Program: Electronics and Telecommunication Engineering

Electronics & Telecommunication Engineering-Third Year (Semester–V)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	IOHSM501	Intellectual Property Rights@@	2	--	--	2	-	-	25	-	25	50
2	ETPCC502	Electromagnetic Theory	3	1	--	4	40#	60*	-	-	-	100
3	ETPCC503	Microcontroller & Embedded Systems	3	--	--	3	40#	60**	-	-	-	100
4	ETPCC504	Digital Communication and Coding Theory	4	--	--	4	40#	60*	-	-	-	100
5	ETPEC505A	Elective I: Digital signal processing	3	--	--	3	40#	60*	-	-	-	100
	ETPEC505B	Elective I: Mechatronics										
6	ETOEC506	IoT-MOOCS	3	--	--	3	40$	60$$	-	-		100
7	ETPCC507	Microcontroller & Embedded Systems Lab	--	--	2	1	-	-	50		-	50
8	ETPCC508	Digital Communication and Coding Lab	--	--	2	1	-	-		50	-	50
9	ETPEC509A	Digital signal processing Lab	--	--	2	1	-	-	-	-	50	50
	ETPEC509B	Mechatronics Lab										
10	IOHSM5ACA	Audit Course 5: Foreign Language Japanese Level I	1	--	--	1	-	-	25			25
	IOHSM5ACB	Audit Course 5: Foreign Language German Level I										
Total			**19**	**01**	**06**	**23**	**200**	**300**	**100**	**50**	**75**	**725**
11	ETMNR501	Microcontroller and Embedded Systems	3	--	--	3	--	75*	--	--	--	75
12	ETMNR502	Microcontroller and Embedded Systems Lab	--	--	2	1	--	--	25	--	--	25
Total			**22**	**01**	**08**	**27**	**200**	**375**	**125**	**50**	**75**	**825**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester I Evaluation** based on Subjective Examination.

In Semester II Evaluation based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/GATE based Multiple-Choice Question (MCQ) examination/numerical based subjective

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOCor Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Note: 1. @@ For subject having more than 1 head, passing in both the heads is mandatory to gain total credits of the subject 2. The detail syllabus of respective Minor subject of all the departments is available on the college website.

Elective-I	**ETPEC505A**	**1. Digital Signal Processing**
	ETPEC505B	**2. Mechatronics**

MOOC: Introduction To Internet of Things (12 weeks)

https://archive.nptel.ac.in/courses/106/105/106105166/

Program: Electronics and Telecommunication Engineering

Third Year Electronics and Telecommunications (2022 Course) Intellectual Property Rights			
Course Code:	**IOHSM501**	**Credit:**	**2**
Contact Hrs.:	**2 Hrs/week (L)**	**Type of Course:**	**Lecture**
Examination Scheme:	**Term-work 25 marks**	**Oral 25 marks**	

Pre-requisites:
Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives	
1	To explain the significance of Intellectual Property
2	To study various aspects of Patents
3	To understand the significance of patent information in Business development
4	To study patents documents and process for examination

Course Outcomes: Students will be able to	
501.1	Describe the significance of intellectual property
501.2	Discuss various aspects of patents
501.3	Search patent information in database
501.4	Explain patents documents and process for examination
501.5	Describe concepts related to trademarks
501.6	Differentiate copyright from patent

Topics covered:

UNIT I: INTELLECTUAL PROPERTY RIGHTS (IPR) (4 Hrs.)
IPR-Meaning, Relevance, Business Impact, Types of Intellectual Property, Protection of Intellectual Property, Competing Rationales for Protection of Intellectual Property Rights, The World Intellectual Property Organization (WIPO) and the UNESCO.

UNIT II : PATENT (4 Hrs.)
Concept of Patent, Types of Product / Process Patents & Terminology, Duration of Patents- Law and Policy Consideration ,Elements of Patentability (Novelty and Non Obviousness /Inventive Steps , Industrial Application, Non- Patentable Subject Matter), Procedure for Filing of Patent Application and types of Applications.

UNIT III:PATENT DATABASES & PATENT INFORMATION SYSTEM (4 Hrs.)
Patent Offices in India, Importance of Patent Information in Business Development, Patent search through Internet, Patent Databases.

UNIT IV: PATENT DOCUMENTS & PROCESS FOR EXAMINATION (4 Hrs.) Lab Notebooks/Logbooks/Record Books, Methods of Invention Disclosures, Patent Application and its Contents, Writing of the Patent Document, Publication of Patent Applications, Request for Examination, Process for Examination & Prosecution, Reissue & Re-examination.
UNIT V: TRADEMARKS (4 Hrs.) Definition and concept of Trademarks, The rationale of protection of trademark, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) .
UNIT VI COPYRIGHTS (4 Hrs.) Definition of Copyright, Nature of Copyright, Works in which Copyrights subsist, Author & Ownership of Copyright , Rights Conferred by Copyright , Registration of Copyrights & Appeals.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):* 1. NA.

Text Books:

1. Intellectual Property Rights-Law and Practice By Laser Typesetting

Reference Books

1. Aswani Kumar Bansal, "Law of Trademarks in India" ,Commercial Law Publishers, 2001
2. B L Wadehra, "Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications" Universal Law Publishing Co Ltd.
3. G.V.G Krishnamurthy , "The Law of Trademarks, Copyright, Patents and Design"
4. Satyawrat Ponkse, "The Management of Intellectual Property" Bhate&Ponkshe, 1991
5. S K Roy Chaudhary& H K Saharay , "The Law of Trademarks, Copyright, Patents and Design.Legal Aspects of Technology Transfer: A Conspectus"

E-Resources:

1. Patent act:
   https://ipindia.gov.in/writereaddata/Portal/IPOAct/1_31_1_patent-act-1970-11march2015.pdf

2. Practice and procedures:
   https://ipindia.gov.in/writereaddata/Portal/Images/pdf/Manual_for_Patent_Office_Practice_and_Procedure_.pdf

Program: Electronics and Telecommunication Engineering

Third Year Electronics and Telecommunications (2022 Course) Electromagnetic Theory (ETPCC502)			
Course Code:	**ETPCC 502**	**Credit**	**4**
Contact Hours:	**Th- 03 Hr/Week** **Tutorial-01 Hr/Week**	**Type of Course:**	Lecture Tutorial
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

1. Vectors, Vector Calculus
2. Coordinate Geometry, Cartesian, Cylindrical, Spherical
3. Engineering Mathematics III

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	Provide the foundation of Electromagnetic theory essential to subsequent courses of radiation, microwave and wireless communications.
2	To Expose the students to basic laws of Electrostatics
3	To Expose the students to basic laws of Magnetostatics
4	To impart knowledge on the concepts of Electric Dipole, Conductors, Boundary conditions for electric field and magnetic field
5	To impart knowledge on the concepts of Faraday‘s law, Induced emf and Maxwell‘s equations.
6	To explain the concepts of Uniform Plane waves.

Course Outcomes: Students will be able to	
502.1	Apply the basic mathematical concepts related to electromagnetic vector fields.
502.2	Apply the basic laws of electrostatics, electric potential, energy density and their applications leading to the Maxwell Equations for static and dynamic fields.
502.3	State, Identify and Apply the basic laws of magneto statics, magnetic flux density, scalar and vector potential and its application leading to the Maxwell Equations for static and dynamic fields.
502.4	Explain and solve the concepts of Electric Dipole, Polarization, Conductors,

	Dielectric Materials, Boundary conditions and Energy density.
502.5	Formulate and Interpret the concepts of Faraday‘s law, Induced emf and Maxwell‘s equations.
502.6	Interpret and solve the uniform plane waves.

Topics covered:

UNIT I : Electromagnetic Basics (6 Hrs)

Sources and effects of electromagnetic fields , Scalar and Vector fields, Vector Calculus, Different Coordinate Systems: Rectangular, Cylindrical and Spherical – Relationship between Coordinate systems Coulomb's Law - Electric field intensity (E) - Field due to point and continuous charges – Electric field due to finite line charge, circular disc, two concentric shells and coaxial cylinders - Electric flux density (D) Gradient, Divergence and Curl – Divergence theorem - Stoke's theorem.

UNIT II Electrostatics (06 Hrs)

Review of 3D Coordinate Geometry, Vector Calculus, Physical significance of Gradient, Divergence, Curl, Gauss‘s law, Electric potential(V), Potential Gradient, E/D/V due to uniform sources (point charge, infinite line charge, infinite surface charge) , Maxwell Equations for Electrostatics, Current, Current Density, physical interpretation.

Application Case Study: Electrostatic Discharge, Cathode Ray Oscilloscope

UNIT III: Magnetostatics (06 Hrs)

Lorentz force, Magnetic field intensity (H), Magnetic Flux Density(B), – Biot–Savart‘s Law – Ampere‘s Circuital Law – H due to straight conductors, circular loop, infinite sheet of current, Maxwell Equations for MagnetoStatics, physical interpretation.

Application Case Study: Lightning, Magnetic Resonance Imaging (MRI).

UNIT IV: Boundary Conditions (06 Hrs)

Electric Dipole, Dielectric Polarization, Properties of Conductors, Dielectric Materials, Boundary conditions (dielectric-dielectric, conductor –dielectric), significance and applications of Poisson‘s and Laplace‘s equations - Capacitance, Energy density. Magnetization, magnetic materials, Boundary conditions for Magnetic Fields, Magnetic force, Torque.

Application Case Study: RF MEMS, Magnetic Levitation, Electromagnetic Pump.

UNIT V: Time Varying Electromagnetic Fields: Maxwell Equations (06 Hrs)
Scalar and Vector Magnetic Potential, Poisson’s and Laplace Equations, Faraday‘s law, Translational and motional emf, Displacement current density, Continuity Equation, Time varying Maxwell‘s equations - point form, integral form, Power and Poynting theorem, concept of Retarded magnetic vector potential,
Application Case Study: Memristor, Electric Motors, Generators...

UNIT VI: Uniform Plane Waves (06 Hrs)
Maxwell‘s equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between E and H, depth of penetration, concept of polarization, Reflection by perfect conductor-normal incidence, reflection by perfect dielectric- normal incidence, Snell‘s law.

Application Case Study: Comparison of Circuit Theory at low frequency and Field theory at High frequencies, Antenna Radiation Mechanism, Propagation of EM energy.

Text Books:

[T1]	M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Press, India, 2015 (Asian adaptation of 'M.N.O. Sadiku, Elements of Electromagnetics, Sixth International Edition, Oxford University Press'), 6th Edition
[T2]	William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 8th Revised Edition.

Reference Books:	
[R1]	Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, 5th Edition.
[R2]	Jordan and Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 1964.
[R3]	Joseph.A.Edminister, Thoery and problems of Electromagnetics, Schaum Series, Tata McGraw Hill, Second Edition,1993
MOOC/NPTEL courses	
1.NPTEL Course "Transmission Lines and EM Waves -Video course" Prof. R.K. Shevgaonkar Link of the Course: https://nptel.ac.in/courses/117/101/117101056/	
2. NPTEL Course on "Electromagnetic theory - Video course" Dr. Pradeep Kumar K Link of the Course: https://nptel.ac.in/courses/108/104/108104087/	
3. David Staelin. 6.013 Electromagnetics and Applications. Spring 2009. Massachusetts Institute of Technology: MIT OpenCourseWare Link:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013- electromagnetics-and-applications-spring-2009/index.htm#	

List of Tutorials to be carried out
At least 2 Assignments should be conducted using Virtual Electromagnetic Lab, https://www.ee.iitb.ac.in/course/~vel/
1. Vector analysis, Electric field Intensity (E): Due to Q, ρL, ρS
2. Gauss's Law, Electric flux Density (D) & Electrical Potential (V) : Due to Q, ρL, ρS ,
3. Electrostatic Boundary Conditions: dielectric-dielectric, conductor –dielectric
4. Poisson's and Laplace's Equation: Capacitance, Energy density.
5. Magnetic field Intensity (H)- Biot-Savart: Due to I dL, K dS, J dV, and Ampere's circuital law
6. Magnetic Boundary Conditions, Inductance, Force, Torque, Energy density.
7. Faraday's Law, Maxwell's Equations
8. Poynting Theorem, Retarded Magnetic Potential
9. Reflection Coefficient, SWR, etc using Smith Chart
10 Uniform Plane Waves: Wave parameters, Incidence/Reflection

Third Year Electronics and Telecommunications (2022 Course) Microcontroller & Embedded Systems (ETPCC503)			
Course Code:	**ETPCC503**	**Credit**	**3**
Contact Hours:	**03Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination (activity based) 60 Marks	

Pre-requisites:

Basic Electronics Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To Explore different features of Microcontrollers with Architecture
2	To explain interfacing of real-world peripheral devices with microcontroller
3	To develop microcontroller based applications.
4	To conceptualize the basics of Embedded Systems

Course Outcomes: Students will be able to	
503.1	Compare different Microcontrollers
503.2	Explain the basics of Embedded Systems
503.3	Analyze the features of microcontrollers
503.4	Explain different interfacing of microcontrollers
503.5	Describe the programming details in peripheral support
503.6	Develop serial port interfacing models according to applications

Topics covered:

Unit I :Introduction to Microcontroller Architecture (6Hrs) (Insem)

Difference between microprocessor and microcontroller Introduction to the Microcontroller classification, Comparison of PIC with ARM, Comparison of PIC family, Criteria for Choosing Microcontroller, features, PIC18FXX architecture with generalized block diagram.

UNIT II: Introduction to Embedded Systems (6Hrs) (MCQ)

Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC. Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description)

UNIT III: PIC 18FXXX Microcontroller (6Hrs) (Activity based project- 3 to 6 Units)

MCU, Program and Data memory organization, Bank selection using Bank Select Register, Pinout diagram. Reset operations, Watchdog Timers, Configuration registers and oscillator options (CONFIG), Power down modes, Brief summary of Peripheral support, Overview of instruction set.

Unit IV : Peripheral Support in PIC 18FXXXX (6hrs)

Timers and its Programming (mode 0 &1), Interrupt Structure of PIC18F with SFR, PORTB change Interrupts, use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP, Block diagram of in-built ADC with Control registers, Sensor interfacing using ADC: All programs in embedded C.

UNIT V: Real Word Interfacing With PIC 18FXXXX (6hrs)

Port structure with programming, Interfacing of LED, LCD and Key board, Motion Detectors, DAC for generation of waveform, Design of PIC test Board and debugging, Home protection System: All programs in embedded C.

Unit VI : Serial Port Programming interfacing with PIC 18FXXXX (6hrs)

Basics of Serial Communication Protocol: Study of RS232, RS 485, I2C, SPI, MSSP structure (SPI & I2C), USART (Receiver and Transmitter), interfacing of RTC (DS1307) with I2C and EEPROM with SPI. Design of Traffic Light Controller; All programs in embedded C.

Text Books

[T1]	Muhammad Ali Mazidi, Danny Causey, RolinMcKinlay, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18”, 4th Edition by, Pearson international edition
[T2]	R.J.A. Buhr, D.L. Bailey, "An introduction to real time systems" Prentice Hall International
[T3]	Raj Kamal Embedded systems Architecture, Programming and Design TMH
[T4]	Andrew Sloss, Dominic Symes, Chris Wright, ―ARM System Developer‘s Guide – Designing and Optimizing System Software‖, ELSEVIER
[T5]	Introduction to embedded systems, Shibu K. V., McGraw Hill

Reference Books:	
[R1]	Microchip’s PIC18FXXX Data Sheet
[R2]	LPC 214x User manual (UM10139) :- www.nxp.com
[R3]	ARM architecture reference manual : - www.arm.com
[R4]	A. V. Deshmukh, "Microcontrollers: theory and applications", Tata McGraw Hill
[R5]	Shibu K V, “Introduction to Embedded System”.

[R6]	Jean J.Labrosse, "Embedded system building blocks", CMP books, 2nd Edition, 1999.
[R7]	Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiely
[R8]	John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000

MOOC/NPTEL courses
1. NPTEL Course on "Microcontroller & Embedded Systems" Link of the Course: https://onlinecourses.nptel.ac.in/noc20_ee42/preview
NPTEL LINK: A Different types of microcontrollers, Embedded Microcontrollers, Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : http://nptel.ac.in/courses/108102045/ http://nptel.ac.in/courses/108102045/1 http://nptel.ac.in/courses/106108100/5
B. Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations http://nptel.ac.in/courses/108102045 http://nptel.ac.in/courses/108102045/3 http://nptel.ac.in/courses/108102045/4
C. Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices http://nptel.ac.in/courses/108102045/28 http://nptel.ac.in/courses/108102045 http://nptel.ac.in/courses/108102045/ http://nptel.ac.in/courses/108102045/29 http://nptel.ac.in/courses/108102045/30 http://nptel.ac.in/courses/108102045/31 http://nptel.ac.in/courses/108102045/35

Third Year Electronics and Telecommunications (2022 Course) Digital Communication and Coding Theory ETPCC 504			
Course Code:	**ETPCC 504**	**Credit**	**4**
Contact Hours:	**04 Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Analog Communication
Digital Systems

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To familiarize students with various digital modulation techniques used in digital communication systems.
2	To explain digital communication systems with spread spectrum modulation.
3	To describe information theory, source coding theorem and techniques.
4	To discuss different error control coding techniques to improve performance of digital communication systems.

Course Outcomes: Students will be able to	
504.1	Compare various digital modulation techniques used in digital communication systems.
504.2	Explain the digital communication system with spread spectrum modulation.
504.3	Analyze communication systems using information theoretic approach.
504.4	Determine coding efficiency
504.5	Apply error control coding techniques to improve performance of a digital communication system.

Topics covered:

UNIT I Digital Bandpass modulation techniques - I (8 hrs.)
Generation, Reception, Signal Space Representation and Probability of Error Calculation for Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Binary Frequency Shift Keying (BFSK), Quadrature Phase Shift Keying (QPSK), M-ary Phase Shift Keying (MPSK).

UNIT II: Digital Bandpass modulation techniques - II (8 hrs.)
Generation, Reception, Signal Space Representation and Probability of Error Calculation for Quadrature Amplitude Shift Keying (QASK), M-ary FSK (MFSK), Pulse Shaping to reduce Inter-channel and Inter-symbol Interference, Issues in transmission and reception, Orthogonal Frequency Division Multiplexing (OFDM), Comparison of digital modulation systems.

UNIT III: Spread Spectrum modulation techniques (8 hrs.)
Spread spectrum principles, Pseudo-noise (PN) sequences, Direct-sequence and frequency hopping spread spectrum (DSSS and FHSS) systems, Jamming considerations, Orthogonality between PN-codes, CDMA, Commercial applications of spread spectrum - Cellular systems and GPS.

UNIT IV: Information theory and source coding (8 hrs.)
Introduction to information theory, Entropy and its properties, Source coding theorem, Fixed length coding, Variable length coding – Prefix codes, Kraft Inequality
Source coding techniques - Huffman coding, Shannon-Fano coding

UNIT V: Error Control Coding - I (8 hrs.)

Discrete memory less channel, Mutual information, Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem.

Channel coding technique – Linear Block Codes: Coding, Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding.

UNIT VI: Error Control Coding - II (8 hrs.)

Cyclic Codes: Description of Cyclic Codes,Encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.

Convolutional Codes: Introduction of convolution code, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding, Introduction to LDPC and Turbo codes.

Text Books:

[T1]	Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition
[T2]	B. P. Lathi, Zhi Ding , "Modern Analog and Digital Communication System", Oxford University Press, 4th Edition
[T3]	Taub, Schilling and Saha, "Principles of Communication Systems", McGraw-Hill, 4th Edition

Reference Books:

[R1]	Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition.
[R2]	K. N. Hari Bhat and D. Ganesh Rao, "Digital Communications – Theory and Lab Practice", Third Edition, Pearson.
[R3]	Simon Haykin, "Digital Communication Systems", John Wiley & Sons, 4th Edition
[R4]	Bernard Sklar and Pabitra Kumar Ray, **"**Digital Communications: Fundamentals and Applications**,"** Pearson Education Asia, Second Edition
[R5]	John G. Proakis and Masoud Salehi, "Digital Communications," Tata McGraw Hill, Fifth Edition

MOOC/NPTEL courses

1. NPTEL Course on "Digital Communications "
   Link of the Course: https://nptel.ac.in/courses/108/102/108102096/
2. NPTEL Course on "Information Theory and Coding"
   Link of the Course: https://nptel.ac.in/courses/117101053
3. OCW Course on "Principles of Digital Communications I"
   Link of the Course: https://ocw.mit.edu/courses/6-450-principles-of-digital-communications-i-fall-2006/

Recommended Websites:

Third Year Electronics and Telecommunications (2022 Course)
Digital Signal Processing ETPEC 505A

Course Code:	**ETPEC 505A**	**Credit**	**3**
Contact Hours:	**03Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Signals & systems

Matrix operations

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To discuss the process of sampling and convolution.
2	To demonstrate the use of DTFT, DFT, FFT and its properties for the analysis of DT signals.
3	To explain digital IIR by different design methods.
4	To explain digital FIR filters by different design methods.
5	To discuss the concept of multi-rate sampling.
6	To demonstrate the implementation of digital filters.

Course Outcomes: Students will be able to

505A.1	Interpret and process discrete/ digital signals to represent DSP system.
505A.2	Implement efficient transforms and their applications to analyze DT signals.
505A.3	Design and implement IIR filters.
505A.4	Design and implement FIR filters.
505A.5	Design of Cascaded Sample rate converter.
505A.6	Apply DSP techniques for speech/ biomedical/ image signal processing.

Topics covered:

UNIT I: DSP Preliminaries (6 Hrs)

Sampling theorem in time domain, recovery of analog signals, and analytical treatment with examples, mapping between analog frequencies to digital frequency, Concept of Interpolation and decimation in signal processing, Representation of signals as vectors, concept of Basis function and orthogonality, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing

UNIT II: Transforms (DFT, FFT) (6 Hrs)

DTFT definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, Computation of linear convolution using circular convolution, FFT, decimation in time (DIT) and decimation in frequency (DIF) using Radix-2 FFT algorithm for 4 point and 8point sequences, DFT & FFT computation complexity for 4 point and 8 point sequences, Linear filtering (Block convolution or Long sequence convolution) using overlap add and overlap save method

UNIT III: IIR filter design (6 Hrs)

Concept of analog filter design, IIR filter design by approximation of backward derivatives, IIR filter design by impulse invariance method, Bilinear transformation method, warping effect.

Butterworth filter design, Characteristics of Butterworth filters, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design.

UNIT IV: FIR filter design (6 hrs)

Windowing techniques: Gibbs phenomenon, characteristics and comparison of different window functions, Linear phase conditions: impulse and phase and group delays, Design of linear phase FIR filter using windows: Rectangular, Hanning, Hamming, Magnitude and Phase response of Digital filters, Frequency response of Linear phase FIR filters, FIR filter realization using Direct Form, Cascade and lattice form structure, finite word length effect in FIR filter.

UNIT V: Multirate Sampling (6 Hrs)

Concept of Multirate DSP, Down Sampling, Spectrum of the Down Sampled Signal, Upsampling, Spectrum of the Up-sampled signal, Anti imaging filter, Cascading Sample rate converter, Implementation of Narrow Band Lowpass Filter.

UNIT VI: Applications of DSP (6Hrs)

Basics of ECG and its features, interference cancellation in ECG, Speech coding and compression, Vibration signature analysis for defective gear teeth, Speech noise reduction, two band digital crossover.

Text Books:

[T1]	John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Prentice Hall, 4th Edition.
[T2]	Dr. Shaila Apte , "Digital Signal Processing", Wiley India Publication, 2nd Edition.
[T3]	S. Salivahanan, C. Gnanapriya , "Digital Signal Processing", McGraw Hill, 2nd Edition.
[T4]	Li Tan , "Digital Signal Processing : Fundamentals and Applications", Academic Press, 3rd Edition.

Reference Books:

[R1]	Ifeachor E.C, Jervis B. W, "Digital Signal Processing : Practical approach", Pearson Publication, 2nd Edition.
[R2]	N Balabanian and T.A. Bickart, „Linear Network Theory: Analysis, Properties, Design and Synthesis", Matrix Publishers, Inc.
[R3]	Schaum's Outline of "Theory and Problems of Digital Signal Processing", 2nd Edition.
[R4]	K.A. Navas, R. Jayadevan , "Lab Primer through MATLAB", PHI, Eastern Economy Edition.

MOOC/NPTEL courses

1. NPTEL Course on "Digital Signal Processing"
Link of the Course: https://nptel.ac.in/courses/117/102/117102060/

2. NPTEL Course on "Digital Signal Processing"
Link of the Course: https://nptel.ac.in/courses/108/105/108105055/

Program: Electronics and Telecommunication Engineering

Third Year Electronics and Telecommunications (2022 Course) Mechatronics ETPEC 505B			
Course Code:	**ETPEC505B**	**Credit**	**3**
Contact Hours:	03Hr/Week	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Basic Electronics Engineering
Basic Mechanical Engineering
Basic Electrical Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To discuss key elements of mechatronics Systems, Mechanical Components and Servo mechanisms along with the daily life applications
2	To explain selection criterion, operating principle as well as characteristics for force, pressure, temperature, motion and smart sensors
3	To describe working principle, types and applications of hydraulic, pneumatic and electrical actuators.
4	To explain various mechatronics systems in automobile applications

Course Outcomes: Students will be able to

505B.1	Identify key elements of mechatronics systems required for various applications
505B.2	Compare and select sensors or transducers as per requirement of application area
505B.3	Use of sensors for position, velocity and liquid flow measurements
505B.4	Differentiate and select hydraulic, pneumatic and electrical actuators
505B.5	Elaborate upon case study of mechatronics system design.

Topics covered:

UNIT I Introduction to Mechatronics (6 Hrs)

Basics of Mechatronics Systems: Definition of Mechatronics, Key elements of Mechatronics Systems, Levels of mechatronics systems, Measurement Characteristics, Examples of Mechatronics systems in daily life as Washing Machines, Digital Cameras, CD Players, camcorders, Mechatronics design process, phases of mechatronics design process, integrated design approach.

Mechanical Components and Servo mechanism: Mechanical System and Motion, Mass Inertia and Dashpot, Gears, types of Gears, Servo mechanism(Concepts and Theory, Problems).Case study Mechatronics Design of Coin Counter/Coin Separator

UNIT II: Overview of Sensors, Transducers and their Characteristics Specifications (6Hrs)

Specifications related to selection criteria for force, pressure, temperature and motion (Rotary and Linear).Classification and selection of transducers: Force-Load Cell, Pressure-Strain Gauge, Piezoelectric, Motion: Rotary and Linear motions, Proximity sensors Inductive, Capacitive and Magnetic, sources & detectors in optical proximity sensors. Comparison of Various proximity sensors, Temperature: Optical Fiber and its use in temperature measurement, Fibre Optic Temperature sensors,

Ultrasonic Transducers for applications as position, level, flow measurement. Gas sensors, Gyroscope, Accelerometer, Magnetometer (As used in smartphones), Smart Sensors: Concept, Radiation Sensors - Smart Sensors - Film sensor, IR- temperature sensors, Introduction to MEMS & Nano Sensors, Rotary Optical Encoder

UNIT III: Hydraulic Systems (6 Hrs)

Introduction to Hydraulic Actuators, Fluid Power systems: Concept of Actuators, Classification of Actuators: Pneumatic, Hydraulic and Electrical Actuators, Fluid Power systems, Hydraulic Systems: Physical Components of a Hydraulic systems, Hydraulic Pumps (e.g. Gear Pumps, Vane Pumps, Piston Pumps and Axial Piston Pumps) , Filters and Pressure Regulation, Relief Valve, Accumulator.

UNIT IV: Pneumatic Systems (6 hrs)

Introduction to Pneumatic a Actuators, Physical Components of a Pneumatic Systems, Pneumatic Cylinders, Pneumatic Actuators (e.g. Spring Actuator and Spring Actuator with positioner), Air compressor, Air Receiver, Air Dryer Air Service Treatment: Air Filter, air regulator and Gauge, Air Lubricator and Pressure regulation, Intake and Air Filter. Case study of Robotic Pick and Place robot

UNIT V: Electro-Mechanical Actuators (6 Hrs)

Electro-Pneumatic: Pneumatic Motors, Valves: Electro Hydraulic: 3/2 Valves, 4/2 Valves, 5/3 Valves, Selection Criterion of control valve, Single acting and Double acting Cylinders.

UNIT VI: Mechatronics Systems in Automobile (6Hrs)

Boat Autopilot, High Speed tilting trains, Automatic car parking systems, Engine Management systems, Antilock Brake systems (ABS) ,CNC Machines

Text Books:

[T1]	W. Boltan, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, 6th Edition, Pearson Education, 201
[T2]	David Alciatore and Maichael B Histand, “Introduction to Mechatronics and Measurement Systems”, 4th Edition, Tata McGraw Hill 2013
[T3]	K.P.Ramachandran, G.K.Vijayaraghavan and M.S. Balasundaram, “Mechatronics-Integrated Mechanical Electronic Systems", Willey Publication 2008

Reference Books:

[R1]	Nitaigour P. Mahalik ,” Mechatronics-Principles, Concepts and Applications”, Tata McGraw Hill, Eleventh reprint 2011.
[R2]	DevdasShetty and Richard A.Kolk, “Mechatronics System Design”, Thomson India Edition 2007.
[R3]	HMT Limited, “ Mechatronics”, Tata McGraw-Hill Publishing House

MOOC/NPTEL courses

1. NPTEL Course on “Mechatronics” By Prof. Pushparaj Mani Pathak , IIT Roorkee,
   Link: https://nptel.ac.in/courses/112107298
2. NPTEL Course on “Mechatronics and Manufacturing Automation” By Dr. Shrikrishna N. Joshi , IIT Guwahati,
   Link: https://nptel.ac.in/courses/112103174

Third Year Electronics and Telecommunications (2022 Course)
Internet of Things (ETOEC 506)

Course Code:	**ETOEC 506**	**Credit**	**3**
Contact Hours:	**03Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Communication Networks, Microcontrollers

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To explain fundamental concepts of IoT and its architecture.
2	To discuss role of sensors, actuators and WSN in IoT.
3	To explain key wireless technologies and IP based protocols IoT systems.
4	ToExplain various IoT platforms..
5	To be familiarize with big data and data analytics in a typical IoT system.
6	To discuss case studies of simple IoT system applications.

Course Outcomes: Students will be able to

506.1	Explain functional blocks, architecture, applications and scope of IoT.
506.2	Explain the role of sensors, actuators and Wireless Sensor Networks (WSN) in IoT..
506.3	Explain key wireless technologies and IP based protocols IoT systems.
506.4	Explain various IoT platforms.
506.5	Elaborate on the role of big data and data analytics in a typical IoT system
506.6	Describe the applications of IoT in various fields with a case study

Topics covered:

UNIT I Introduction to IoT (6 hrs.)

Definitions & Characteristics of IoT, IoT History, Modern Day IoT Applications, IoT Architectures, IoT Enablers, IoT connectivity Terminologies, Challenges in IoT

UNIT II: Sensor Networks (6 hrs.)

Sensing and Actuator Devices Examples and Working, RFID Principles and components,
Wireless Sensor Networks: History and Context, the sensor node, Connecting nodes, Networking Nodes, Wireless Multimedia Sensor Networks, Stationary and Mobile WSN's Applications of WSN, Machine to Machine (M2M) communication: Overview, Applications and Features

UNIT III: IoT Protocols (6 hrs.)
WPAN Technologies for IoT: 6LowPAN, IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP-based Protocols: IPv6, RPL, REST, AMPQ, CoAP, MQTT.

UNIT IV: IoT Platforms (6 hrs.)
Introduction to Arduino Programming: Features and types of Arduino, Arduino IDE, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Python IDE, Networking in Python, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi Cloud Software Requirements, Secure Cloud Software Testing.

UNIT V: IoT and Big Data Analytics (6 hrs.)
Introduction to Data Analytics and Big Data, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Data Handling using Hadoop. Introduction to data Analytics, Types of Data analytics, Statistical Models, Analysis of Variance, Data Dispersion, Contingence and Correlation, Regression Analysis, Precision and Error limits.

UNIT VI: IoT Applications (6 hrs.)
IoT Design Ethics, IoT Applications in Agriculture, Health care, IoT applications in Smart cities and Smart Home, Home Area Networks (HAN), IoT in Energy, Retail Management and Logistics, Industrial IoT, IoT in Environmental Protection.

Text Books:

[T1]	Hakima Chaouchi, — The Internet of Things Connecting Objects to the Web‖ ISBN : 978-1-84821-140-7, Wiley Publications
[T2]	Olivier Hersent, David Boswarthick, and Omar Elloumi, —The Internet of Things: Key Applications and Protocols‖, WileyPublications
[T3]	Vijay Madisetti and ArshdeepBahga, —Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.

Reference Books:	
[R1]	Daniel Minoli, —Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Willy Publications
[R2]	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
[R3]	http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
Online Resource Links	
	https://archive.nptel.ac.in/courses/106/105/106105166/ **NPTEL course by Sudeep Misra**

Third Year Electronics and Telecommunications (2022 Course) Microcontroller & Embedded Systems Lab (ETPCC507)			
Course Code:	**ETPCC 507**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Term work** 50 Marks		

Pre-requisites:

- Basic Electronics Engineering
- Basics of C Language

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives	
1	To explain the hardware and software design for microcontroller
2	To describe programming techniques used in microcontroller
	To explain the practical aspects of embedded systems in industry

Course Outcomes: Students will be able to	
507.1	Analyze the fundamentals of microcontroller
507.2	Describe the programming details in peripheral support
507.3	Develop interfacing models according to the applications

List of Experiments

. **PIC Microcontroller: (PIC18F4550)**

1. To write a program interfacing button, LED, relay and buzzer as follows:

a. On pressing button1- relay and buzzer is turned ON and LED‘s start chasing from left to right.

b. On pressing button2- relay and buzzer is turned OFF and LED starts chasing from right to left.

2. Interfacing of 16X2 LCD to PIC18FXXXX
3. Interfacing 4X4 keypad and displaying key pressed on LCD.
4. Generate square wave using timer with interrupt
5. Interface analog voltage 0-5V to internal ADC and display value on LCD
6. Generation of PWM signal for DC Motor control
7. Rotate a stepper motor with different speeds
8. Read data from temperature sensor and display values in PC

Activity: Project on Real time application using Microcontroller

B. Embedded System - Design case studies:

Digital clock, Battery operated smart card reader, Automated meter reading system, Digital camera

Beyond syllabus: Virtual Lab Practicals: Real Time Embedded Systems Lab: Any 3

1. DF-Part3: MCU-DAC interfacing and generation of ramp wave

http://vlabs.iitkgp.ac.in/rtes/exp3/index.html

2. DF-Part4: Interfacing of ADC and data transfer by software polling, study of aliasing
http://vlabs.iitkgp.ac.in/rtes/exp4/index.html#

3. DF-Part5: ADC triggering through timer (On Chip Timer)
http://vlabs.iitkgp.ac.in/rtes/exp5/index.html

4. DF-Part6: Interrupt driven data transfer from ADC
http://vlabs.iitkgp.ac.in/rtes/exp6/index.html#

5. SM-Part1: LCD - MCU interfacing and displaying a string
http://vlabs.iitkgp.ac.in/rtes/exp8/index.html#

6. SM-Part2 Keyboard-MCU interfacing take a input from keypad and display on LCD
http://vlabs.iitkgp.ac.in/rtes/exp9/index.html

7. SM-Part3: Stepper Motor Control Using ATMEGA-16 Microcontroller
http://vlabs.iitkgp.ac.in/rtes/exp10/index.html

8. HN-Part1: Interface a LED matrix and display a number on the matrix.
http://vlabs.iitkgp.ac.in/rtes/exp11/index.html

9. SC: Serial Communication between microcontroller and PC
http://vlabs.iitkgp.ac.in/rtes/exp15/index.html#

11. TC: Temperature control using ATmega16 http://vlabs.iitkgp.ac.in/rtes/exp16/index.html#

Virtual LAB Links: Real Time Embedded Systems Lab

http://vlabs.iitkgp.ac.in/rtes/index.html#

Program: Electronics and Telecommunication Engineering

Third Year Electronics and Telecommunications (2022 Course)
Digital Communication and Coding Theory Lab ETPCC 508

Course Code:	**ETPCC508**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

- Analog Communication Lab

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To demonstrate hardware implementation of digital modulation techniques.
2	To discuss logical concepts for software implementation of digital modulation techniques.
3	To discuss logical concepts for software implementation of source and channel coding techniques.

Course Outcomes: Students will be able to

508.1	Measure bandwidth of different digital modulation techniques.
508.2	Compare different digital modulation techniques.
508.3	Calculate coding efficiency of Huffman and Shannon Fano source coding techniques.
508.4	Encode and decode using channel coding techniques.

List of Experiments:

1. Study of BPSK transmitter and receiver using hardware kit
2. Study of QPSK transmitter and receiver using hardware kit
3. Study of DSSS transmitter and receiver using hardware kit
4. Study of Error Control Coding using suitable hardware setup/kit.
5. Simulation study of random processes. Find various statistical parameters of the random process.
6. Simulation study of Performance of M-ary PSK
7. Simulation Study of performance of BPSK receiver in presence of noise.
8. Simulation study of source coding technique.
9. Simulation study of linear block codes.
10. Simulation study of cyclic codes.

Beyond syllabus

1. Application of MATLAB to coding theory
2. Learning basic commands of MATLAB

Third Year Electronics and Telecommunications (2022 Course)

Digital Signal Processing Lab ETPEC 509A

Course Code:	**ETPEC509 A**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Oral** 50 Marks		

Pre-requisites:

Signals and systems

Experiments can be performed using any appropriate software such as MATLAB/SCILAB/ C programming skill

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral Examination	External	50

Course Objectives

1	To demonstrate transforms for analysis of Discrete time signals and systems.
2	To discuss applications of sampling of signals.
3	To familiarize with practical implementation of the digital signal processing.

Course Outcomes: Students will be able to

509A.1	Implement DSP algorithms for convolution, DFT, filtering of signals.
509A.2	Analyze the discrete time signals and system using different transforms.
509A.3	Design and implement LTI filters for filtering different real world signals.

List of Experiments: (Any 8)

1. Generate and plot basic signals in time domain and also sketch its amplitude and phase spectrum.
2. Verify the sampling theorem and aliasing effects with various sampling frequencies.
3. Find the convolution integral of any two types of signals and write a program to sketch the out response of the system.
4. Verify the commutative property of convolution integral.
5. Find N-point circular convolution using formula and verify its results. Implement linear filtering using circular convolution.
6. Verify the Sampling Theorem in the frequency domain using FFT for under-sampled, Nyquist, and oversampled signals.
7. Compute DFT and IDFT {e.g. x(n) = {1,2,3,4} using N=4 and N= 8}
8. Design a Butterworth filter using Bilinear Transformation.
9. Study the windowing effect (time and frequency) for rectangular, hamming window.
10. Design the symmetric FIR low pass filter using the Rectangular window.
11. Design the symmetric FIR low pass filter using the Hamming window.

Virtual LAB Link: Link of the Virtual Lab:
Virtual Labs (iitkgp.ac.in)

1. Study of quantization of continuous amplitude, discrete time analog signal
2. Study of different types of companding techniques.

Program: Electronics and Telecommunication Engineering

Third Year Electronics and Telecommunications (2022 Course)
Mechatronics Lab ETPEC 509B

Course Code:	**ETPEC509B**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Oral** 50 Marks		

Pre-requisites:

Basic Electronics Engineering, Basic Mechanical Engineering
Basic Electrical Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral Examination	External	50

Course Objectives

1	To discuss key elements of mechatronics Systems, Mechanical Components and Servo mechanisms along with the daily life applications.
2	To explain selection criterion, operating principle as well as characteristics for force, pressure, temperature, motion and smart sensors.
3	To describe working principle, types and applications of hydraulic, pneumatic and electrical actuators.
4	To explain various mechatronics systems in automobile applications.

Course Outcomes: Students will be able to

509B.1	To identify key elements of mechatronics systems required for various applications.
509B.2	To compare and select sensors or transducers as per requirement of applications.
509B.3	To use sensors for position, velocity, and liquid flow measurements.
509B.4	To differentiate and select hydraulic, pneumatic, and electrical actuators.
509B.5	To elaborate upon case study of mechatronics system design.

List of Experiments:

1. Position Control Using Servomechanism with Photo Electric Pick up or with appropriate sensor.
2. Displacement and velocity measurement using encoder / suitable sensor.
3. Liquid flow measurement using appropriate transducer.
4. Weight Measurement using Load cell or any appropriate sensor.
5. Liquid Level measurement using appropriate sensor.
6. Interfacing of any two Sensors to DAQ.
7. Demonstration of Hydraulic /Electro-hydraulic components and Circuits.
8. Demonstration of Pneumatic/ Electro-pneumatic Components and Circuits.
9. Case Study 1 (Implementation and Demonstration)

Virtual LAB Link: https://sl-coep.vlabs.ac.in/Introduction.html

Audit Course
Foreign Language Japanese Level I IOHSM5AC

Course Code:	**IOHSM5AC**	**Credit**	**1**
Contact Hours:	**01Hr/Week**	**Type of Course:**	**Lecture**
Examination scheme:	**Term-work 25 marks**		

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To meet the needs of an ever growing industry with respect to language support.
2	To get introduced to Japanese society and culture through language.

Course Outcomes: Students will be able to

5AC.1	Demonstrate basic communication skills.
5AC.2	Show knowledge of Japanese script.
5AC.3	Apply skills to reading , writing and listening
5AC.4	Develop interest to pursue professional Japanese Language courses.

Topics covered:

UNIT I Introduction to Japanese Language (2 hrs.)

Introduction to Japanese Language.Hiragana basic Script, colors, Days of the week.

UNIT II: Hiragana (2 hrs.)

Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo Long vowels, Greetings and expressions.

UNIT III: Personal Essentials of Japanese Language (2 hrs.)

Self-Introduction, Introducing another person, Numbers, Months, Dates, Telephone numbers, Stating one's age.

UNIT IV: Katakana Basic (2 hrs.)

Katakana basic Script, Denoting things (nominal & prenominal demonstratives) Purchasing at the Market / in a shop / mall (asking & stating price).

UNIT V: Katakana (2 hrs.)

Katakana : Modified kana, double consonant, letters with ya, yu, yo, Long vowelsDescribing time, describing starting & finishing time (kara ~ made) Point in time (denoting the time when any action or the movement occurs)

UNIT VI: Travel Essentials (2 hrs.)

Means of transport (Vehicles), Places, Countries,Starting Birth date, Indicating movement to a certain place by a vehicle.

Text Books:

[T1]	Minna No Nihongo, "Japanese for Everyone", Elementary Main Textbook 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:	
[R1]	George Trombley, Yukari Takenaka "Japanese from Zero!" Learn From Zero Publisher
MOOC/NPTEL courses	
1. NPTEL Course on "**JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi)** " Link of the Course: **https://onlinecourses.nptel.ac.in/noc23_hs76/preview** **2.NPTEL Course on"** Introduction to Japanese Language and Culture" Link of the Course :https://onlinecourses.nptel.ac.in/noc19_hs52/preview	
Guidelines for Assessment (Any one of following but not limited to) • Written Test • Presentation • Report	

AUDIT COURSE
FOREIGN LANGUAGE GERMAN LEVEL I (IOHSM5AC)

Course Code :	IOHSM5AC	**Credit :**	**01**
Contact Hours :	1 Hr./Week (L)	**Type of Course :**	Lecture
xamination Scheme :	Term Work 25 Marks		

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	**Internal**	**25**

Course Objective:	
1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever growing German industry with respect to language support.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
5AC.1	Use German language for basic communication.
5AC.2	Apply the knowledge of German script.
5AC.3	Read, write and improve their listening skills.
5AC.4	Develop interest to pursue profession in Indo-German Industry.
5AC.5	Grasp the basic sentence structure and build a good foundational vocabulary.

Unit 01	**:**	**Introduction to the German Language-I**	**(04 Hrs)**

Introduction of German Alphabets,

- Spell the names
- Addresses
- Numbers,
- Telephone numbers
- Ordinal Numbers
- Pin code Numbers
- Dates
- Birthdates
- Age
- days of the week
- Months

Unit 02	**:**	**Introduction to the German Language-II**	**(04 Hrs)**

- Basic Greetings
- Personal Pronouns
- Possessive Pronouns

Unit 03	**:**	**Introduction to the German Language-II**	**(04 Hrs)**

- Self-Introduction
- Introducing other people, about family, friends, course mates
- Introduction to seasons, and seasons in Germany and in neighboring countries.

Text Books:

[T1]	" Netzwerk A-1 (Deutsch als Fremdsprache) " Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

[R1]	Tipps und Uebungen A1

Online Resources:

1. Practice Material like Listening Module, reading Texts
2. NPTEL COURSE ON GERMAN -I LANGUAGE
3. ONLINE GERMAN-ENGLISH DICTIONARY www.leo.org

Electronics & Telecommunication Engineering-Third Year (Semester–VI)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	IOHSM601	Seminar and Technical paperwriting	1	--	2	2	-	-	50	-	-	50
2	ETPCC 602	ComputerNetworks	3	--	-	3	40#	60*	-	-	-	100
3	ETPCC603	Power Electronics	3	--	-	3	40#	60**	-	-	-	100
4	ETPCC 604	Cellular Network	3	--	-	3	40#	60*	-	-	-	100
5	ETPEC605A	Elective II: Antenna and wave theory	3	--	--	3	40#	60*	-	-	-	100
	ETPEC605B	Elective II : VLSI										
6	ETVSE 606	Embedded systems & RTOS @@	1	-	4	3	-	-	50	50	-	100
7	ETPCC 607	PowerElectronicsLab	--	--	2	1	-	-	25	-	-	25
8	ETPCC 608	Cellular Networks Lab	--	--	2	1	-	-		25	-	25
9	ETPEC609A	Antenna and wave theory Lab	--	--	2	1	-	-		50		50
	ETPEC609B	VLSI Lab										
10	ETELC610	Mini project	--	--	4	2	-	-		-	50	50
11	IOHSM6ACA	Audit Course 6:Foreign Language Japanese Level II	1	-	--	1	-	-	25	-	-	25
	IOHSM6ACB	Audit Course 6:Foreign Language German Level II										
12	IOLLC6L3	Lifelong learningskills III	--	--	--	1	-	-	25	-	-	25
13	IOLLC6L4	Lifelong learningskills IV	--	--	--	1	-	-	25	-	-	25
Total			**15**	**-**	**16**	**25**	**160**	**240**	**200**	**125**	**50**	**775**
14	ETMNR601	VLSI	3	--	--	3	--	75*	--	--	--	75
15	ETMNR602	VLSI Lab	--	--	2	1	--	--	25	--	--	25
Total			**18**	**-**	**18**	**29**	**160**	**315**	**225**	**125**	**50**	**875**

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester I Evaluation** based on Subjective Examination.

In Semester II Evaluation based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/GATE based Multiple-Choice Question (MCQ) examination/numerical based subjective

Note: 1. @@ For subject having more than 1 head, passing in both the heads is mandatory to gain total credits of the subject

2. The detail syllabus of respective Minor subject of all the departments is available on the college website.

Elective-II	**ETPEC605A**	**1. Antenna and wave theory**
	ETPEC605B	**2. VLSI**

Third Year Electronics and Telecommunications (2022 Course) Seminar and Technical Report Writing (IOHSM601)			
Course Code:	**IOHSM601**	**Credit**	**2**
Contact Hours:	1 Hrs/ Week (L) 2 Hrs /Week (PR)	**Type of Course:**	Lecture Practical
Examination Scheme		TW 50 Marks	

Pre-requisites: Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Wok Evaluation	Internal	50

Course Objectives

1	To prepare students to communicate effectively as professionals.
2	To train students to use visual aids effectively.
3	To implant technical writing skills.
4	To develop presentation and technical writing skill among the students.

Course Outcomes: Students will be able to

601.1	Analyze communication-related problems and improve communication skill
601.2	Use various types of technical communication as per need.
601.3	Write proposals and reports
601.4	Develop key skills in research, dissemination and documentation.

Topics covered:

UNIT I: Technical Communication: Oral (06 Hrs)

Basics of Technical Communication, different forms of communication and advanced communication skills, dynamics of professional presentations , group discussions, etiquettes and mannerisms, job interviews (online/offline mode), public speaking, oral presentation.

UNIT II: Technical Communication: Written (6 Hrs.)

Technical proposal, technical writing: efficient process to create a report, research paper, report writing and documentation style-LaTex, use of visual aids, ethics in writing using plagiarism tools, resume writing.

Text Books:

[T1]	Sunita Mishra, "Communication Skills for Engineers" Pearson Education
[T2]	Prof. K. R. Laxminarayanan and Dr. T. Murugavel "Communication Skills for Engineers" SCITECH.
[T3]	Sharon J Gerson and Steven Gerson "Technical Writing – Process& Product", Pearson Education.
[T4]	Danial Riordan, Steven E. Pauley Technical Report Writing Today
[T5]	Krishna Mohan, Meera Banerji "Developing Communication skills", Laxmi Publications.

[T6]	Meenakshi Raman and Sangeeta Sharma," Technical Communication Principles and Practice", Oxford University Press.
Reference Books:	
[R1]	Sanjay Kumar and Pushp Lata, "Communication Skills" Oxford University Press.
[R2]	Davies J.W. "Communication for engineering students", Longman
[R3]	Eisenberg, "Effective Technical Communication", Mc. Graw Hill.
[R4]	Robert A. Day, "How To Write and Publish a Scientific Paper", Fifth Edition, Oryx Press, Phoenix, AZ, 1998.

Note: The assessment for the subject shall be based on presentation and report submission.

List of Assignments / Activities :

Any eight of the following

1. Introduction to technical communication
2. Group Discussion
3. Official/Public Speaking
4. Communication ethics
5. Conversational skills for job interviews
6. Theme based seminar/ oral presentation /poster presentation
7. Writing ethics-letter of application, resume e-mails.
8. Develop proposal in LaTex for selected research project
9. Publication process: How to write and submit paper for conference, journal, the evaluation process, how to communicate with the editors, copyright, plagiarism.

Third Year Electronics and Telecommunications (2022 Course)
Computer Networks (ETPCC602)

Course Code:	**ETPCC602**	**Credit**	**3**
Contact Hours:	**03Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Basic Networking &OSI model

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To introduce students network protocols, architectures and applications.
2	To provide students' knowledge of media access control in computer networks.
3	To outline the basic network configurations
4	To describe the transmission methods
5	To Explain application layer protocol and introduction to cryptography.

Course Outcomes: Students will be able to

602.1	Explain the fundamental underlying principles of computer networking.
602.2	Describe components of a network and their interrelations.
602.3	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
602.4	Explain the transition of network IPV4 to IPV6.
602.5	Specify and identify deficiencies in existing protocols and select new and better protocols.
602.6	Describe application layer protocol and cryptography.

Topics covered:

UNIT I: Introduction to Networks and physical layer (6 hrs.)
Networks Topology, Networks Types, TCP/IP Protocol Suit and Introduction to physical layer: Data and signals, Digital Signals, Spread Spectrum, Transmission media, Switching: Circuit switched Networks, Packet switching.

UNIT II: Data link layer (6 hrs.)
Introduction to data link layer, Media Access Control: Random Access, Controlled Access-Reservation, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet (100 MBPS), Gigabit Ethernet, 10 Gigabit Ethernet. Wireless LAN : Introduction, IEEE 802.11.

UNIT III: Network Layer Part-I (6 hrs.)
Introduction to Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPv4 Addresses, Forwarding of IP Packets, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP.

UNIT IV: Network Layer Part-II (6 hrs.)
Unicast and Multicast Routing: Introduction, Routing Algorithms, Unicast Routing Protocols, Introduction, Multicasting Basics, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, IGMP. Next Generation IP:IPv6 Addressing, The Ipv6 Protocol, TheICMPv6 Protocol, Transition From IPv4 toIPv6.

UNIT V: Transport Layer (6 hrs.)

Process to process delivery, Transport Layer Protocols: User Datagram Protocol, Transmission Control Protocol, SCTP.

UNIT VI: Application Layer (6 hrs.)

Standard Client Server Protocols:World Wide Web and HTTP , FTP, Electronic Mail, Telenet, SSH, DNS. Cryptography & Network Security: Introduction Confidentiality, Other Aspects Of Security. Internet Security: Network-Layer Security, Application-Layer Security.

Text Books:

[T1]	Behrouz A. Forouzan, "Data Communications and Networking‖ MacGraw Hill, 5th edition
[T2]	James F. Kurouse& W. Rouse, —Computer Networking: A Top down Approach‖, 6thEdition, Pearson Education..

Reference Books:	
[R1]	Andrew S. Tannenbaum, —Computer Networks‖, Pearson Education, Fourth Edition,2003
[R2]	Wayne Tomasi, —Introduction to Data Communication and Networking‖, 1/e, Pearson Education
[R3]	Natalia Olifer, Victor Olifer, —Computer Networks‖ Wiley Student Edition
MOOC/NPTEL courses	
1. NPTEL Course on "Computer Networks and Internet Protocol" By Prof. Soumya Kanti Ghosh, IIT Kharagpur Link: https://onlinecourses.nptel.ac.in/noc22_cs19/preview	
Recommended Websites: 1. https://aws.amazon.com/what-is/computer-networking/ 2. www.javatpoint.com/computer-network-tutorial	

Third Year Electronics and Telecommunications (2022 Course) Power Electronics ETPCC 603			
Course Code:	**ETPCC 603**	**Credit**	**3**
Contact Hours:	**03 Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks(**)	

Pre-requisites:

1.Basic Electronics

2.Electronics Devices & Circuits

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60**

Course Objectives	
1	To discuss different power devices to study their construction, characteristics and turning on circuits.
2	To illustrate phase controlled converters.
3	To explain the operation, switching techniques and basics topologies of DC-DC converters.
4	To explain single and three phase voltage source inverters and PWM techniques.
5	To explain operation of AC voltage controller and various configurations.
6	To discuss different applications of Power Converters.

Course Outcomes: Students will be able to	
603.1	Explain various power semiconductor devices.
603.2	Interpret the performance parameters of single and three phase controlled converters with different loads.
603.3	Design and develop various types of choppers and switched mode regulators.
603.4	Design single phase voltage source inverters.
603.5	Design and analyze single phase AC voltage controllers.
603.6	Develop various power electronic applications.

Topics covered:

UNIT I: Power Semi-Conductor Devices (6 Hrs.)

Study of switching devices, SCR, GTO, MOSFET and IGBT- Static characteristics: SCR, MOSFET and IGBT – Triggering and commutation circuit for SCR

Performance overview of Silicon, Silicon Carbide & GaN based MOSFET and IGBT. Series and parallel connection of power devices.

UNIT II: Phase-Controlled Converters (6 Hrs.)

Single phase Half, Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, three phase Semi & Full converters for R load, effect of source inductance, Power factor improvement techniques, Diode based boost converter. Single Phase dual converter with inductive load.

UNIT III: DC TO DC Converters (6 Hrs.)

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E - Switched mode regulators- Buck, Bost, Buck- Bost regulator, Introduction to Resonant Converters.

UNIT IV: Inverters (6 Hrs.)

Single phase and three phase voltage source inverters (both120^o mode and 180^o mode)– Voltage & harmonic control-PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Unipolar and bipolar.

UNIT V: AC TO AC Converters (6 Hrs.)

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo-converters.

UNIT VI: Power Electronics Applications (6 Hrs.)

ON-line and OFF-line UPS with battery AH, back up time, battery charger rating. Single phase separately excited DC motor drive, stepper motor drive, BLDC motor drive. Battery operated vehicles.

Text Books:

[T1]	M. H. Rashid, "Power Electronics circuits devices and applications", PHI 3rd edition, 2004,New Delhi.
[T2]	M. S. Jamil Asghar, "POWER ELECTRONICS", PHI, 2004, New Delhi
[T3]	M. D. Singh and K. B. Khanchandani, "Power Electronics", TMH, 2nd Edition 2006.

Reference Books:

[R1]	Ned Mohan, T. Undeland& W. Robbins, "Power Electronics Converters applications and design" 2nd edition, John Willey & sons, Singapore
[R2]	Muhammad H. Rashid , "Power Electronics Handbook", Academic Press, 2nd Edition, 2001.
[R3]	Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi.
[R4]	Vinod Kumar Khanna "Insulated Gate Bipolar Transistor IGBT Theory and Design", John Wiley & Sons, Illustrated Edition. **Print ISBN:9780471238454; Online ISBN:9780471722915, DOI:10.1002/047172291.**
[R5]	P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi.
[R6]	Nagrath Kothari, "Electrical Machines", TMH.

Third Year Electronics and Telecommunications (2022 Course)
Cellular Networks (ETPCC604)

Course Code:	**ETPCC 604**	**Credit**	**3**
Contact Hours:	**Th-03 Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

1 Analog communication
2 Digital Communication
3 Information theory and coding
4 Computer networks

Course assessment methods/tools

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	TTo discuss an analytical treatment on traffic & how to evaluate it for different conditions in telecommunication..
2	To describe the of basic concepts of cellular system & mobile radio propagation.
3	To discuss radio channel and cellular capacity.
4	To explain mobile management, voice signal processing and architecture & coding in GSM, CDMA system.

Course Outcomes: Students will be able to

604.1	Describe large scale and small scale fading..
604.2	Explain cellular concepts and its propagation mechanism.
604.3	EApply traffic engineering concepts to calculate grade of service.
604.4	Explore the architecture of GSM.
604.5	Explain GSM channels and GSM transmission concepts.
604.6	Differentiate and explain concept of 4G LTE.

Topics covered:

Unit I –Mobile Radio propagation (6Hrs)

Large Scale Fading : Free space propagation model, Three basic propagation mechanisms, Reflection, Ground Reflection(Two-Ray)Model, Diffraction, Scattering, Practical link budget using path loss models. Small Scale Fading : Multipath Propagation, Types of small scale fading, Parameters of Mobile Multipath channels, Fading effects due to multipath time delay Spread and Doppler spread.

Unit II - Cellular Concept (6Hrs)

Introduction to cellular telephone system, Cellular concept : Expansion of mobile system capacity through frequency reuse, Cell geometry, Selection of cluster size, Cell splitting and sectoring, Coverage and capacity in cellular system and Handoff strategies.

Unit III- Traffic Engineering and Signalling (6Hrs)

Telecommunication Traffic:Unit of Traffic, Traffic measurement, A mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem, traffic tables, Erlang Distribution, probability of delay, Systems with a single server, delay tables and application of delay formulae. Signalling: Customer line signalling. FDM carrier systems, PCM signalling, Inter-register signalling

Unit IV - GSM Fundamentals (6Hrs)

Introduction, Architecture of GSM, characteristics of GSM standards, services, Radio transmission parameters in GSM System, Applications.

Unit V - GSM Channels and Services (6Hrs)

Traffic and Logical Channels in GSM, GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover mechanism in GSM, Security in GSM. Data transmission in GSM: Data Services, SMS, HSCSD, GPRS, EDGE. Multiple Access Techniques-TDMA, CDMA and OFDMA.

Unit VI - Evolution of Mobile Technologies (6Hrs)

Evolution of Mobile Generation and its comparison(GSM & CDMA) Overview of LTE : LTE basics , LTE frame structure, LTE Design parameters with Standardization and Architecture of LTE. Overview of 5 G Networks : Comparison of 4G and 5G technology

Text Books:

[T1]	Thiagarajan Vishwanathan, ―Telecommunication Switching Systems and Networks‖; PHI Publications
[T2]	Teodore Rappaport, ―Wireless Communications Principles and Practice‖ Second Edition, Pearson Education
[T3]	Aditya Jagannatham, ‖Principles of Modern Wireless Communication Systems‖

Reference Books:

[R1]	Fei Hu, ―Opportunities in 5G Networks : A research& development perspective‖, CRC Press
[R2]	J. E. Flood , ―Telecommunications Switching, Traffic and Networks‖, Pearson Education
[R3]	Krzysztof Wesolowski, ―Mobile Communication Systems‖, Wiley Student Edition
[R4]	John C. Bellamy, ―Digital Telephony‖, Third Edition; Wiley Publications
[R5]	Mischa Schwartz, ―Mobile Wireless Communications, Cambridge University Press

List of Experiments: (Any Eight)

1. Form an experiment to explain PSTN TST switch
2. Perform an experiment to elaborate the operation of GSM.
3. Perform an experiment / Simulate to elaborate the operation of Multiple access techniques CDMA.
4. Set up and carry out an experiment to explain the VoIP call routing process.
5. Set up and carry out experiments on AT commands for call operation.
6. Perform an experiment to elaborate the operation of 3G mobile using 3G Mobile Trainer kit.
7. Write a program to elaborate Lost call system/ delay system used in the analysis of voice/data traffic.
8. Write a program to measure bit error rate in presence of AWGN model.
9. Write a program to measure bit error rate in presence of Hata/ Multipath propagation model.
10. Visit to the Mobile Telephone Switching Office (MTSO).

Third Year Electronics and Telecommunications (2022 Course)

Antenna and wave theory (ETPEC605A)

Course Code:	ETPEC605A	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

Electromagnetic Field Theory and Transmission Lines : Fundamental knowledge of Engineering Electromagnetic (Maxwell's equations, three basic coordinate systems and polarization).

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To describe characteristic features of different wave propagations
2	To discuss fundamental theory of radiation.
3	To explain the electric field and magnetic fields for a given wire antenna radiation characteristics.
4	To solve the electric field and magnetic fields for a given wire antenna
5	To elaborate different antenna measurements.

Course Outcomes: Students will be able to

605A.1	Determine the characteristic features of different wave propagations.
605A.2	Define different antenna parameters.
605A.3	Analyze the wire antenna and its radiation characteristics.
605A.4	Explain the structure of the antenna array.
605A.5	Identify the suitable antenna for a given communication system .
605A.6	Explain different antenna measurements.

Topics covered:

UNIT I: Wave Propagation **(6 hrs.)**

Fundamental equations for free space propagation, Friis Transmission equation. Attenuation over reflecting surface, Effect of earth's curvature. Ground, sky & space wave propagations. Structure of atmosphere. Characteristics of ionized regions. Effects of earth's magnetic field. Virtual height, MUF, Skip distance. Ionospheric abnormalities. Multi-hop propagation. Space link geometry. Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

UNIT II: Antenna Fundamentals **(6 hrs.)**

Introduction, Types of Antenna, Radiation Mechanism. Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency effective length, effective area, reciprocity.

UNIT III: Wire Antennas **(6 hrs.)**

Analysis of Linear and Loop antennas: Infinitesimal dipole, small dipole, and finite length dipole half wave length dipole, small circular loop antenna. Complete Analytical treatment of all these elements.

UNIT IV: Antenna Arrays **(6 hrs.)**

Antenna Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, non uniform amplitude, array factor.Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

UNIT V: Antennas and Applications **(6 hrs.)**

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors.

UNIT VI:Antenna Measurements (6 hrs)

Measurement of Impedance, Field/Radiation Pattern and gain of antennas, Ionospheric measurements – Vertical incidence measurements of the ionosphere – Relation between oblique and vertical incidence transmission – System Issues – antenna noise, SNR, and link Budget.

Text Books:

1. C.A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.
2. Mathew N O Sadiku, “ Elements of Electromagnetics” 3rd edition, Oxford University Press

Reference Books:

1. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi G.B.Clayton, “Operational Amplifiers”, International Edition.
2. John D Kraus, “ Antenna& Wave Propagation”, 4th Edition, McGraw Hill, 2010.
3. Vijay K Garg, “Wireless Communications and Netwoking”, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

E- Books / E- Learning References:

1. NPTEL Course on “antennas ”
Link of the Course: https://onlinecourses.nptel.ac.in/noc20_ee20/preview
2. NPTEL Course on “Engineering Electromagneics ”
Link of the Course: https://nptel.ac.in/courses/108102119

Third Year Electronics and Telecommunications (2022 Course) VLSI (ETPEC 605B)			
Course Code:	**ETPEC605B**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:
Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To explore VHDL and respective digital design methodologies.
2	To overview ASIC issues and understand PLD architectures with advanced features
3	To realize importance of testability in logic circuit design.
4	To train the students for CMOS circuit designs.
5	To explain low power VLSI design.

Course Outcomes: Students will be able to	
605B.1	Design Digital systems using VHDL programming.
605B.2	Implement VLSI Design Flow using FPGAs
605B.3	Design CMOS based digital circuits.
605B.4	Analyze various constraints in design of CMOS based circuits.
605B.5	Apply knowledge of testability in design.
605B.6	Apply knowledge of low power VLSI Design

Topics covered:

UNIT I: VHDL Design (6 hrs.)

Design Flow, Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, HDL modeling of Combinational, Sequential circuits and FSM. Simulations, Synthesis

UNIT II: PLD Architectures and applications (6 hrs.)
Design Flow. CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications, Applications. The Simulation and Synthesis Tools, FPGA synthesis and implementation.
UNIT III- Basic MOS Theory (6 hrs.)
MOS transistor theory, MOSFET scaling and small geometry effects, MOSFET capacitances. CMOS inverter, DC characteristics, static load MOS inverter, pull up/pull down ratio, static & dynamic power dissipation, CMOS & NMOS process technology – explanation of different stages in fabrication, body effect
UNIT IV- Digital CMOS circuits and Issues (6 hrs.)
Stick diagram and design rules, lambda based design rules, switching characteristics & inter connection effects: rise time, fall time delays, noise margin. CMOS logic gate design: NAND, NOR, XOR and XNOR gates, Transistor sizing, combinational MOS logic circuits: pass transistor and transmission gate designs.
UNIT V: VLSI Testing and Analysis (6 hrs.)
Types of fault, Need of Design for Testability (DFT), DFT Guideline, Testability, Fault models, Path sensitizing, Test pattern generation, Sequential circuit test, Built-in Self Test, JTAG & Boundary scan, TAP Controller.
UNIT VI- Low Power VLSI Design (6hrs.)
Introduction: Need for low power VLSI chips, Power and Energy basics, Sources of power dissipation, important parameters for low power design, Low power design approaches. Device & Technology Impact on Low Power.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*1. NA.

Text Books:

[T1]	E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit &System Perspective", Pearson Publication.
[T2]	R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3E, Wiley-IEEE Press
[T3]	Low Power Design Methodologies by J. M. Rabaey, M.Pedram, KAP.

Reference Books:

[R1]	John F. Wakerly, "Digital Design Principles and Practices" , 3E, Prentice Hall
[R2]	M. Morris Mano , "Digital Design", 3E , Pearson.
[R3]	CemUnsalan, Bora Tar, "Digital System Design with FPGA: Implementation Using Verilog and VHDL", McGraw-Hill

E- Books / E- Learning References:

CMOS Digital VLSI Design: CMOS Digital VLSI Design - Course (nptel.ac.in)

Third Year Electronics and Telecommunications (2022 Course) Embedded systems & RTOS (ETVSE606)			
Course Code:	**ETVSE606**	**Credit**	**3**
Contact Hours:	**TH 01Hr/Week** **PR 04Hr/Week**	**Type of Course:**	Lecture
Examination scheme:	Term Work 50 Marks	Practical Examination 50 Marks	

Pre-requisites:

Microcontroller and embedded system

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	50
2.	Practical Examination	External	50

Course Objectives	
1	To discuss the Embedded system design issues and real time operating system concepts
2	Explain the concepts of Real time system.
3	To explain features of µcos-II Real time operating system (RTOS)
4	To explain the Architecture of advanced embedded controllers

Course Outcomes: Students will be able to	
606.1	Relate design metrics of Embedded systems to design real time applications to match recent trends in technology.
606.2	Explain the concepts of Real time system and implement services of µcos-II RTOS

Topics covered:

UNIT I: Introduction to Embedded System and Advanced Embedded architectures (6 Hrs)

Embedded System Introduction, Hardware and software architectures of ES, Design metrics(technical and techno- economical), Prototyping models, Development tool chain insights(GNU), guidelines for Selection of hardware and memory architecture, Introduction to ARM 7 and ARM CORTEX series, Survey of ARM7 and CORTEX based controllers. Embedded Open Hardware Platform:Arduino/Raspberry Pi

UNIT II: Concepts of RTOS and Services of µcos-II –RTOS (6 Hrs)

Concept of RTOS, Types of RTOS, real time scheduling algorithms, commercial RTOS, survey of RTOS. µcos-II features, kernel structure, µcos-II services such as task management, time management, Inter-process communication services such as Semaphore, Message Mailbox, Mutex, queue events, memory management. Porting of µcos-II on ARM7 architecture.

Text Books	
[T1]	Jean J. Labrosse, “MicroC OS II, The Real-Time Kernel”, 2 nd Edition, CMP Books.

[T2]	Frank Vahid and Tony Givargis, ― Embedded System Design – A Unified hardware/ Software introduction ‖ 3rd edition, Wiley

Reference books

[R1]	Raj Kamal, ―Embedded Systems – Architecture, Programming and Design" 2nd edition,
[R2]	David E. Simon, "An Embedded Software Prime", Pearson Education

MOOC / NPTEL Courses:

1. NPTEL Course on "Embedded System Design with ARM", by Prof. Indranil Sengupta, and Prof. Kamalika Datta, IIT Kharagpur Link of the Course: https://nptel.ac.in/courses/106105193

2. NPTEL Course on "Real-Time Systems", by Prof. Rajib Mall, Prof. Durga Prasad Mohapatra, IIT Kharagpur Link of the Course: https://nptel.ac.in/courses/106105229

List of Practical:

1. Study of ARM family microcontrollers and its architecture.
2. Programing of ARM7 for GPIO interfacing.
3. Study of LPC1768: Features, Architecture (Block Diagram &its Description)
4. Interfacing of LED to GPIO of LPC1768.
5. Multitasking in µCOS II RTOS using minimum 3 tasks on ARM7.
6. Implementation of Semaphore as signaling in µCOS II RTOS on ARM7.
7. Implementation of Semaphore as Synchronizing in µCOS II RTOS on ARM7.
8. Implementation of message Mailbox for message passing in µCOS II RTOS on ARM7.
9. Implementation of Message Queue for message passing in µCOS II RTOS on ARM7.
10. Implementation of Mutex in µCOS II RTOS on ARM7.
11. Programming with Arduino development for GPIO and Serial Communication on Arduino board
12. OS installation on RaspberryPi/Beagle board/Arduino.
13. Interfacing Temperature/Humidity/Smoke sensor with Arduino/Raspberry-pi
14. Interfacing Stepper Motor/DC Motor with Arduino/Raspberry Pi.
15. Interfacing Arduino/Raspberry-pi to Bluetooth Module.
16. Case Study of CAN Protocol for Automotive Application

Vlab Experiments:

1.DeadloackAlgorithm:

https://naim30.github.io/OS-virtual-lab/deadlockAlgo/deadlock.html

2.Binary semaphore:

https://naim30.github.io/OS-virtual-lab/deadlockAlgo/OS-Team%2048%20Semaphore,%20Deadlock%20and%20Concurrency/Binary%20semaphore/home.html

Third Year Electronics and Telecommunications (2022 Course) Antenna and wave theory Lab ETPEC 609A			
Course Code:	ETPEC 609A	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Practical** 50 Marks		

Pre-requisites:

Electromagnetic Field Theory and Transmission Lines: Fundamental knowledge of Engineering Electromagnetic (Maxwell's equations, three basic coordinate systems and polarization).

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives	
1	To discuss radiation pattern of folded dipole and dipole antenna.
2	To explain design & simulation of Dipole , Loop,Antenna, Horn,dipole anteena array.
3	To discuss various types of parabolic reflector and their feed systems

Course Outcomes: Students will be able to	
609A.1	Plot radiation pattern of folded dipole and dipole antenna.
609A.2	Design & Simulation of Dipole , Loop,Antenna, Horn,dipole antenna array.
609A.3	To study various types of parabolic reflector and their feed systems

List of Experiments: (Any 8)

1. To plot radiation pattern of folded dipole antenna.
2. To plot radiation pattern of dipole antenna.
3. Design & Simulation of Dipole Antenna
4. Design & Simulation of LOOP Antennas
5. Design & Simulation of Horn Antenna
6. Design & Simulation of Dipole Antenna Array.
7. Design of Micro strip Patch antenna and measurement of line impedance.
8. Design & Simulation of Inset Feed Micro strip Square Patch antenna.
9. To study various types of parabolic reflector and their feed systems.

Virtual LAB Links:

1. **Link of the Virtual Lab:**
   1.Antenna gain measurement : https://eem-iitd.vlabs.ac.in/exp8.html
2. **Link of the Virtual Lab:**
   2.Radiation pattern of horn antenna : https://eem-iitd.vlabs.ac.in/exp7.html

Third Year Electronics and Telecommunications (2022 Course)
VLSI (ETPEC 609B)

Course Code:	**ETPEC609B**	**Credit**	**1**
Contact Hours:	2 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	Practical 50 Marks		

Pre-requisites:

- Basic knowledge of Semiconductor Physics and Basic Electronics Engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical Examination	External	50

Course Objectives

1	To explore VHDL and respective digital design methodologies.
2	To overview ASIC issues and understand PLD architectures with advanced features.
3	To realize the importance of testability in logic circuit design.
4	To train the students for CMOS circuit designs.

Course Outcomes: Students will be able to

609B.1	To train the students for CMOS circuit designs.
609B.2	Implement VLSI Design Flow using FPGAs.
609B.3	Design CMOS based digital circuits by applying CMOS technology specific layout rules.
609B.4	Analyze various issues and constraints in design of CMOS based circuits.

List of Experiments:

A. To write VHDL code, simulate with test bench, synthesis, implement on PLD(Any 4).

1. Traffic Light Controller.
2. 4 bit up-down counter.
3. 4 bit ALU for add, subtract, AND, NAND, XOR, XNOR, OR, & ALU pass.
4. Universal shift register with mode selection input for SISO, SIPO, PISO, & PIPO modes.
5. FIFO memory.
6. Keypad interface

B. To prepare CMOS layout in selected technology, simulate with and without capacitive load, comment on rise, and fall times (Any 4).

1. Inverter, NAND, NOR gates.
2. Half Adder
3. 2:1 Multiplexer using logic gates and transmission gates.
4. Single bit SRAM cell.
5. D Flip-flop.

Third Year Electronics and Telecommunications (2022 Course) Mini Project ETELC610			
Course Code:	**ETELC610**	**Credit**	**2**
Contact Hours:	4 Hrs/week	**Type of Course:**	**Practical**
Examination Scheme	**Oral** 50 Marks		

Pre-requisites:

- Analog Electronics and Digital Circuits
- Microcontrollers and Its Applications

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral Examination	External	50

Course Objectives	
1	To make the students understand the Product Development Process‟ including budgeting through Mini Project.
2	To plan for various activities of the project and distribute the work amongst team members..
3	To inculcate electronic hardware implementation skills by learning PCB artwork design using an appropriate EDA tool.
4	To develop student‘s abilities to transmit technical information clearly and test the same by delivery of seminar based on the Mini Project.
5	To make the students understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes: Students will be able to	
610.1	Summarize the literature survey in societal/health/safety/l related issues.
610.2	Design and excute a Mini Project with the team.
610.3	Implement electronic hardware by learning PCB artwork design, soldering techniques, testing and troubleshooting.
610.4	Deliver technical seminar based on the Mini Project work carried out.
610.5	Demonstrate working model with enclosure and technical report.

Guidelines for Mini Project

. : Execution

- Project group shall consist of not more than 3 students per group.
- Mini Project Work should be carried out in the Projects Laboratory.
- Project designs ideas can be referred from recent issues of electronic design magazines, or application notes from well-known device manufacturers.
- Use of Hardware devices/components is mandatory.
- PCB Layout versus schematic verification is mandatory.
- Assembly of components and enclosure design is mandatory.

B. :Domains for projects may be from the following, but not limited to:
- Embedded Systems
- Electronic Communication Systems
- Instrumentation and Control Systems
- Biomedical Electronics
- Power Electronics
- Microcontroller based projects should preferably use Microchip PIC controllers / ATmega controller / AVR microcontrollers/ Ardino / Rasberry Pi.

C. Following Activities should be monitored in the Laboratory:
- Formation of groups, Finalization of mini project & distribution of task.
- Circuit Design, PCB design using an EDA tool, Simulation.
- PCB manufacturing through PCB Manufacturer, Hardware assembly and soldering, programming (if required), Testing, Enclosure Design, Fabrication etc
- Testing of final project, Checking & Correcting of the Draft Copy of Project Report
- Final Demonstration and Group presentations of Mini Project
- Maintaining of log book for all activities related to project

Audit Course
Foreign Language Japanese Level II
IOHSM6AC

Course Code:	**IOHSM6AC**	**Credit**	**1**
Contact Hours:	**01Hr/Week**	**Type of Course:**	**Lecture**
Examination scheme:	**Term-work 25 marks**		

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To understand the basics of the Japanese writing system, including Kanji characters.
2	To indicate an action or motion in progress, describe habitual actions, and express permission and prohibition.

Course Outcomes: Students will be able to

6AC.1	Demonstrate basic communication skills.
6AC.2	Describe their daily routines in Japanese.
6AC.3	Describe things, people, and places using appropriate adjectives.
6AC.4	Express the existence or presence of a thing or a person in different contexts.

Topics covered:

UNIT I: Kanji (2 hrs.)

Introduction to Kanji Script, Describing one‘s daily routine. To ask what someone does. Expressions of Giving & Receiving.

UNIT II: Adjectives (2 hrs.)

Adjectives (Types of adjectives) Asking for an impression or an opinion about a thing / person / place that the listener ,Has experienced, visited, or met , Describing things / person / places with the help of the adjectives.

UNIT III: Comparative Expressions (2 hrs.)

Expressions of Like & Dislikes. Expressing one‘s ability, hobby Comparison between objects, persons & cities.

UNIT IV: Spatial Basics (2 hrs.)

Stating existence or a presence of thing (s), person (s) Relative positions, Counters.

UNIT V: Action Directives (2 hrs.)

Expressing one‘s Desire & wants Verb groups, Asking, Instructing a person to do something.

UNIT VI: Progressive Phrases (2 hrs.)

Indicating an action or motion is in progress. Describing habitual action Describing a certain continuing state which resulted from a certain action in the past. Express permission & prohibition.

Text Books:

[T1]	Minna No Nihongo, “Japanese for Everyone”, Elementary Main Textbook 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:	
[R1]	George Trombley, Yukari Takenaka "Japanese from Zero!" Learn From Zero Publisher
MOOC/NPTEL courses	
1. NPTEL Course on "**JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi)** " Link of the Course: **https://onlinecourses.nptel.ac.in/noc23_hs76/preview** **2.NPTEL Course on"** Introduction to Japanese Language and Culture" Link of the Course :https://onlinecourses.nptel.ac.in/noc19_hs52/preview	
Guidelines for Assessment (Any one of following but not limited to) • Written Test • Presentation • Report	

AUDIT COURSE FOREIGN LANGUAGE GERMAN LEVEL II (IOHSM6AC)			
Course Code :	IOHSM6AC	**Credit :**	**01**
Contact Hours :	1 Hr./Week (L)	**Type of Course :**	Lecture
Examination Scheme :	Term Work 25 Marks		

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	**Internal**	**25**

Course Objective:	
1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever growing German industry with respect to language support.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
6AC.1	Communicate using advanced level of German Language.
6AC.2	Develop reading, writing and listening skills.
6AC.3	Use tenses in German Language.
6AC.4	Develop interest to pursue a German language course.
6AC.5	Get an comprehensive understanding of basic German Language and build a good enough vocabulary to articulate themselves in any given daily life situation.

Unit 01	**:**	**Introduction of Cases**	**(04 Hrs)**
Introduction of Cases: Nominative, Akkusative, Dative. Personal & Possessive Pronouns in Nominative, Akkusative, Dative			
Unit 02	**:**	**Prepositions**	**(04 Hrs)**
Prepositions:- Akkusative & Dative			
Unit 03	**:**	**Tenses**	**(04 Hrs)**
Tenses:- Past tense of sein & haben Verbs, Perfect tense			

Text Books:

[T1]	" Netzwerk A-1 (Deutsch als Fremdsprache) " Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

[R1]	Tipps und Uebungen A1

Online Resources:

1. Practice Material like online Worksheets regarding the Grammar.
2. NPTEL COURSE ON GERMAN -II LANGUAGE
3. ONLINE GERMAN-ENGLISH DICTIONARY www.leo.org