interface with sensors, actuators, and other hardware components.	**2**
CO4	Integrate mechanical components and subsystems with electronics and software, ensuring seamless communication and optimal functionality.	**3**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Mechatronics:** Elements of mechatronics system: Sensor, actuator, plant, and controller. Applications of mechatronics system. Systems like CDROM, scanner opened to see whats there inside and why? Integrated mechanical-electronics design philosophy. Examples of real-life systems. Smart sensor concept and utility of compliant mechanisms in mechatronics.	**6**
Unit 2	**Microprocessors & Microcontrollers:** Microprocessor building blocks, combinational and sequential logic elements, memory, timing, and instruction execution fundamentals with example of primitive microprocessor. Microcontrollers for mechatronics: Philosophy of programming interfaces, setting sampling time, and getting started with TIVA programming. programming different interfaces PWM, QEI etc. Mathematical modeling of mechatronic systems,	**6**
Unit 3	**Modeling, Simulation, and Dynamics of Electromechanical Systems:** Modeling friction DC motor, Lagrange formulation for system dynamics. Dynamics of 2R manipulator, Simulation using Matlab, Selection of sensors and actuators.	**6**
Unit 4	**Fundamentals of Feedback Control and Nonlinear Stability Analysis:** Concept of feedback and closed loop control, mathematical representations of systems and control design inline domain. Basics of Lyapunov theory for nonlinear control, notions of	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

	stability, Lyapunov theorems and their application	
Unit 5	**Nonlinear Trajectory Tracking Control and Digital Signal Processing Basics:** Trajectory tracking control development based on Lyapunov theory, Basics of sampling of a signal, and signal processing.	**6**
Unit 6	**Digital Control Systems, Filtering Techniques, and Advanced Mechatronic Applications:** Digital systems and filters for practical mechatronic system implementation. Research example/ case studies of development of novel mechatronics system: 3D micro-printer, Hele Shaw system for micro fabrication	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Introduction to Mechatronics Systems: Fundamentals and system elements
Tutorial No. 2	Microprocessors and Microcontrollers: Architecture and programming fundamentals
Tutorial No. 3	TIVA Microcontroller Programming Interfaces: Embedded system implementation
Tutorial No. 4	Mathematical Modeling of Mechatronic Systems: System modeling
Tutorial No. 5	Dynamics and Simulation of Electromechanical Systems: DC motor and manipulator dynamics
Tutorial No. 6	Feedback Control and Stability Analysis: Control systems and Lyapunov theory
Tutorial No. 7	Trajectory Tracking and Signal Processing: Nonlinear control and signal basics
Tutorial No. 8	Digital Control and Advanced Applications: Digital systems and case studies

Text Books
1) Devdas Shetty, Richard A. Kolk, Mechatronics System Design, I PWS Publishing company.
2) Boukas K, Al-Sunni, Fouad M., Mechatronic, Systems Analysis, Design and Implementation, Springer.
Reference Books:
1) Sabri Cetinkunt, Mechatronics with Experiments, 2nd Edition, Wiley.
2) Janschek, Klaus, Mechatronic Systems Design, Springer.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous EN06269 Institute

Dr. S. S. Mohite
Director

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Design of Mechatronic Systems	Prof. Prasanna Gandhi	IIT Bombay	Design of Mechatronic Systems-Course (nptel.ac.in)

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

ETHICAL HACKING

Course Code and Course Title	**0ETPE601B Ethical Hacking**			
Semester	**III**			
Prerequisites	Programming Languages			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Gain a comprehensive understanding of ethical hacking concepts, methodologies, and its role in enhancing cyber security.	**2**
CO2	Acquire a solid grasp of cyber security principles, types of threats, and the importance of proactive defense strategies.	**3**
CO3	Develop proficiency in various hacking techniques, including reconnaissance, scanning, exploitation, and post-exploitation activities.	**3**
CO4	Perform effective vulnerability assessments on systems and networks, identifying potential security weaknesses and exposures.	**3**
CO5	Demonstrate the ability to conduct penetration tests, simulating real-world attacks to evaluate the strength of security measures.	**2**

Course Contents

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction To Ethical Hacking:** Fundamentals of computer networking. TCP/IP protocol stack IP addressing and routing. TCP and UDP. IP subnets. Routing protocols. IP version 6.	**6**
Unit 2	**Ethical Hacking Setup and Information Gathering Techniques:** Installation of attacker and victim system. Information gathering using advanced google search, archive.org, net craft, who is, host, dig, and NMAP tool.	**6**
Unit 3	**Vulnerability Assessment and System Attacks:** Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.	**6**
Unit 4	**Introduction To Cryptography:** Private-key encryption, public-key encryption. Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks, DNS, and Email security.	**6**
Unit 5	**Network Sniffing and Security Attacks:** Packet sniffing using Wire shark and Burpsuite, password attack using burpsuite. Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 6	**Exploitation and Web Application Attacks:** Different types of attacks using Meta sploit framework: password cracking, privilege Escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Fundamentals of Computer Networking: Networking basics
Tutorial No. 2	Ethical Hacking Setup and OSINT: Lab setup and information gathering
Tutorial No. 3	Vulnerability Assessment Techniques: Scanning and analysis
Tutorial No. 4	System Hacking and Malware: Exploitation basics
Tutorial No. 5	Cryptography and Security Mechanisms: Data security fundamentals
Tutorial No. 6	Network Sniffing and DoS Attacks: Network-level attacks
Tutorial No. 7	Hardware Security and Advanced Threats: Hardware vulnerabilities
Tutorial No. 8	Exploitation and Web Application Attacks: Web security and penetration testing

Text Books :
1) Data and Computer Communications - W. Stallings.
2) Data Communication and Networking - B. A. Forouzan
3) TCP/IP Protocol Suite-B.A. Forouzan
Reference Books:
1) UNIX Network Programming - W.R. Stallings
2) Introduction to Computer Networks and Cybersecurity - C. H. Wu and J.D. Irwin Cryptography and Network Security: Principles and Practice - W. Stalling

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Ethical Hacking	Prof. Indranil Sengupta	IIT Kharagpur	Ethical Hacking– Course(nptel.ac.in)

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

SUSTAINABLE POWER GENERATION SYSTEMS

Course Code and Course Title	**0ETPE601C Sustainable Power Generation Systems**			
Semester	**III**			
Prerequisites	Basic Electrical Engineering			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (CO) After completion of course student will be able to		**BL**
CO1	Explain the principles of sustainability in the context of power generation and understand its significance in the global energy transition.	**2**
CO2	Identify and describe various renewable energy sources, including solar, wind, hydro, geothermal, and biomass, and explain their potential for power generation.	**3**
CO3	Compare and contrast the advantages and limitations of different sustainable power generation technologies.	**3**
CO4	Analyze the environmental, social, and economic impacts of both conventional and sustainable power generation methods, and evaluate their contributions to mitigating.	**4**

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction To Power Generation:** Global and Indian scenario, an overview of current technologies available for power generation, Concept of the renewable energy- based power plant. **Solar Thermal Power Generation:** Fundamentals of Solar thermal energy conversion, solar thermal based power plant design and analysis (flat plate and concentrator), ORC, RC, and Stirling engine.	**6**
Unit 2	**Solar Photovoltaic Power Generation** Fundamentals of Solar photovoltaic energy conversion, Solar PV power plant design, Performance analysis of standalone and grid connected PV systems. **Wind Power Generation:** Introduction to wind turbine, classification and analysis of different components, Theory, design, and analysis of wind turbines (horizontal axis and vertical axis) and wind farms.	**6**
Unit 3	**Hydro Power Generation** Introduction to hydro power plant, overview of micro, mini and small hydro power plants, hydraulic turbines, Selection and design criteria of pumps and turbines, Brief theory, design, and analysis of hydro power plants. **Biomass Power Generation:** Fundamentals of bioenergy production technologies through different routes, design, and analysis of biochemical and thermochemical reactors for clean power generation.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 4	**Hydrogen Energy and Fuel Cells Importance:** Various routes of hydrogen generation, basic principle, and design of different types of fuel cells and their applications, prospects, IGFC Week 8: Module-8:GeothermalEnergyFundamentals, classification, theory, design, and analysis of geothermal power plant.	**6**
Unit 5	**Ocean Thermal Energy** : Fundamentals, classification, theory, design, and analysis of ocean thermal power plant, Wave and Tidal Energy Fundamentals, classification, theory, design, and analysis of wave and tidal power plant	**6**
Unit 6	**Energy Storage:** Different modes of energy storage; design and analysis of different technologies for thermal, mechanical, and electro-chemical energy storage systems Energy Economics Cost analysis, interest, accounting rate of return, Payback, Discounted cash flow, Net present value, Internal rate of return, Inflation, and life cycle analysis of energy systems.	**6**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Renewable Energy Systems: Introduction to Power Generation
Tutorial No. 2	Solar Thermal Power Generation: Solar thermal systems
Tutorial No. 3	Solar Photovoltaic Power Generation: PV systems
Tutorial No. 4	Wind Power Generation: Wind energy systems
Tutorial No. 5	Hydro and Biomass Power Generation: Hydro and bioenergy systems
Tutorial No. 6	Hydrogen Energy, Fuel Cells, and Geothermal: Emerging energy technologies
Tutorial No. 7	Ocean Energy Systems: Ocean-based energy
Tutorial No. 8	Energy Storage and Economics: Storage systems and financial analysis

Text Books:

1) J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis,4th Edition, 2021.
2) G. Boyle (Editor), Renewable Energy: Powerfora Sustainable Future, Oxford University press, 3rd Edition, 2012.
3) G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4) J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 4th Edition, 2013.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. Institute of Technology, Budhgaon, An Autonomous Institute, EN06269

Dr. S. S. Mohite
Director

5) R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer, 2nd Edition, 2012.

Reference Books:

1) P. Breeze, Hydropower, Elsevier, 1st Edition,2018.
2) S. C. Bhattacharyya, Energy Economics Concepts, Issues, Markets and Governance, springer, 2nd Edition, 2019.
3) S.P Sukhatme and J.K.Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Private Limited, 3rd Edition, 2010.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Sustainable Power Generation Systems	Dr. Pankaj Kalita	IIT Guwahati	Sustainable Power Generation Systems–Course(nptel.ac.in)

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

LINEAR ALGEBRA

Course code and Course Title	**0ETPE601D Linear Algebra**			
Semester	III			
Prerequisites	Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Demonstrate proficiency in performing matrix operations and solving linear equations in diverse mathematical contexts.	**2**
CO2	Apply linear algebra concepts to model and solve practical problems across multiple disciplines.	**3**
CO3	Analyze and interpret geometric transformations through the lens of linear transformations.	**4**
CO4	Develop critical thinking and problem-solving skills by using linear algebra as a foundation for advanced mathematical and scientific studies.	**4**
Unit No.	**Contents**	**Hrs.**
Unit 1	**Fundamentals of Vector Spaces:** Vectors and vector spaces: definition, examples ($\mathbb{R}^n$, function spaces), Subspaces and their properties, Linear combinations and span of a set, Linear independence and dependence , Basis and dimension of a vector space, Coordinate representation with respect to a basis .	**8**
Unit 2	**Linear Transformations and Matrix Representation:** Definition and properties of linear transformations, Kernel (null space) and range (image) of transformations, Rank–nullity theorem, Matrix representation of linear transformations , Change of basis and coordinate transformations, Matrix multiplication and composition of linear maps, Invertibility and isomorphisms	**7**
Unit 3	**Advanced Vector Space Concepts:** Products and quotients of vector spaces, Direct sum of subspaces, Dual spaces and dual basis, Linear functionals and their properties, Coordinate change and transition matrices	**7**
Unit 4	**Matrix Theory and Determinants:** Review of elementary row operations and echelon forms, Rank of a matrix and its computation, Determinants: definition and properties, Cofactor expansion and applications, Invertibility criteria using determinants, Systems of linear equations and solutions	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 5	**Eigenvalues and Diagonalization:** Eigenvalues and eigenvectors: definitions and properties, Characteristic polynomial and eigenvalue computation, Diagonalization of matrices, Conditions for diagonalizability Applications of eigenvalues in systems analysis	**8**
	Total Hours	**36**

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Vector Spaces and Subspaces: Basic definitions and properties, Examples
Tutorial No. 2	Basis and Coordinate Systems: Representation of vectors, Examples
Tutorial No. 3	Linear Transformations: Mapping between vector spaces, Examples
Tutorial No. 4	Matrix Operations and Isomorphisms: Matrix representation and invertibility, Examples
Tutorial No. 5	Determinants and Rank: Matrix properties and systems, Examples
Tutorial No. 6	Eigenvalues and Diagonalization: Eigen theory, Derivations
Tutorial No. 7	Eigenvalues and Diagonalization: Eigen theory, Examples
Tutorial No. 8	Inner Product Spaces and Orthogonality: Geometric interpretation

Text Books

1) Bhattacharya P. B., Jain S. K. and Nagpaul S. R., First Course in Linear Algebra, Wiley Eastern Ltd., 1991.
2) Friedberg S. H, Insel A. J.and Spence L. E., LinearAlgebra,4th Edition,Prentice-Hall of India, New Delhi, 2004.
3) Hoffman K. and Kunze R., Linear Algebra,2ndEdition,Prentice-HallofIndia, New Delhi, 2000.
4) KalmanD., A singularly valuable decomposition; the SVD of a matrix, The College Math. Journal, Vol .27, No.1, (1996).

Reference Books:

1) Kumaresan, S., Linear Algebra-A Geometric approach, Prentice-Hall of India, New Delhi, 2001.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Linear Algebra	Prof. Pranav Haridas	Kerala School of Mathematics	https://onlinecourses.nptel.ac.in /noc20_ma21/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course code and Course Title	**0ETPE601E Artificial Intelligence and Machine Learning**			
Semester	**III**			
Prerequisites	Programming Languages, Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credits	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (CO): After completion of course student will be able to		**BL**
CO1	Explain fundamental concepts of Artificial Intelligence and problem-solving through state space search.	**2**
CO2	Apply informed and uninformed search techniques to solve AI problems efficiently.	**3**
CO3	Analyze heuristic and evolutionary algorithms such as genetic algorithms for optimization problems.	**4**
CO4	Apply neural network models, particularly BPNN, for learning and prediction tasks.	**3**

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Artificial Intelligence and Search Techniques:** Definition, history, and applications of Artificial Intelligence , Problem formulation in AI and state space representation, State space search: concept and examples, Uninformed (unguided) search techniques: BFS, DFS, Uniform Cost Search, Informed (guided) search techniques: Greedy Best-First Search, A* algorithm, Problem characteristics and solution strategies	**7**
Unit 2	**Advanced Search and Evolutionary Techniques:** Heuristic functions and admissibility, Other search methods: hill climbing, beam search, iterative deepening, Optimization problems in AI, Genetic Algorithms: principles, operators (selection, crossover, mutation), Applications of evolutionary algorithms	**7**
Unit 3	**Neural Networks and Learning:** Introduction to Artificial Neural Networks (ANN), Biological inspiration and architecture of neural networks, Perceptron model and limitations, Backpropagation Neural Network (BPNN), Learning process in BPNN: forward pass, backward pass, weight update, Training, testing, and performance evaluation	**7**
Unit 4	**Planning and Game Playing:** AI planning: problem formulation and solution methods, State space planning and goal stack planning, Game playing strategies in AI, Minimax algorithm and its variants, Alpha-beta pruning, Applications in board games and decision making	**7**
Unit 5	**Advanced AI Concepts and Expert Systems:** Fuzzy logic: concepts, membership functions, applications, Conceptual dependency (CD) and scripts, Introduction to expert systems: components and architecture, Knowledge acquisition and representation in expert systems, Development and applications of expert systems, Introduction to Machine Learning and its applications	**8**
	Total Hours	**36**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Tutorials	
Students should complete minimum Eight Tutorials	
Tutorial No. 1	Introduction to AI and State Space Search: Fundamentals and problem representation
Tutorial No. 2	Uninformed and Informed Search Techniques: Search algorithms
Tutorial No. 3	Heuristics and Advanced Search Methods: Optimization and heuristics
Tutorial No. 4	Genetic Algorithms: Evolutionary computation
Tutorial No. 5	Neural Networks and BPNN: Learning models
Tutorial No. 6	Planning and Game Playing: Decision-making algorithms
Tutorial No. 7	Knowledge Representation and Reasoning: Logic and inference
Tutorial No. 8	**Expert Systems and Machine Learning:** Intelligent systems

Text Books :
1) Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach. III Edition.
2) E. Rich, K. Knight & S. B. Nair, Artificial Intelligence, 3/e, Mc GrawHill.
3) Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hal of India.
Reference Books:
1) G. Luger, Artificial Intelligence: Structures and Strategies for complex problem Solving‖, Fourth Edition, Pearson Education,2002.
2) N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press-2015.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Artificial Intelligence and Machine Learning	By Prof. Bhushan Trivedi	GLS University	https://onlinecourses.swayam2.ac.in/cec21_cs08/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

STUDENT PSYCHOLOGY

Course code and Course Title	**0ETOE602A Student Psychology**			
Semester	**III**			
Prerequisites	--			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	3			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Understand Psychological Factors.	**2**
CO2	Develop the ability to recognize and appreciate the diverse needs.	**2**
CO3	Apply psychological theories and principles to address various challenges.	**2**
CO4	Acquire skills in utilizing psychological assessment tools.	**3**
CO5	Understand to create positive and conducive learning experiences.	**2**

Unit No.	**Contents**	**Hrs.**
Unit 1	**Teaching Learning Process:** Meaning and scope of teaching and learning, Nature of learning: behavioral, cognitive, and constructivist perspectives, Teaching–learning process: components (teacher, learner, content, environment), Factors affecting learning (individual, social, environmental) , Learning theories: Behaviorism (classical and operant conditioning), Cognitivism (information processing, insight learning), Constructivism (Piaget, Vygotsky), Teaching strategies and methods (lecture, discussion, experiential learning), Classroom management and effective teaching practices	**7**
Unit 2	**Student Characteristics, Types, and Problems:** Individual differences among learners, Types of learners (visual, auditory, kinesthetic; slow and gifted learners), Learning styles and preferences, Common student problems: academic, behavioral, emotional, social, Identification and management of learning difficulties, Inclusive education and handling diverse classrooms, Role of teacher in addressing student diversity	**6**
Unit 3	**Psychological Tests, Inventories, and Motivation:** Concept and types of psychological tests (intelligence, aptitude, personality) , Test construction, reliability, validity, and standardization, Use of inventories in education (interest, attitude, personality inventories), Student motivation: meaning, types (intrinsic and extrinsic), Theories of motivation (Maslow's hierarchy, Herzberg, expectancy theory) , Techniques to enhance student motivation, Role of teacher in motivating learners	**6**
Unit 4	**Physical and Cognitive Development:** Stages of physical development (childhood to adolescence), Growth and maturation	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON, An Autonomous Institute, EN06269

	processes, Cognitive development theories: Piaget's stages of cognitive development , Information processing theory, Intelligence: types and measurement, Creativity and its development, Implications of cognitive development in teaching	
Unit 5	**Emotional and Social Development:** Emotional development: characteristics and stages, Emotional intelligence (EQ) and its importance, Social development and socialization processes, Peer relationships and group dynamics, Personality development and influencing factors, Behavioral issues and emotional problems in students, Role of teacher in emotional and social development	**6**
Unit 6	**Neuro-Linguistic Programming and Counselling Skills:** Introduction to Neuro-Linguistic Programming (NLP), Principles and techniques of NLP in education, Communication skills and rapport building, Counselling: meaning, types, and importance in education, Counselling skills for teachers (listening, empathy, guidance) , Techniques for handling student problems, Ethical considerations in counselling, Course summary and integration of concepts	**5**
	Total Hours	**36**

Text Books / Reference Books:
1) Sharma, R. A. (2007). Training Technology. Meerut: Surya Publications.
2) Sharma, R. A. (2007). Psychology of Teaching-Learning Process. Meerut: Surya Publications
3) B. Mukhopadhyay (1997). Motivation in Educational Management. New Delhi: Sterling Publishers.

Reference Books:
1) Barki & Mukhopadhyay. (1995). Guidance and Counseling .New Delhi: Sterling Publishers.
2) Agochya,D. (2010). Life competencies for adolescents. New Delhi: Sage Publications.
3) Davies,I.K. (1971). Management of Learning. Berkshire: Mc Graw Hill.
4) Dusay. (1980). Egograms. NewYork: harper &Row.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Student Psychology	Dr. S. Renukadevi	NITTTR, Chennai	https://onlinecourses.swayam2.ac.in/ntr19_ed23/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

BUSINESS TO BUSINESS MARKETING (B2B)

Course code and Course Title	**0ETOE602B Business To Business Marketing (B2B)**			
Semester	**III**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	3			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (CO): After completion of course student will be able to		**BL**
CO1	Gain a strong grasp of the core concepts and theories that form the basis of B2B marketing, enabling practical application.	**2**
CO2	Develop skills to analyze B2B markets, segment customers effectively, and make informed marketing decisions.	**3**
CO3	Acquire the ability to design and execute B2B marketing strategies tailored to the unique needs of business customers.	**3**
CO4	Learn how to build and nurture enduring relationships with B2B clients through effective communication and collaboration.	**3**
CO5	Master the art of B2B sales, negotiation strategies, and contract management for successful transactions.	**2**
Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to B2B Marketing:** Business marketing, Classifying goods for the business market, Business market customers, Market structure, Environment and Characteristics of Business Marketing, Strategic role of marketing, Commercial enterprises, Commercial and institutional customers, B2B vs B2C Marketing. Organizational Buying and Buyer Behavior: Organizational buyers decision process- A Stepwise Model and A Process Flow Model, Organizational and business markets- Government as a customer-Commercial enterprises-Commercial and institutional customers, Value analysis, Buy grid framework, Strategic procurement.	**8**
Unit 2	**B2B Marketing Strategy:** Strategy making and strategy management process, Industrial product strategy-Managing Products for Business Markets-Managing Services for Business Markets-Managing Business Market Channels the Growth- Share Matrix, Multifactor Portfolio Matrix, The Balanced Scorecard.B2B Marketing STP: Market Segmentation, bases for segmenting business markets, basic framework of segmentation, choosing target segments and positioning.	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Unit 3	**Business Marketing Communications:** B2B Advertising, Digital marketing, Trade shows, exhibitions, business meets-Managing the sales force-Deployment analysis, , Forecasting-meaning, importance and relevance, issues related to forecasting, forecasting measurement models, sales force forecasting, estimating segment demand, Collaborative approach to estimate demand, qualitative and quantitative forecasting methods.	**6**
Unit 4	**Product Management (Existing And New) In Industrial Market:** role of product in the industrial market, new product development, industrial product life cycle, product evaluation matrix, techniques for identifying new products QFD, perceptual mapping, reverse engineering, fish bone diagram, role of service and maintenance in industrial markets, customer experience life cycle, service quality. Pricing: Pricing strategies: The pricing policy; Price on the Internet; Financial marketing, competitive bidding, commercial terms and conditions, role of leasing.	**6**
Unit 5	**Buyer Seller Relationship:** types of relationships, transactional and collaborative relationships, influencing industrial customers, role of service in industrial markets. CRM.B2B marketing research, challenges in B2B research, developing a marketing information system, role of qualitative research techniques in B2B research.	**5**
Unit 6	**Business Marketing Channels And Participants:** Channel design and managcmcnt dccisions-B2B logistics management, types of industrial middlemen and interme-diaries, marketing logistics and physical distribution. Strategic decision making in industrial markets, strategic planning at corporate levels, allocation of resources, portfolio analysis, developing SBU'S objectives and goals, implementing and controlling marketing plan. Marketing through electronic commerce.	**5**
	Total Hours	**36**

Text Books:

1) Business Market Management Understanding, Creating and Delivering Value by James C. Anderson, Das Narayandas, James A. Narus and D.V.R. Seshadri Pearson, 2010 3rd edition.
2) Business Marketing Management b2b By Hutt and Speh South-Western CENGAGE Learning www.cengagebrain.com 2013
3) B2B Brand Management by Kotler and P. Foertsch Springer www.springer.com 2006.

Reference Books:

1) Business Marketing: Text and Cases by Krishna K Havaldar, McGrawhill Publications, 2014, 4th edition.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Business To Business Marketing (B2B)	Prof. J. K. Nayak	IIT Roorkee	https://onlinecourses.nptel.ac.in/noc23_mg120/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

ORGANIZATIONAL BEHAVIOUR

Course code and Course Title	**0ETOE602C Organizational Behaviour**			
Semester	**III**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	3			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Develop a grasp of how individual factors influence workplace behavior, impacting job satisfaction and performance.	4
CO2	Acquire skills to foster productive group dynamics, facilitating better communication, decision- making, and conflict resolution.	3
CO3	Understand the role of organizational culture, and learn to manage and cultivate cultures aligned with organizational goals.	2
CO4	Gain insights into diverse leadership styles, enhancing the ability to manage teams and guide them towards success.	3
CO5	Develop the capacity to navigate change, promote diversity, and create an inclusive work environment, fostering resilience.	3

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction** a) Defining organization, behavior and organizational behavior, b) assumptions of OB, c) principles of OB, d) levels of OB, e) scope of OB, f) OB and Human Resource Management, g) Applications of OB, h) Historical developments of OB, i) emerging concerns. Perception and Learning a) understanding perception, b) Basic elements of perception, c) Principles of perceptual selection, d) Perceptual grouping, e) Social Perception, f) Self-perception and identity, g) attribution of causality, h) Perceptual biases in social perception, i) Implications for human resource management, j) defining learning, k) classical and operant conditioning l) learning in organizations.	8
Unit 2	**Personality:** a) Defining Personality, b) History of the concept, c) Key assumptions, d) biological and social determinants, e) Theories – Intra psychic theory, social learning theory, self-theory, Trait, and type theories f) Related concepts (locus of control, dogmatism, authoritarianism, Machiavellianism), g) measuring personality. Attitudes: a) Definition, b) Key elements of attitudes, c) Attitudes and related concepts (Values, opinion, belief, and ideology), e) Characteristics of attitudes, f) Attitude formation, g) Attitude measurement, h) Changing attitudes, i) Attitudes at workplace (job satisfaction, work attitude and organizational commitment), j) Prejudice and discrimination at workspace.	6

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Unit 3	**Emotions in workplace:** a) Definition, b) Types of emotions, c) Related concepts (mood, temperament), d) Stress in workplace, e) General Adaptation Syndrome, f)Managing Stress, g) Psychosomatic disorders and stress h) emotional labor and emotional contagion. **Motivation**: a)Definition, b)Process of motivation, c)Types of motives, d) Motivators at workplace, e) Motivation theories (Process and Content theories).	**6**
Unit 4	**Interpersonal Dynamics:** a) Definition, b) Psychological Contract, c) Trust and trust building, d) Prosocial behaviour, e) Cooperation Vs Competition f) Conflict management, g) Levels and types of conflict at workplace, h) Conflict management Styles, i) Managing **Negotiations Power and Leadership**: a)Defining Power, b) Sources of Power, c) Organizational politics, d) Leadership e) Managers Vs Leaders, f) Trait and Type approach to leadership g) Leadership style, h) Leadership Grid, i) Contingency Theories j) Contemporary issues	**6**
Unit 5	**Team Dynamics:** a)Groups and Teams, b)Types of Teams ,c) Stages in group development, Problems in team work(Free riding, social loafing, groupthink),e) Cross- cultural virtual teams **Organizational culture:** a) Defining culture, b) levels of culture, c) cultural dimensions, d) high and low context cultures, e) Strong and weak organizational cultures, f) Expressions of organizational culture, g) Impact of culture on individuals, h) Organizational cultural change.	**5**
Unit 6	**Organization Change:** a) Change in Organizations, b)Nature of the chance process, c)Types of chance, d) Impact of change, e) Managing resistance to change, f) Organizational Development interventions **Organizational Structure and Design:** a) Basic dimensions of structure, b)Departmentalization, c) Organizational life cycle, d) Organizations associo-technical systems, e) Organizational design and its impact on employees, f) Organizational boundary spanning.	**5**
	TOTAL hours	**36**

Text Books
1) Behaviour in Organizations by Jerald Green berg and Robert A. Baron, PHI learning private Ltd, New Delhi (Ninth Edition).
2) Understanding Organizational Behaviour by Udai Pareek, Oxford University Press (Third Edition).
Reference Books:
1) ORGB by Nelson, Quick and Khandelwal , Cengage Learning New Delhi (second edition).

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Organizational Behaviour	Prof. M. P. Ganesh	IIT Hyderabad	Organizational Behaviour--Course (nptel.ac.in)

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

PRINCIPLES OF ECONOMICS

Course code and Course Title	**0ETOE602D Principles of Economics**			
Semester	**III**			
Prerequisites	Engineering Mathematics I & II			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	3			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Grasp key economic principles, like supply and demand, opportunity cost, and marginal analysis, forming a foundation for economic understanding.	**2**
CO2	Gain insights in to market structures ,pricing mechanisms, and factors influencing consumer and producer behavior.	**3**
CO3	Understand the role of government inter venations, regulations, and fiscal / monetary policies in shaping economic outcomes.	**2**
CO4	Learn how societies allocates resources efficiently, exploring to pics like production, distribution, and factors of production.	**2**
CO5	Develop analytical thinking by applying economic principle store al-world scenarios, making informed personal and business decisions.	**3**
Unit No.	**Contents**	**Hrs.**
Unit 1	**Principles of Economics:** Thinking like an Economist; Interdependence and the gains from Trade.	**7**
Unit 2	**Market forces of supply and Elasticity:** Application of elasticity; supply, demand, and government policies.	**8**
Unit 3	**Consumer and producer surplus:** Cost of taxation and international trade, Externalities, and cost of production.	**8**
Unit 4	**Competitive market and monopoly market:** Game theory and oligopoly, measures national income, measuring cost of living.	**7**
Unit 5	**Production and growth:** Saving, Investment and the financial system the monetary system, Money growth and inflation.	**6**
TOTAL hours		**36**

Text Books / Reference Books:

1) N .Gregory Mankiw, Principles of Economics.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Principles of Economics	Prof. Sabuj Kumar Mandal	IIT Madras	Principles of Economics– Course (nptel.ac.in)

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous EN06269 Institute

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme

to be implemented from Academic Year 2025-26

INTELLECTUAL PROPERTY &RIGHTS

Course code and Course Title	**0ETOE602E Intellectual Property &Rights**			
Semester	**III**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	3			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Explain the fundamentals of Intellectual Property Rights (IPR).	**2**
CO2	Analyze the role of TRIPS, WTO, and international conventions in protection and management of intellectual property rights.	**4**
CO3	Apply the procedures related to patent filing, copyright registration, licensing, and infringement remedies in engineering and technological domains..	**3**

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to IPR:** Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Introduction to TRIPS and WTO, Kinds of Intellectual property rights-Copy Right, Patent, Trade Mark, Trade; Secret and trade dress, Design, Layout Design, Geographical Indication, Plant. Varieties and Traditional Knowledge.	**6**
Unit 2	**Patent Rights and Copy Rights:** Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.	**6**
Unit 3	**Copy Right:** Origin, Definition &Types of Copy Right, Registration procedure, Assignment & license, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.	**6**
Unit 4	**Trade Marks:** Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. Domain Names on cyber space.	**6**
Unit 5	**Design:** Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.	**6**
Unit 6	**IT Act and Cyber Law Fundamentals:** Basic Tenants Of Information TechnologyAct-2000, IT Act- Introduction, E- Commerce and legal provisions, E- Governance and legal provisions, Digital	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

	signature and Electronic Signature. Cybercrimes.	
	Total Hours	**36**

Text Books:
1) Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G. B. Reddy IPR by P. Narayanan.
Reference Books:
1) Law relating to Intellectual Property, Universal Law Publishing Co, by Dr. B. L.Wadehra

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Intellectual Property& Rights	Prof. Feroz Ali	IIT Madras	https://onlinecourses.nptel.ac.in/noc23_hs55/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

INDIAN KNOWLEDGE SYSTEM (IKS): CONCEPTS AND APPLICATIONS IN ENGINEERING

Course code and Course Title	**0ETIK603 Indian Knowledge System(IKS): Concepts and Applications in Engineering**			
Semester	**III**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Contents

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:		**BL**
CO1	Gain a comprehensive understanding of the philosophical, scientific, and technological aspects of Indian Knowledge Systems and their historical development.	**2**
CO2	Understand the philosophical under pinning's of IKS, Including concepts like dharma, karma, and holistic thinking, and explore their relevance to engineering.	**2**
CO3	Understand Vedic mathematical principles and computational methods, and their potential relevance in solving modern engineering problems.	**2**
CO4	Investigate the connections between yoga, meditation, and stress management, and their potential impact on mental well-being in engineering contexts.	**3**
CO5	Reflect on the ethical, cultural, and social dimensions of integrating IKS concepts into engineering practices and applications.	**4**

Unit No.	**Contents**	**Hrs.**
Unit 1	**Indian Knowledge System–An Introduction &Vedic Corpus:** What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS, Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: Distinctive Features.	**6**
Unit 2	**Number system &Mathematics:** Number systems in India-Historical evidence, Salient aspects of Indian Mathematics, Bhūta- Saṃkhyā system, Kaṭapayādi system, Measurements for time, distance, and weight, Piṅgala and the Binary system. Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry, Trigonometry, Binary mathematics, and combinatorial problems in ChandaḥŚāstra, Magic squares in India	**6**
Unit 3	**Engineering Technology: Metal & Other Applications:** Wootz Steel: The rise and fall of a great Indian technology, The Indian S & T heritage, Mining and ore extraction, Metals and metalworking technology, Iron and	**6**

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

	steel in India, lost wax casting of idols and artifacts, Apparatuses used for extraction of metallic components. Irrigation systems and practices in South India, literary sources for science and technology, Physical structures in India, irrigation and water management, dyes and painting tecnology, the art of making perfumes, Surgical techniques, shipbuilding, sixty-four art forms (64 Kalās) status of Indigenous S & T.	
Unit 4	**Town Planning and Architecture:** Perspective of Arthaśāstra on town planning, Vāstu-śāstra-The science of architecture eight limbs of Vāstu, town planning, temples in India: Marvelous stone architecture for eternity, temple architecture in India, Iconography.	**6**
Unit 5	**Knowledge Framework and Classifications:** Indian scheme of knowledge, The knowledge triangle, Prameya- A vaiśeṣikan approach to physical reality, Dravyas-the constituents of the physical reality, Attributes- the properties of substances and Action- the driver of conjunction and disjunction, Sāmānya, viśēṣa, samavāya, Pramāṇa- the means of valid knowledge, Saṃśaya- ambiguities in existing knowledge, Framework for establishing valid knowledge, Deductive or inductive logic framework, Potential fallacies in the reasoning process, Siddhānta: established tenets in a field of study.	**6**
Unit 6	**Linguistics:** Introduction to Linguistics, Aṣṭādhyāyī, Phonetics, word generation, computational aspects, Mnemonics, Recursive operations, Rule based operations, Sentence formation verbs and prefixes, role of Sanskrit in natural language processing.	**6**
Total hours		**36**

Text Books / Reference Books:
1) Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), Introduction to Indian Knowledge System: Concepts and Applications‖, PHI Learning Private Ltd. Delhi.

NPTEL Platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Indian Knowledge system (IKS): Concepts and Applications in Engineering	Prof. B. Mahadevan, Dr. Vinayak Rajat	(IIMB), Chanakya	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

DISSERTATION PHASE I

Course code and Course Title	**0ETEL651 Dissertation Phase I**		
Semester	**III**		
Prerequisites	--		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	-
Credits	10		
Evaluation Scheme	**ESE**		
	50		

Contents

Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation that may include mathematical model/SRS/UML/ERD/block diagram/PERT chart, and layout and design of the proposed system/work. As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic. It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal. The student shall submit the duly certified progress report of project -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme to be implemented from Academic Year 2025-26

DISSERTATION PHASE I

Course code and Course Title	**0ETEL651 Dissertation Phase I**		
Semester	**III**		
Prerequisites	--		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	2
Credits	10		
Evaluation Scheme	**ESE**		
	50		

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Analyze research problems in electronics and telecommunication engineering through literature survey and identify appropriate methodologies, tools, and techniques for proposed work.	4
CO2	Evaluate the feasibility of proposed solutions by developing initial design, modelling, or simulation and interpreting preliminary results.	5

Contents

The Project Work Phase-I shall focus on the identification and formulation of a research or engineering problem in the field of Electronics and Telecommunication Engineering or interdisciplinary domains, approved by the concerned guide. The project may be analytical, computational, experimental, or a combination of these approaches.

The student should carry out a comprehensive literature survey using reputed sources such as journals, conference papers, and standard references to understand the current state-of-the-art and identify research gaps. Based on this study, the student shall define clear objectives, scope, and methodology of the proposed work. The work in this phase should include selection of appropriate tools, techniques, and software/hardware platforms, followed by the initial design, modelling, and simulation of the proposed system. The emphasis should be on problem formulation, feasibility analysis, and preliminary results.
The student must regularly interact with the project guide and present progress at periodic intervals.

The work carried out should demonstrate analytical ability, understanding of the problem, and technical competence. At the end of the semester, the student shall submit a detailed Phase-I report in the prescribed format, clearly presenting the literature review, problem statement, methodology, and preliminary work. The evaluation will be based on problem definition, literature survey, methodology, progress, and report quality.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

Dr. S. S. Mohite
Director

Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI

An Autonomous Institute, affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad
(Accredited by NAAC)

Department of Electronics & Telecommunication Engineering

M. Tech.

Curriculum including Structure and Evaluation Scheme
to be implemented from Academic Year 2025-26

DISSERTATION PHASE II

Course code and Course Title	**0ETEL652 Dissertation Phase II**			
Semester	**IV**			
Prerequisites	-			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	-	-	4	
Credits	20			
Evaluation Scheme	**ISE**		**ESE**	
	100		100	

Course Outcomes (COs): After completion of course student will be able to		**BL**
CO1	Evaluate the performance of the developed system through detailed implementation, testing, and validation, and compare results with existing methods or expected outcomes.	**5**
CO2	Design and develop a complete engineering solution by integrating analytical, computational, and/or experimental approaches, and create a comprehensive project report with effective presentation.	**6**

Contents

Project Work Phase-II shall focus on the implementation, testing, and completion of the project based on the work carried out in Phase-I. The student is expected to extend the design, develop the complete system, and obtain final results. The work should include detailed analysis, experimentation/simulation, validation of results, and performance evaluation of the proposed system. The student(s) should compare the obtained results with expected outcomes or existing methods and provide necessary discussions and improvements. The project should demonstrate depth of knowledge, originality, and the ability to solve complex engineering problems independently. Proper documentation, interpretation of results, and critical analysis are essential components of this phase.

The student must continue regular interaction with the guide and incorporate feedback to improve the quality of work. At the end of the semester, the student shall submit a comprehensive final project report including all aspects of the work such as introduction, literature review, methodology, implementation, results, and conclusions. The student shall also deliver a presentation and/or demonstration of the work. The evaluation will be based on quality of implementation, results obtained, innovation, report quality, presentation, and overall understanding of the project.

Dr. M. S. Chavan
HoD

Dr. K. K. Pandyaji
Dean Academics

P.V.P. INSTITUTE OF TECHNOLOGY, BUDHGAON An Autonomous Institute EN06269

Dr. S. S. Mohite
Director