Autonomous Programme Structure of
Final Year B. Tech. (Electronics & Telecommunication)
Academic Year: 2019-2020 Onwards

Final Year B. Tech. Electronics and Telecommunication Engineering Semester – II										
Course Code	**Course Title**	**Teaching Scheme**			**Examination Scheme**				**Marks**	**Credits**
		Hours /Week								
		Lecture	**Tutorial**	**Practical**	**In Semester**	**End Semester**	**Oral**	**Practical**		
EC 4201	Broadband Communication Systems	3	0	0	50	50	0	0	100	3
PEEC4201	Programme Elective – I	3	0	0	50	50	0	0	100	3
OE 4201	Open Elective- II	3	0	0	50	50	0	0	100	3
EC 4202	Broadband Communication Systems Lab	0	0	2	0	0	50	0	50	1
EC 4203	Project Phase-II	0	2	16	100	0	50	0	150	10
EC 4204	Project based online course**	2	0	0	50	0	0	0	50	2
	Total	**11**	**2**	**18**	**300**	**150**	**100**	**0**	**550**	**22**
	Grand Total	**31**			**550**				**550**	**22**

****The student shall register and complete the project based online course preferably in semester- I but may complete the same till the end of semester-II**

PEEC 4201: Programme Elective I

1. Advanced DSP
2. Microwave and Radar Engineering
3. Mobile Communication

OE 4201: Open Elective II

1. Computer Vision
2. Automotive Electronics

EC 4201 BROADBAND COMMUNICATION SYSTEMS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To explain different components of Broadband communication system
2. To identify system design issues and the role of WDM components in advanced optical fiber communication system
3. To describe the basics of orbital mechanics and the look angles from ground stations to the satellite
4. To illustrate the satellite subsystems
5. To design Satellite Link for Up Link and Down Link

Course Outcomes:
After completion of the course, students will be able to

1. Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers
2. Describe optical sources and detectors and determine their performance parameters
3. Calculate link power budget and rise time budget of optical link and describe WDM components
4. Describe satellite subsystems and compute orbital parameters for satellite
5. Design of satellite uplink and downlink

Unit I: Fiber optic communications system **(07)**
Electromagnetic Spectrum and Optical spectral bands, Key elements of fiber optic communications system, Ray theory of propagation: Fiber types, Transmission characteristics of optical fibers, Intra modal Dispersion, Intermodal dispersion.

Unit II: Optical Sources & Detectors **(06)**
Introduction to optical sources: Wavelength and Material Considerations, LEDs and semiconductor LASERs: principle of working and their Characteristics, Material Considerations, PN, P-I-N, Avalanche photodiodes and photo transistors: Principle of working and characteristics.

Unit III: Design considerations in optical links & WDM **(07)**
Point to point Links: System design considerations, Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques, Overview of WDM, WDM Components: 2 x 2 Fiber Coupler, Optical Isolators and Circulators, Multiplexers and De-multiplexers, Fiber Bragg Grating, Diffraction Gratings, Overview of Optical Amplifiers: SOA, EDFA in brief.

Unit IV: Orbital Mechanics and Launchers **(07)**

History of Satellite Communication, Orbital Mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and Launch Vehicles, Orbital effects in Communication system performance.

Unit V: Satellites subsystems **(06)**

Satellite Subsystems, Attitude and control systems (AOCS), Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment Reliability and space qualification.

Unit VI: Satellite Communication Link Design **(07)**

Introduction, Basic transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design of Specified C/N: Combining C/N and C/I values in Satellite Links, System Design Examples.

Text Books:

1. Gerd Keiser, **"Optical Fiber Communications",** *Tata McGraw Hill,* (5th Edition), (2013).
2. John M. Senior, **"Optical Fiber Communications: Principles and Practice",** *PHI,* (3nd Edition), (2008).
3. Timothy Pratt, Charles Bostian, Jeremy Allnutt "**Satellite Communications**", *John Wiley &Sons*, (3rd Edition), (2002).

Reference Books:

1. Djafar K. Mynbaev and Lowell L. Scheiner, **"Fiber Optic Communications Technology",** *Pearson Education*, (1st Edition), (2000).
2. Govind P. Agrawal, **"Fiber Optic Communication Systems",** *Wiley India,* (3rd Edition), (2002).
3. Dennis Roddy, "**Satellite Communications**", McGraw Hill, (4th Edition), (2017).

Online Recourses:

1. https://onlinecourses.nptel.ac.in/noc18_ee28

PEEC 4201 ADVANCED DIGITAL SIGNAL PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain concepts of Multi-rate signal processing and its applications
2. Explain linear prediction and optimum filter design and its necessity
3. Introduce adaptive filters and their applications
4. Discuss Power Spectral Estimation methods
5. Explain necessity of time-frequency analysis

Course Outcomes:

After completion of the course, students will be able to-

1. Apply concepts of Multi-rate signal processing to design and realize multi-rate filters
2. Explain the necessity of adaptive filters and make use of adaptive algorithms to design adaptive filters
3. Classify and compare spectral estimation methods, analyze their performance
4. Apply linear prediction and Levinson-Durbin algorithm to compute and optimize filter coefficients
5. Apply STFT and WT transform techniques on the signals and interpret their spectra
6. Explain the applications of advanced digital signal processing techniques

Unit I: Multi-rate Digital Signal Processing **(09)**

Introduction to Multi-rate Digital Signal Processing, Decimation by integer factors, Interpolation by integer factors, Sampling rate conversion by a rational factor I/D, Multistage multi-rate implementation of sampling rate conversion, Poly-phase filter structure, Applications of Multi-rate Signal Processing.

Unit II: Linear Prediction and Optimum filter **(09)**

Overview of random process, Innovation Representation of a stationary random Process, power spectra as rational function, AR, MA, ARMA Processes, relation between autocorrelation and filter coefficients, Yule-Walker equations, forward and backward Linear Prediction, Lattice Filter, Solution of normal equation using Levinson-Durbin Algorithm.

Unit III: Adaptive filter **(08)**

Wiener filter, FIR Wiener filter, Basic Concepts of Adaptive filter as a Noise Canceller, Other configurations of the adaptive filter, components of the adaptive filter, LMS adaptive algorithm, Practical limitations of the LMS algorithm, Applications of adaptive filters.

Unit IV: Power Spectrum Estimation **(07)**

Energy Spectral Density, Power Spectral Density, Periodogram, DFT as power spectra estimator, Power spectrum estimation by parametric and non-parametric Methods: Bartlett and Welch methods.

Unit V: Time-Frequency Analysis **(09)**

Time Frequency description of signals, Uncertainty principle, Need for joint time-frequency representation, Tiling diagrams, Short Time Fourier Transform, Wigner Ville distribution,

Continuous Wavelet Transform, Discretization of STFT and CWT, Spectrograms and Scalograms, Discrete Wavelet Transform and its relation to multi-rate filter banks.

Text Books:

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "**Digital Signal Processing-A Practical Approach**", *Pearson Education*, (2nd Edition), (2007).
2. J. G. Proakis, "**Digital Signal Processing, Principles, Algorithms and Applications**", *Pearson Education*, (4th Edition), (2007).
3. K. P. Soman, K. I. Ramchandran, N. G. Reshmi, "**Insight into Wavelets- from theory to Practice**", *PHI Learning Private Limited*, (3rd Edition), (2010).

Reference Books:

1. Monson Hayes, "**Statistical Digital Signal Processing and Modeling**", *John Wiley and Sons,* (1st Edition), (2008).
2. Leon Cohen, "**Time-Frequency Analysis**", *Prentice Hall*, (1995).

Online Recourses:

1. https://nptel.ac.in/courses/117101001/

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PEEC 4201 MICROWAVE AND RADAR ENGINEERING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To introduce the basics of waveguides and various microwave components
2. To analyze microwave components using scattering parameters
3. To explore various microwave measurement techniques
4. To explain different types of Radars and its applications

Course Outcomes:

After completion of the course, students will be able to

1. Discuss the advantages and applications of microwaves
2. Analyze different modes of propagation in waveguides
3. Derive and analyze S parameters for different microwave components
4. Compare performance of different microwave tubes
5. Analyze and measure parameters at microwave frequencies
6. Discuss the principle of Radar and compare different types of Radars

Unit I: Microwave Transmission Lines **(07)**

Introduction of Microwaves and their applications, Rectangular waveguides, Solution of Wave equation in TE and TM modes, Power transmission and Power losses, Planar transmission lines.

Unit II: Wave Guide Components **(07)**

Scattering matrix representation of networks, Rectangular cavity resonator, Waveguide Tees, Directional couplers, Faraday rotation principle, Circulators and isolators.

Unit III: Microwave Tubes **(08)**

Introduction to conventional vacuum tubes, High frequency limitations of conventional tubes, Klystron tubes, Magnetron, TWT and their applications.

Unit IV: Microwave Measurements **(06)**

Introduction to microwave measurements, measurement methods of parameters such as frequency, power, attenuation, phase shift, VSWR, impedance, insertion loss, Q of a cavity resonator.

Unit V: Radar Fundamentals **(06)**

Radar block diagram and operation, radar range equation, prediction of range performance, minimum detectable signal, radar cross section of targets, Pulse repetition frequency and range ambiguities.

Unit VI: Types of Radar and Applications **(06)**

Doppler effect, CW radar, basic principle and operation of FMCW radar, MTI and Pulse Doppler Radar.

Text Books:

1. S.Y. Liao, **"Microwave Devices and Circuits"**, *Prentice Hall India,* (2nd Edition), (2014).
2. M. Kulkarni, **"Microwave and Radar Engineering"**, *Umesh Publications,* (4th Edition), (2013).
3. M. I. Skolnik, "**Introduction to Radar Systems"**, *McGraw Hill,(3rd* Edition), (2008).

Reference Books:

1. David M. Pozar, **"Microwave Engineering"**, *John Willey and Sons,* (5th Edition), (2014).
2. Nadow Levanon, **"Radar Principals"**, *John Wiley and Sons,* (5th Edition), (1989).

Online Recourses:

1. https://nptel.ac.in/courses/108101112/
2. https://nptel.ac.in/courses/117105130/

PEEC 4201 MOBILE COMMUNICATION

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To introduce the fundamentals of cellular system design and the techniques used to maximize the capacity of cellular network
2. To describe the basics of multi-path fading and various parameters used to characterize small scale fading
3. To explain various multiple access techniques
4. To explore the architecture and call processing of GSM and CDMA system

Course Outcomes:

After completion of the course, students will be able to

1. Explain the basics and design challenges of cellular networks
2. Analyze signal propagation issues and their impact on the communication system performance
3. Compare and determine capacity of different multiple access techniques
4. Describe the architecture, operation and call processing of GSM system
5. Describe CDMA system and analyze it's design parameters

Unit I: Cellular Fundamentals **(10)**

Introduction to wireless Communication Systems, Evolution in cellular standards, Cellular concepts, Introduction, Frequency reuse, Channel assignment, Handoff, Interference and System capacity, Trunking and Grade of service, Improving coverage and capacity.

Unit II: Mobile Radio Propagation **(10)**

Propagation Mechanism, Free space loss, Reflection, Diffraction, Scattering, Fading and Multipath, Small scale multipath propagation, Impulse response model of multipath channel, Parameters of mobile multipath channels, Types of small scale fading, Equalization techniques.

Unit III: Coding and Multiple Access Techniques for Wireless Communications **(06)**

Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, Multiple Accesses techniques, FDMA, TDMA, FHMA, CDMA, SDMA, OFDM.

Unit IV: Global System for Mobile Communications (GSM) **(07)**

Evolution of Mobile standards, System Overview, The air interface, Logical and Physical channels, Synchronization, GMSK modulation, Call establishment, Handover.

Unit V: CDMA **(07)**

System overview, Air interface, Coding, Spreading and modulation, Logical and physical channels, Handover, Comparison of WCDMA and CDMA 2000, Overview of LTE, Introduction to 5G, Comparison between 4G and 5G.

Text Books:

1. Theodore S Rappaport, **"Wireless Communications Principles and Practice"**, *Pearson Education,* (2nd Edition), (2014).
2. Andreas F Molisch, **"Wireless Communications"**, *Wiley India,* (2nd Edition), (2013).

Reference Books:

1. Vijay K Garg, Joseph E Wilkes, **"Principles and Applications of GSM"**, *Pearson Education* , (5th Edition), (2014).
2. *Vijay K Garg, Joseph E Wilkes,* **"IS-95CDMA and CDMA 2000 Cellular/PCS Systems Implementation"**, *Pearson Education,* (5th Edition), (2014).
3. R. Blake, **"Wireless Communication Technology"**, *Thomson Delmar,* (1st Edition), (2015).
4. W.C.Y. Lee, **"Mobile Communications Engineering: Theory and applications"**, *McGraw-Hill International*, (2nd Edition), (2015).

Online Recourses:

1. https://onlinecourses.nptel.ac.in/noc18_ee29/

OE 4201 COMPUTER VISION

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50Marks
Credits: 3

Course Objectives:

1. To explain the mapping from 3D world to 2D world
2. To describe hands on Camera calibration techniques and basics of stereo imaging
3. To describe the concepts of feature analysis and extraction techniques such as Corner detector, Scale Invariant Feature Transform
4. To introduce the concepts of machine learning

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the image formation and working of camera as an image sensor
2. Analyze the procedure of camera calibration
3. Analyze the importance of stereo imaging
4. Compare different feature detectors and descriptors techniques
5. Apply machine learning algorithms for computer vision applications
6. Apply computer vision concepts for development of the specific application

Unit I: Camera Calibration and Stereo Imaging **(12)**

Camera calibration: pin hole, thin lens equations, FOV, DOF, CCD and COM sensor, camera parameters, camera calibration Stereo imaging: epipolar geometry, rectification, correspondence, triangulation, RANSAC algorithm, Dynamic programming.

Unit II: Feature Detection and Descriptors **(08)**

Corner detector, Edge Detector, Histogram of Gradient, Scale Invariant Feature Transform.

Unit III: Introduction to Machine Learning for Computer Vision **(13)**

Supervised and Non supervised learning, KNN, Machine learning framework, Classifiers, Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network, CNN.

Unit IV: Applications **(07)**

Non-visible-light Imagery: Infrared imaging applications, Applications of computer vision: Image mosaiking, Pedestrian classification, Image in painting.

Text Books:

1. M. Shah, **"Fundamentals of Computer Vision"**, *Online book,* (1997).
2. D. A. Forsyth, J. Ponce, **"Computer Vision, A Modern Approach"**, *Prentice Hall,* (2nd Edition), (2003).
3. R. Szeliski, **"Computer vision algorithms and applications"**, *Springer-Verlag*, (2nd Edition), (2010).
4. Tom Mitchell, **"Machine Learning.. First Edition"**, *McGraw- Hill*, (1st Edition), (2017).

Reference Books:

1. L. G. Shapiro, George C. Stockman, **"Computer Vision"**, *Prentice Hall*, (1st Edition), (2001).
2. E. Trucco, A. Verri, **"Introductory Techniques for 3-D Computer Vision"**, *Prentice Hall,* (1st Edition), (1998).
3. D. H. Ballard, C. M. Brown, **"Computer Vision"**, Prentice Hall, (1st Edition), (1982).
4. M. Sonka, V. Hlavac, R. Boyle, **"Image Processing, Analysis, and Machine Vision"**, *Thomson Press*, (3rd Edition), (2011).

OE 4201 AUTOMOTIVE ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To explain the operation of basic Automotive system components
2. To explain various sensors and their interfacing in Automotive applications
3. To describe the system view of various Automotive Control and Communication systems
4. To introduce the diagnostic methodologies and safety aspects in Automotive system

Course Outcomes:

After completion of the course, students will be able to

1. Explain the functioning of automotive system components and compare I. C. Engines
2. Discuss the working principle of sensors and their use in automotive applications
3. Discuss the role of automotive control systems to improve the fuel efficiency and emission quality
4. Explain diagnostic tools and their operation
5. Discuss the safety norms, standards and safety systems in modern automobiles

Unit I: Fundamentals of Automotive Systems **(10)**

Overview of Automotive System, System Components, Basics of Petrol, Diesel and Gas Engines, Evolution of Electronics in Automotive, Engine configuration and its associated components, Ignition system, Drive Train, Suspension system, Braking system, Steering system, Fuel Delivery system, Alternator and battery charging circuit, Alternative fuels, Overview of Hybrid vehicle, Introduction to autonomous Car.

Unit II: Automotive Sensors, Actuators, Control systems **(10)**

Systems approach to Control and Instrumentation : Concept of a system, Analog and Digital system, Basic Measurement system, Analog and Digital Signal Processing, Sensor characteristics, In-vehicle Sensors :Air flow sensing, Crankshaft Angular Position sensing, Throttle angle sensing, Temperature sensing, EGO sensor, Vibration sensing (in Air Bags) , Actuators : Fuel injector, EGR actuator, Ignition system, VVT, BLDC motor, Electronic Engine Control, Engine Management System strategies and Methods of improving engine performance and efficiency.

Unit III: Microcontrollers / Microprocessors in Automotive domain **(08)**

Critical review of Microcontroller/Microprocessor, Architecture of 8-bit/16-bit Microcontrollers with emphasis on Ports, Timers / Counters, Interrupts, Watchdog Timer, PWM, Criteria to choose the appropriate microcontroller for automotive applications, Automotive grade processors.

Unit IV: Automotive Communication Protocols **(06)**

Overview of Automotive Communication Protocols, CAN, LIN, FLEXRAY, MOST, Communication Interface with ECUs, Interfacing techniques and interfacing with infotainment gadgets, Applications of telematics in automotive domain - GPS and GPRS.

Unit V: Safety systems in Automobiles and Diagnostics **(08)**

Active Safety Systems-- Anti-lock Braking System, Traction Control System, Electronic Stability Program, Passive Safety systems – Airbag System, Advanced Driver Assistance System (ADAS), Fundamentals of Diagnostics, Self Diagnostic System, On-Board Diagnostics and Off-Board Diagnostics.

Text Books:

1. Williams. B. Ribbens, **"Understanding Automotive Electronics"**, *Elsevier Science, Newnes Publication, (6th Edition), (2003).*
2. Robert Bosch, **"Automotive Electronics Handbook",** *John Wiley and Sons,* (2004).

Reference Books:

1. Ronald K Jurgen, **"Automotive Electronics Handbook"**, *McGraw-Hill,* (2nd Edition), (1999).
2. James D Halderman, **"Automotive Electricity and Electronics"**, *PHI Publication* (2005).
3. Tom Denton, **"Automobile Electrical & Electronic Systems",** *Routledge*,(4th Edition).
4. Jack Erjavec, **"A Systems Approach to Automotive Technology",** *Cengage Learning.*
5. V.A.W.Hillier, **"Fundamentals of Automotive Electronics ",** *Nelson Thornes.*
6. Tom Denton, **"Advanced Automotive Diagnosis",** *Elsevier,* (2nd Edition), (2006).

Online Recourses:

1. https://nptel.ac.in/downloads/108103009/
2. http://www.ignou.ac.in/upload/Unit-3-61.pdf

EC 4202 BROADBAND COMMUNICATION SYSTEMS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral : 50 Marks
Credits: 1

Course Objectives:

1. Interpret performance parameter of optical fiber
2. Describe characteristics of optical sources& detectors
3. To design optical fiber communication link
4. To understand satellite communication link

Course Outcomes:

After completion of the course, students will be able to

1. Compute parameters of optical fiber like NA ,attenuation and bending losses
2. Illustrate characteristics of optical sources& detectors
3. Calculate link power budget and rise time budget of optical link
4. Demonstrate satellite communication link

List of Experiments:

1. To measure numerical aperture of optical fiber
2. To determine attenuation and bending loss of optical fiber
3. To Plot VI characteristics of LED used in optical fiber communication
4. Compare performance of APD for different load resistor and biasing voltage
5. Tutorial on Power budget and time budget analysis of optical fiber system
6. Establish a direct communication link between Transmitter and Receiver for tone signal.
7. To establish satellite link between Transmitter and Receiver for audio-video signal.
8. Tutorial on satellite link design

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EC 4203 PROJECT PHASE II

Teaching Scheme
Tutorial: 02 Hours/Week
Practical: 16 Hours / Week

Examination Scheme
In Semester: 100 Marks
Oral: 50 Marks
Credits: 10

Course Outcomes:
After completion of the course, students will be able to

1. Build and Test the hardware and/or software modules
2. Achieve the intended outcome through a systematic work plan
3. Draft the report and present the outcome of project
4. Demonstrate the working project and analyze the process to achieve the results

Guidelines:

A. Verification of the technical design using simulation tools and other appropriate methods. The verification results should be documented in the Logbook and authenticated by the respective guide. Weekly attendance should be logged in with the respective guide and will be monitored.

B. Assembly of the system by taking into account the appropriate design considerations.

C. Testing of the assembled system and validation of the objective proposed in the Project's Synopsis. The validation results should be documented in the Logbook and authenticated by the respective guide.

D. A report mentioning the project work done during the entire academic year, is required to be submitted. The said report should be certified by the respective guide and the college Authority. The same should be presented during the exam.

E. The working of the Project's set-up should be demonstrated during the exam. The exam should be conducted by TWO Examiners (Internal and External).

EC 4204 PROJECT BASED ONLINE COURSE

Teaching Scheme
Tutorial: 02 Hours/Week

Examination Scheme
In Semester: 50 Marks
Credits: 02

Course Objective:
To obtain the domain knowledge as required for the completion of the project

Course Outcome:
1. Explain the basics concepts as required to complete the project
2. Apply domain knowledge to implement the project

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