Department of Electronics and Communication Engineering
Bhagat Phool Singh Mahila Vishwavidyalaya,
Khanpur Kalan (Sonepat), Haryana-131305
(A state university established by govt. of Haryana vides Act no. 31 of 2006)
www.bpswomenuniversity.ac.in

Course Structure for B. Tech Seventh Semester (Fourth Year)									
S No.	**Code**	**Course Title**	**Hours/Week**			**Total Credits**	**Internal Marks**	**External Marks**	**Total Marks**
			L	**T**	**P**				
Subjects									
1.	ECL-471	Fiber Optic Communications	3	0	0	3	20	80	100
2.	*	Program Elective-3	3	0	0	3	20	80	100
3.	**	Program Elective-4	3	0	0	3	20	80	100
4.	***	Program Elective-5	3	0	0	3	20	80	100
5.	****	Open Elective-3	3	0	0	3	20	80	100
Labs									
6.	ECP-471	Minor Project	0	0	8	4	20	80	100
7.	ECP-473	Design & Simulation Lab	0	0	2	1	10	40	50
7.	IPT-471	Professional Training Assessment–II	0	0	0	1	50	0	50
Total			**15**	**0**	**10**	**21**	**180**	**520**	**700**

***Program Elective-3**		****Program Elective-4**	
Code	**Subject**	**Code**	**Subject**
ECEL-471-A	Network Security and Cryptography	ECEL-473-A	Multimedia Communication
ECEL-471-B	Embedded System Design	ECEL-473-B	Consumer Electronics
ECEL-471-C	Digital Signal Processors and Architectures	ECEL-473-C	Digital Image & Video Processing
ECEL-471-D	Machine Learning & AI	ECEL-473-D	Biomedical Instrumentation
ECEL-471-E	Introduction to MEMS	ECEL-473-E	Mixed Signal Design
*******	MOOC/NPTEL Course	*******	MOOC/NPTEL Course
****Program Elective-5**		*****Open Elective-3**	
Code	**Subject**	**Code**	**Subject**
ECEL-475-A	Software Defined Network	OEL-471-A	Skills for Employability
ECEL-475-B	VLSI Design	OEL-471-B	Hybrid and Electrical Vehicle
ECEL-475-C	Biomedical Signal Processing	OEL-471-C	Intelligent Instrumentation
ECEL-475-D	Mobile Programming	OEL-471-D	Design Thinking & Product Innovation
*******	MOOC/NPTEL Course	OEL-471-E	Product Design & Simulation

Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.

1. Students may opt Elective course/Additional course as decided by Departmental Committee from NPTEL/MOOCs/Swayam or any other online platform. The course code for the same will be decided by Departmental Committee.
2. The students may opt individual project/R&D project/start-up project in collaboration with industry, R&D institutions etc.
3. Students may opt Programme Elective/Open Elective/Generic elective course from CBCS offered by other deptt.
4. Project coordinator and other assisting co-coordinators will be assigned the Project Stage-II load of, maximum of 02 Hours per week including their own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

Fiber Optic Communication

ECL-471 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is to learn:

- To discuss technology developments in Optical Communication system.
- To provide an in-depth knowledge on various types of fibres and their transmission characteristics, the construction, working principle and characteristics of transmitters, receivers and various optical amplifiers used in long distance communication.
- The characteristics of optical sources and detectors.
- To describe the concepts of Wavelength Division Multiplexing technique, components used and the estimation of rise-time and power budget for digital transmission system.

Pre-requisite:

- Having an ability to apply mathematics and science in engineering applications
- Having a clear understanding of the subject Digital Communication Systems concepts

Course Outcome: After completion of the course, student will be able to:

- Understand the concept of optical communication.
- Select fibre and optoelectronic components to design, analyze an optical communication system and understand the basic concepts of optical transmitters, modulators and nonlinear effects.
- Understand the concepts of photo detectors and receivers and various optical amplifiers.
- Establish optical communication systems for multichannel systems using multiplexing techniques.
- Understand the concepts of WDM system and their applications.
- Understand and classify various types of optical Networks and their applications.

Contents

UNIT-I	**10 Hours**
Spectral bands and windows-Key elements of optical fiber system, Optical Spectral Band with Operating Windows, Optical Communication System with its advantag Optical Fiber Waveguides: Ray Theory of Transmission with TIR, Acceptance Angle, Numerical Aperture and Skew Rays.	
UNIT-II	**12 Hours**
Optical fibers: Types - SM-SI; MM-SI, MM-GI; specialty fibers Geometrical-Optics Description, Wave Propagation, Attenuation, Material Absorption Losses (Intrinsic and Extrinsic absorption), types of Linear and Non-Linear Scattering Losses, Fiber Bending Losses, Kerr Effect. Chromatic Dispersion, Polarization Mode Dispersion, Dispersion-Induced Limitations, Fiber Losses, Nonlinear Optical Effects (SRS, SBS, SPM, FWM).	
UNIT-III	**10 Hours**
Optical transmitter and Receivers-Sources: LED, LASER, Modulators, Transmitter Design, Mach-Zehnder and Electro-absorption Modulators. Photo detector, Receiver Design, Receiver Noise, Bit Error rate, Receiver Performance. Optical Amplifiers-Semiconductor Optical Amplifiers, Raman Amplifiers, Erbium-Doped Fiber Amplifiers, System Applications.	
UNIT-IV	**10 Hours**
Light wave transmission system- Intensity Modulation-Direct Detection Systems, Optical time	

division multiplexing, Wavelength-division multiplexing, Sub carrier multiplexing. Digital links: Point-to-Point links-System consideration-Link power budget-Rise time budget. Multichannel system-WDM Light wave Systems and Components, Operational principles of WDM-Passive optical coupler: 2x2, Fiber coupler-Wave guide coupler-Star couplers-MZI Multiplexers, Isolators and Circulators-Fiber Bragg Grating-FBG Applications.	
Suggested Text Books	
1.	J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
	J. M. Senior, Optical Fiber Communications: Principles and Practice, 2011, Pearson.
1.	B.Mukerjee, Optical WDM Networks (Optical Networks), 2006, Springer edition.
2.	Cvijetic, M., Djordjevic. I. B.: Advanced Optical Communication Systems and Networks,2012, Artech House.
3.	G. P. Agrawal, Nonlinear Fiber Optics, 2008, 2nd Edition, Academic Press.
4.	J. Gowar, Optical communication systems, Prentice Hall India, 1987.
5.	S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press,1979.
6.	G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7.	F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Network Security and Cryptography

ECEL-471-A **Total Credit: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- Understand the fundamental principles of access control models and techniques.
- Familiarize with the basic concept of authentication and secure system design.
- Understanding of different cryptographic protocols and techniques.
- Learn the methods for authentication, intrusion detection and prevention.

Pre-requisite: Fundamentals of networks.

Course Outcomes: At the end of this course students will be able to:

- Understand the concept and applications of network security and cryptography.
- Demonstrate security principles to system design.
- Identify and investigate network security threat.
- Describe various network security protocols.

Contents

UNIT- I	**10 Hours**
Security in Networks: Threats in networks, Network Security Controls – architecture, encryption, content integrity, strong authentication, access controls, wireless security, honeypots, traffic flow security, Firewalls – Design and types of Firewalls, Personal Firewalls, IDS, email security – PGP, S/MIME.	
UNIT- II	**08 Hours**
Introduction: Introduction to cryptography, security threats, vulnerability, active and passive attacks, security services and mechanism, conventional encryption model, CIA model. **Classical Cryptography:** Dimensions of cryptography, Classical cryptographic techniques.	
UNIT- III	**12 Hours**
Block Ciphers (DES, AES): Feistal Cipher structure, simplifies DES, DES, double and triple DES, Block Cipher design principles, AES, modes of operations. **Hash and MAC Algorithms:** Authentication requirement, functions, message authentication code, Hash functions, security of hash functions and Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures.	
UNIT- IV	**10 Hours**
Public-Key Cryptography: Principles of Public-Key cryptography, RSA algorithm, Key management, Diffie- Hellman Key Exchange, Elgamal algorithm, Elliptic Curve cryptography, Key distribution techniques, Kerberos.	
Suggested Text Books	
1.	William Stallings, "Cryptography and Network Security Principles and Practice", Fourth Edition, Pearson Education.
2.	Wenbo Mao, "Modern Cryptography: Theory and Practice", Prentice Hall PTR.
3.	William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall.
4.	Douglas R. Stinson, "Cryptography: Theory and Practice", CRC press.
5.	Laura Chappell, "Introduction to Cisco Router Configuration", Techmedia, 1999.

6.	Michael A. Miller, “Data & Network Communications”, Vikas Publication, 1998.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Embedded System Design

ECEL-471-B
L T P
3 0 0

Total Credits: 3
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives: The objective of this course is:

- To study the design principles of Embedded System. .
- To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.
- To study programming model of 8051 microcontroller and its programming.
- To study modular and Dos/Bios programming using 8086 micro processor.
- To visualize the role of Real time Operating System in Embedded System.

Pre-requisite: Microprocessor and operating system concepts.

Course Outcome: After studying this course students will be able to:

- Explain the functional blocks of an embedded system and its software development processes
- Explain the theoretical background and practical experience in the design and development of sophisticated embedded system
- Visualize the role of Real time Operating Systems in Embedded Systems.
- Describe the Embedded system design techniques.

Contents

UNIT-1	**10 Hours**
Introduction to Embedded System Design: Definition, Embedded system and General purpose computers, Embedded system components, Embedded System Design Process, Classification of an embedded system, Applications of an embedded system, Processor Selection for embedded systems and its issues, Memory organization, Interfacing, IDE Selection, Tool chain and Programming	
UNIT-II	**12 Hours**
Implementation Platforms and Its Programming: The ARM programmers model, ARM development tools, ARM instruction set: Software interrupt (SWI) Interrupt Service RoutinesWriting simple assembly language programs for ARM, 3-stage pipeline ARM organization, Comparison between ARM and Atom processors. Introduction to Reconfigurable platforms(SoC, FPGA).	
UNIT-III	**12 Hours**
RTOS: Operating system service, RTOS architecture, Process management, Timer and Event function, Memory management, Device , File and I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt service calls, Watch dog timer, Real time clock, Customizing OS for Embedded system, Introduction to Embedded C	
UNIT-IV	**10 Hours**
Design Technology: Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.	

Suggested Text Books	
1.	Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill,Second Edition Paperback – 1 2017
2.	Embedded Systems Design: An Introduction to Processes, Tools, and Techniques by Arnold S. Berger, Elsevier India, 2010, Paperback
3.	William Hohl, "ARM Assembly Language: Fundamentals and Techniques," CRC Press, 2nd Edition.
4.	Dr.K.V.K.K.Prasad, "Embedded/Real Time Systems: Concepts, Design and Programming," DreamTech press, Black Book, 2005.
5.	Embedded Systems- Architecture, Programming and Design ,Rajkamal, McGraw Hill Education 3rd Edition, 2017

NOTE: There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Digital Signal Processors and Architectures

ECEL-471-C **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective:

- To recall digital transform techniques
- To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
- To give practical examples of DSP Processor architectures for better understanding.
- To develop the programming knowledge using Instruction set of DSP Processors.

Prerequisites: Digital Electronics, Microprocessors, Digital Signal Processing

Course Outcomes:

- Understand the basics of Digital Signal Processing and transforms.
- Able to distinguish between the architectural features of General purpose processors and DSP processors.
- Can interface various devices to DSP Processors.
- Able to write simple assembly language programs using instruction set of TMS320C54xx.

Contents

Unit - I	**10 Hours**
Intoroduction to DSP: Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB. **Computational Accuracy in DSP Implementations:** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.	
Unit - II	**10Hours**
Architectures For Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing. **Execution Control and Pipelining:** Hardware looping, Interrupts, Stacks, Relative Branch support Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models	
Unit - III	**10 Hours**
Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors. **Implementations of Basic DSP Algorithms:** The Q-notation, FIR Filters, IIR Filters,	

Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing	
Unit - IV	**10 Hours**
Implementation of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum. **Interfacing memory and I/O peripherals to programmable DSP devices:** Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).Multichannel buffered serial port, McBSP Programming, a CODEC interface circuit, CODEC Programming, A CODEC-DSP interface example.	
Suggested Text Books	
1.	Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004
2.	DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand,2000
3.	Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Machine Learning & AI

ECEL-471-D **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- Understand the fundamentals and applications of Machine learning.
- Understand the theory and algorithms of machine learning.
- Learn to design a network for a particular application.
- Understand the concepts of Artificial Intelligence and challenges.

Pre-requisite: Basic knowledge of Algorithms and probability.

Course Outcomes: At the end of this course students will be able to:

- Describe the concepts and working of different machine learning algorithms.
- Apply machine learning concepts and algorithms to given problems.
- Analyze the performance of machine learning algorithms.
- Differentiate between various machine learning algorithms.
- Describe the concept and applications of Artificial Intelligence.

Contents

UNIT- I	**10 Hours**
Introduction: Overview of machine learning, designing a learning system, issues in machine learning, the concept learning task, concept learning as search, finding a maximally specific hypothesis, version spaces and candidate elimination algorithm, remarks on version spaces and candidate-eliminations, Inductive bias.	
UNIT- II	**10 Hours**
Supervised Learning: Introduction to linear regression, estimating the coefficients, accessing the accuracy of the coefficient estimates, accessing the accuracy of the regression model, Multiple linear regression, Logistic regression, basic decision tree learning (ID3) algorithm, hypothesis space search in decision tree learning algorithm, Inductive bias in decision tree learning, Issues in decision tree learning, k-nearest neighbor learning.	
UNIT- III	**10 Hours**
Unsupervised Learning: About clustering, type of data in clustering analysis, k-means and k-medoids, DBSCAN density-based clustering method, performance analysis of clustering algorithms. Artificial Neural Networks: Neural Network representations, appropriate problems for neural network learning, perceptron, perceptron training rule, gradient descent and delta rule, Multilayer Networks and back propagation algorithm.	
UNIT- IV	**10 Hours**
Artificial Intelligence (AI): AI problems, what is an AI technique; characteristics of AI, applications, problem solving using AI, search and control strategies, general problem solving, production systems. Control strategies: forward and backward chaining, Exhaustive searches: Depth first, Breadth first search.	
Suggested Text Books	
1.	Ethem Alpaydin, " Introduction to Machine Learning", 2nd Edition, MIT Press Ltd, 2010.
2.	Stephen Marsland, "Machine Learning: An Algorithmic Perspective", 2nd Edition, CRC Press, 2014.
3.	Tom M. Mitchell, "Machine Learning", McGraw Hill, 199
4.	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill.

5.	Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India.
6.	Elaine Rich, Kevin Knight and Shivashankar B Nair, "Artificial intelligence", McGraw Hill Education. 3rd Edition, 2009.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Introduction to MEMS

ECEL-471-E **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- To make proficient working principles of MEMS and MEMS devices.
- To understand about the design and model MEMS devices.

Pre- requisites: Knowledge of fundamentals of Electrical Engineering, Chemical Engineering, Material Science and Mechanical Engineering.

Course Outcomes: At the end of the course, students will be able to:

- Understand the Basic concept of MEMS, Fabrication Technologies,
- Explain Mechanics of Beam and Diaphragm Structures.
- Understand the applications of MEMS in RF

Contents

Unit – I	**8 Hours**
Introduction and Historical Background: Scaling Effects. Micro/Nano Sensors, Actuators and Systems overview: Case studies.	
Unit - II	**8 Hours**
Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.	
Unit - III	**12 Hours**
Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect.	
Unit - IV	**10 Hours**
Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.	
Suggested Text Books	
1.	G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2.	S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3.	S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001
4.	M. Madou, Fundamentals of Microfabrication, CRC Press, 1997
5.	G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Multimedia Communication

ECEL-473-A **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- To Learn Syntax and Semantics and create Functions in Matlab.
- To Handle Strings and Files.
- To Understand Lists, Dictionaries.

Pre-requisite: Knowledge of text, image and Video.

Course Outcomes: After studying this course, students will be able to:

- Understand basics of different multimedia networks and applications.
- Understand different compression techniques to compress audio and video.
- Describe multimedia Communication across Networks.
- Analysis different media types to represent them in digital form.

Contents

Unit - I	**12 Hours**
Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology. Digitization principles, Text, Images, Audio and Video.	
Unit - II	**12Hours**
Introduction, Audio compression, video compression, video compression principles, video compression. . Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks.	
Unit - III	**10 Hours**
Introduction to information networks: LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8.	
Unit - IV	**12Hours**
Introduction to broadband ATM networks, Cell format, Switfh and Protocol Architecture ATM LANs, Introduction, TCP/IP, TCP, UDP, RTP and RTCP.	

Suggested Text Books

1.	Raifsteinmetz, Klara NaHourstedt, ―Multimedia: Computing, Communications and Applications‖, Pearson education, 2002. ISBN -9788177584417
2.	Fred Halsall, ―Multimedia Communications‖, Pearson education, 2001
3.	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, ―Multimedia Communication Systems‖, Pearson education, 2004. ISBN -9788120321458

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Consumer Electronics

ECL-473-B **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- To Exposure of many Electronic equipments which hail from scientific, domestic, sports almost every domain of life.
- To analyze various triggering circuits used for different semiconductor switches and their comparative study
- To Acquire knowledge of various power electronic converter for real time application like rectifier, ac voltage controller etc.

Pre-requisite: Awareness of Electrical, communication and analog circuits.

Course Outcomes: At the end of the course, students will be able to:

- Understand the latest advancements of Electronics and Communication Engineering.
- Students will be proficient and familiar to electronic equipments and power electronics devices with applications in domestic commercial lives with new picture.

Contents

UNIT-I	**10 Hours**
Domestic appliances: UPS, Rolling Display, Microprocessor based Mixer, Microprocessor based Washing Machine, Micro Wave Oven, Electronic Calculator, Electronic Advertisement Display, Electronic Choke, Electronic Torch, Solar Panels, Inverter.	
UNIT-II	**10 Hours**
Audio Systems: Audio Power Amplifier, Pre Amplifier, Tone Control, Graphic Equalizer Magnetic Tape Recorders, CD Players, Dolby systems. **Video Systems:** B/W and Colour TV Receiver, VCR, VCP, CD Videos, CCTV, Video Games, Video-Tape and Video-Disk Recording, Home Cinema, Mobile Phone, IoT Smart Building.	
UNIT-III	**10 Hours**
SCR: Role of power electronics, review of construction and characteristics of power diode, Shottky diode, power transistor, power MOSFET, SCR, DIAC, TRIAC, GTO, IGBT. **AC Regulators:** Types of regulator, equation of load current, calculation of extinction angle, output voltage equation, harmonics in load voltage and synchronous tap changer, three phase regulator.	
UNIT-IV	**10 Hours**
Seminar Based: Contemporary/Latest advancements in the field of Electronics and communication Engineering for environment friendly applications, energy saver applications, smart applications.	

Suggested Text Books

1.	Consumer Electronics: K. Arun, Chhaya Publishing House, 2000.
2.	Consumer Electronics: B. R. Gupta, Katson, 2003, S.K. Kataria & Sons
3.	Power Electronics: MH Rashid; Publisher Pearson Education
4.	Power Electronics: PC Sen; TMH
5.	Power Electronics: HC Rai; Cbs Publishers and Distributors

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be

required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Digital Image & Video Processing

ECEL-473-C **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- To cover the fundamentals and mathematical models in digital image and video processing.
- To develop time and frequency domain techniques for image enhancement.
- To expose the students to current technologies and issues in image and video processing.
- To develop image and video processing applications in practice.

Pre requisites: Signals and Systems, Digital Signal Processing

Course Outcomes: At the end of the course, students will demonstrate the ability to:

- Mathematically represent the various types of images and analyze them.
- Process these images for the enhancement of certain properties or for optimized use of the resources.
- Develop algorithms for image compression and coding

Contents

Unit - I	**12 Hours**
Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain	
Unit - II	**12Hours**
Sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass. Color Image Processing-Color models–RGB, YUV, HSI; Color transformations–formulation, color complements, color slicing, tone and color corrections;	
Unit - III	**10 Hours**
Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation. Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression predictive, Still image compression standards – JPEG and JPEG-2000.	
Unit - IV	**12Hours**
Digital Video & Coding: Basics of Video, Time-varying Image formation Models, SpatioTemporal Sampling, Optical flow, General methodologies, Overview of coding systems, Video Compression Standards	
Suggested Text Books	
1.	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2.	Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3.	Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit.

Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Biomedical Instrumentation

ECEL-473-D **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The basic objective of this course is:

- To provide an overview about various physiological signal measurements.
- To provide an overview about electrical parameter acquisition and recording.
- To provide knowledge on electrical safety.
- To make students understand various biomedical Instruments used for non-electrical parameter measurement.
- To make students familiarized with various medical imaging systems.

Pre-requisite: None

Course Outcomes: At the end of the course, students will be able:

- To analyze and compare the operation of different medical devices.
- To detect, measure and analyze the bio-signals.
- To select and apply the appropriate medical instruments for measurement.
- To design medical devices for diagnosis and therapeutic applications.
- To analyze simple bio-sensing and transduction problems.
- To apply safety standards and select disposal method and procedures for electrical diagnostic equipment.

Contents

UNIT- I	**9 Hours**
Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals – Basic components of a biomedical system- Cardiovascular systems- Respiratory systems - Kidney and blood flow – Biomechanics of bone – Biomechanics of soft tissues – Basic mechanics of spinal column and limbs Physiological signals and transducers – Transducers – selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements – Fibre optic temperature sensors.	
UNIT- II	**9 Hours**
Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter – ESR, GSR measurements.	
UNIT- III	**12 Hours**
Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.	
UNIT- IV	**10 Hours**
Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.	

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers.	
Suggested Text Books	
1	Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
2	Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
3	Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
4	M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
5	Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
6	Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

MIXED SIGNAL DESIGN

ECEL-473-E **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks:80**
Total Marks: 100

Course Objective: The objective of this course is:

- To analyze and handle the inter-conversions between signals.
- To understand the practical situations where mixed signal analysis is required.
- To teach designing of systems involving mixed signals.

Prerequisites: CMOS Analog IC design.

Course outcome: At the end of the course, students will demonstrate the ability to:

- Understand the practical situations where mixed signal analysis is required.
- Analyze and handle the inter-conversions between signals.
- Design systems involving mixed signals.

Contents

Unit - I	**8 Hours**
Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform. Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications	
Unit - II	**12Hours**
Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.	
Unit - III	**10 Hours**
Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.	
Unit - IV	**10Hours**
Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.	
Suggested Text Books	
1.	R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2.	Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003
3.	R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4.	Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5.	Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6.	R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7.	M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Software Defined Network

ECEL-475-A **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- Understand the concepts Software Defined Networks and components.
- Understand the modern tools to implement SDN Controllers in a Network.
- Understand the functioning of Open flow protocol.
- Learn the programming for implementation of SDN.

Pre-requisite: None.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Explain Software Defined Networks and its various components.
- Describe techniques to make the Network Programmable for better flexibility.
- Apply the knowledge to use modern tools to implement SDN Controllers in a Network.
- Demonstrate the working of SDN through various protocols.
- Demonstrate SDN using Application Programming Interface and compute its performance.

Contents

UNIT- I	**10 Hours**
Introduction: The need for Programmable Networks, Evolution of Software Defined Networks, Software Defined Networks' Architecture and Design, Traditional Switch Architecture, Centralized and decentralized Control Plane and Data Plane, IETF SDN framework, Scalability (Service provider Networks, ISP Automation), 192 Reliability (QoS and Service Availability), Consistency (Configuration management and Access Control violations).	
UNIT- II	**8 Hours**
Openflow and Software Defined Networks Controllers: Control and Data Plane Separation, Evolution of Openflow, SDN Controllers (POX, floodlight, open Day Light), Applicability of Openflow protocols in SDN Controllers, scalable Programming for SDN Controllers.	
UNIT- III	**10 Hours**
Network Virtualization: Virtual Network, Abstraction of physical Network, Components of Virtual Network (Virtual Switch, Bridge, Host-virtual adapter, NAT device, DHCP server, Network Adapter), Network as a Service (NaaS), Network Virtual Machine.	
UNIT- IV	**12 Hours**
Software Defined Networks Programming: Programming Software Defined Networks, Northbound Application Programming Interface, Current Languages and tools, Network Functions Virtualization, Software Defined Networks implementation and Applications, Bandwidth Calendaring- Data Center Orchestration, Mininet. Usecases (Network Access Control, Virtual Customer Edge, Data center Optimization), Latest trends in SDN.	

Suggested Text Books

1.	Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.
2.	Thomas D.Nadeau, Ken Gray, "Software Defined Networks", O'Reilly Media, 2013.
3.	Siamak Azodolmolky, "Software Defined Networking with Openflow", Packt Publishing, 2013.
4.	Kingston Smiler, "Openflow Cookbook", Packt Publishing, 2015.

5.	Doug Marschke, Jeff Doyle, PeteMoyer, "Software Defined Networking: Anatomy of Openflow", Volume-I, Lulu Publishing Services, 2015.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

VLSI Design

ECEL-475-B **Total Credits: 3**

L T P **Internal Marks: 20**

3 0 0 **External Marks: 80**

Total Marks: 100

Course Objectives:

- To understand MOS transistor fabrication processes.
- To understand basic circuit concepts
- To have an exposure to the design rules to be followed for drawing the layout of circuits
- Design of building blocks using different approaches.
- To have a knowledge of the testing processes of CMOS circuits.

Pre-requisite: Electronics Devices and Circuits

Course Outcome: After studying this course students will be able to:

- To understand MOS transistor theory, technology and circuit characterization.
- To gain knowledge on combinational and sequential circuit design

Contents

UNIT-1	**12 Hours**
MOS TRANSISTOR THEORY:VLSI Design Flow- MOS Transistors, CMOS Logic - Ideal I-V Characteristics - Nonideal I-V Effects,, DC Transfer Characteristics.	
UNIT-II	**12 Hours**
MOS TECHNOLOGY AND CIRCUIT CHARACTERIZATION: MOS Fabrication - CMOS Fabrication, BiCMOS Technology, Layout Design Rules, Latch up in CMOS circuits, CMOS Process Enhancements, Technology Related CAD Issues -Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Interconnect, switching characteristics.	
UNIT-III	**12 Hours**
Combinational circuit design: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Circuits, Sense-amplifier Circuits, BiCMOS Circuits, Low-power Logic Design.Sequential circuit design: CMOS circuit design Latches and Flip flops, Two-phase timing types, Synchronizers.	
UNIT-IV	**12 Hours**
TESTING AND VERIFICATION: Logic verification, Manufacturing tests, Test fixtures and test programs, Logic verification principles, Manufacturing test principles, Design for testability, Boundary scan.	
Suggested Text Books	
1.	Neil H.E. Weste, David Harris &Ayan Banerjee, "Principles of CMOS VLSI Design: A System Perspective", Second Edition, Pearson Education Pvt. Ltd. 2013.
2.	Douglas A. Pucknell& K. Eshraghian, "Basic VLSI Design", (3/e), Third Edition, PHI, 2011.
3.	John P.Uyemura"Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc., 2002.
4.	Wayne Wolf, "Modern VLSI Design System on chip. Pearson Education, 2002

NOTE: There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Biomedical Signal Processing

ECEL-475-C **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- Educate the students in the application of signal processing methods to biomedical systems.
- Introduce Signal processing concepts are using real-life biomedical examples.

Teach the students how to use a computer workstation as part of a measurement/signal-processing system.

Pre-requisites: Signal and Systems, Probability/Random Processes.

Course Outcomes: At the end of this course students will be able to:

- Educate the students in the application of signal processing methods to biomedical systems.
- Signal processing concepts are introduced using real-life biomedical examples.

Contents

Unit - I	**8 Hours**
Introduction: Importance of Computer in Signal Processing, Basic Electrocardiography lead system, ECG Signal Characteristic, Single Sampling, Signal Conversion. **Digital Filter:** Z-transform, elements of digital filters, Type of digital filters, Transfer function of a difference equation Z-plane pole-zero plots. **IIR Filters:** Generic Equations, One pole and two pole filters integrators.	
Unit - II	**12Hours**
Integer Filters: Basic Design Concept, Low Pass, High Pass, Band Pass, Band reject filters, Effect of cascading of filters, fast operating design techniques. **Adaptive Filters:** Principal noise canceller model, GO Hz, Adaptive Canceling, Applications	
Unit - III	**10 Hours**
Signal Averaging: Signal averaging as a digital filter, a typical averager, Software for single averaging, limitations, Data Reduction Techniques-Turing point Algorithm, AZTEC Algorithm, Fan Algorithm, Huffman coding. Fourier Transform, Correlation, Convolution, Power Spectrum Estimation.	
Unit - IV	**8 Hours**
ECG-QRS Detection: Power Spectrum of ECG, Band Pass Filtering Techniques, Differentiation Techniques, Template Matching, QRS Detection Algorithm. **ECG Analysis System:** ECG Interpretation. ST Segment Analyzer, Portable Arrhythmia Monitor..	
Suggested Text Books	
1.	WJ.Tompkin, Biomedical Signal processing, PHI
2.	JG. Prokis, Digital Signal processing, PHI
3.	Salivahanan, Digital Signal Processing, Tata Mc-Graw Hill.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Mobile Programming

ECEL-475-D **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to:

- Understands the working of Android OS Practically.
- Understand and develop Android user interfaces.
- Learn skills for creating and deploying Android applications.
- Learn to Install and use appropriate tools for Android development

Pre-requisite: JAVA or object-oriented programming experience.

Course Outcomes: At the end of this course students will be able to

- Install and use appropriate tools for Android development, including IDE, device emulator, and profiling tools.
- Understand the Android application architecture, including the roles of the task stack, activities, and services.
- Demonstrate user interfaces with fragments, views, text input, lists, tables, and more.
- Store application data on the mobile device, in internal or external storage locations.

Contents

UNIT- I	**8 Hours**
Introduction to Android Operating System: Android OS design and features, Android development framework, SDK features, installing and running applications on Android Studio, creating AVDs, types of Android applications, best practices in Android programming.	
UNIT- II	**10 Hours**
Android tools: Android application components, Android Manifest file, externalizing resources like values, themes, layouts, menus etc, resources for different devices and languages, runtime configuration changes, Android application lifecycle – activities, activity lifecycle, activity states, monitoring state changes.	
UNIT- III	**10 Hours**
Intents and Broadcasts: Intent – using intents to launch Activities, explicitly starting new Activity, Implicit Intents, passing data to Intents, getting results from Activities, Native Actions, using Intent to dial a number or to send SMS broadcast Receivers – using Intent filters to service implicit Intents, resolving Intent filters, finding and using Intents received within an Activity notifications – creating and displaying notifications, displaying Toast.	
UNIT- IV	**10 Hours**
Persistent Storage: Files – using application specific folders and files, creating files, reading data from files, listing contents of a directory, Shared Preferences – creating shared preferences, saving and retrieving data using Shared Preference.	
Suggested Text Books	
1.	Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox) , 2012.
2.	James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013.Publishing house- Wrox
3.	J.F. DiMarzio, "Android: A Programming Guide".Pearson

4.	Ed Burnett, "Hello, Android: Introducing Google's Mobile Development Platform", Paperback
5.	Programming android by Zigurd Mednieks, Publisher- **O'Reilly**
6.	Ian G. Clifton, "Android User Interface Design: Turning Ideas and Sketches into Beautifully Designed Apps", Publisher Addison-Wesley Professional

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Skills for Employability

OEL-471-A **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- To hone the employability related communication skills of the students on the foundations built during Executive Communication.
- To develop students' knowledge of communication skills in the structure, elucidation, and delivery of message.

Pre- requisites: NA

Course Outcomes: At the end of the course, students will be able to:

- Have clarity on their career exploration process and to match their skills and interests with a chosen career path.
- Explain the use of functional and chronological resume.
- Develop thinking ability and polish his expression in group discussions.
- Be prepared for the personal interview through mock interviews while being aware of the various kinds of interviews.

Contents

Unit – I	**10 Hours**
English Literacy: , social Greetings, difference between formal & informal Greetings, importance of greetings , Formal Self-Introductions skill, Writing Skills: concept of writing skill, importance and strategies , Importance of English in the workplace.	
Unit - II	**10 Hours**
Communication Skills:. Importance & types of Communication, Listening Skills: concept of Listening skill, importance and strategies, Managing Emotions, Interview Preparation.	
Unit - III	**15 Hours**
Entrepreneurship: Concept, meaning and definitions of entreneurship, nature and characteristics of entrepreneurship, importance and benefits of entrepreneurship, types of entrepreneur.	
Unit - IV	**12 Hours**
Basics of Computers: Introduction to Computers and its applications, Basics of Operating System, Basic operating of MS- Office, Introduction to world wide web (WWW), Useful websites, web browser - usage, search engine etc. Using popular sites like Bharat Skills, Skill Training related Government portals, naukri.com and other job portals, CITS applications, Apprenticeship portal (NAPS).	
Suggested Text Books	
1.	Raja Gopal, entrepreneurship & Rural markets, Vikas Publishing House.
2.	Employability Skills Paperback by Arihant, 1 January 2017.
3.	NSQF Employability Skills 1 and 2 Year Paperback by Srishti Agarwal – 22 August 2021

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Hybrid and Electrical Vehicle

OEL-471-B **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The aim of this course is to:

- Understand the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- Analyze various electric drives suitable for hybrid electric vehicles.
- Study the energy storage requirements in Hybrid and Electric Vehicles

Pre-requisite: Basic Electrical and Electronics Engineering

Course Outcomes: At the end of the course, students will be able to:

- Understand the basic concept and history of EV and HEV.
- Understand the models to describe hybrid vehicles and their performance.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy management systems.
- Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.

Contents

UNIT- I	**10 Hours**
Introduction: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern electric vehicles on energy supplies. Electric Vehicle Composition and Configurations, Basic concept of hybrid Electric vehicle, HEV configuration types – series, parallel, series-parallel and complex hybrid, Power flow control.	
UNIT- II	**10 Hours**
Electric Propulsion: major requirements of EV motor drive, characteristics and control of DC motor, Induction motor, Switched Reluctance motor and Permanent Magnet motor, power converters devices/topology, control hardware, software and strategy vehicle, power source characterization, transmission characteristics.	
UNIT- III	**12 Hours**
Energy Storage: Introduction to energy storage requirements in Hybrid and Electric Vehicles, Energy sources, Battery based energy storage and its analysis, Fuel cell based energy storage and its analysis, super capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis.	
UNIT- IV	**12 Hours**
Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Plug-in electric vehicles, Vehicle to grid (V2G) and Grid to vehicle (G2V) fundamentals.	
Suggested Text Books/References	
1.	S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
2.	M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and

	Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
3.	T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.
4.	Web course on "Introduction to Hybrid and Electric Vehicles" by Dr. Praveenkumar and Prof. S Majhi, IIT Guwahati available on NPTEL at https://nptel.ac.in/courses/108/103/108103009/
5.	Video Course on "Electric Vehicles" by Prof. Amitkumar Jain, IIT Delhi available on NPTEL at https://nptel.ac.in/courses/108/102/108102121/

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Intelligent Instrumentation

OEL-471-C **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- To review the fundamentals and practices to acquire the basic knowledge of Intelligent Instruments.
- To analyse active filters, A/D & D/A convertors.
- Understand the use of intelligent instruments in sensor networks and communication.

Pre-requisite: Basic concepts of Analog and Digital circuits, microprocessor etc.

Course outcome: After completion of the course, student will be able to:

- Understand the fundamentals and practices of basic knowledge of Intelligent Instruments.
- To analyse and perform design of various linear integrated circuits.

Contents

UNIT-I	**12 Hours**
Introduction: Definition of an intelligent instrumentation system; types of instrumentation system, feature of intelligent instrumentation; components of intelligent instrumentation; Block diagram of an intelligent instrumentation, static and dynamic characteristics of instruments.	
UNIT-II	**12 Hours**
Interfacing Instruments & Computers: Basic issue of interfacing; the number systems, programming and executions of program, Address decoding; Data transfer control; A/D converter; D/A converter; choosing the different types of instruments, other interface consideration.	
UNIT-III	**10 Hours**
Sensor Networks and Communication: Introduction, Ordinary sensor v/s networked sensors, communication and networking concepts, ISO/OSI network reference model, network technologies, applying network communications, standards for smart sensor interface: IEEE 1451, serial & parallel interfaces; Serial communication lines; Parallel data bus; Local area Networks, Star networks, Ring & Bus networks, Fiber optic distributed networks, Fiber optic sensors.	
UNIT-IV	**6 Hours**
Software Filters: Description of Spike Filter, Low pass filter, High pass filter etc.	
Suggested Text Books	
1	Intelligent Instrumentation Principles and Applications: Manabendra Bhuyan; CRC Press, 2010.
2	Modern Intelligent Instruments Theory and Applications: Changjian Deng; Bentham Science Publishers Pvt. Ltd. Singapore, 20220.
3.	Principles of measurement and Instrumentation: Alan S. Morris; PHI.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Design Thinking & Product Innovation

OEL-471-D **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: At the end of the course, students will be able to:

- Familiarize students with design thinking process as a tool for breakthrough innovation.
- It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems..

Pre- requisites: NA

Course Outcomes: At the end of the course, students will be able to:

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation.
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment.
- Formulate specific problem statements of real time issues.

Contents

Unit – I	**11 Hours**
Introduction to Design Thinking Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.	
Unit - II	**10 Hours**
Design Thinking Process: Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking -person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes.	
Unit - III	**8 Hours**
Innovation: Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Teams for innovation, Measuring the impact and value of creativity.	
Unit - IV	**10 Hours**
Product Design: Introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design	

Suggested Text Books	
1.	Design Thinking in the Classroom by David Lee, Ulysses press.
2.	Change by design, Tim Brown, Harper Bollins (2009) 2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons..
3.	Universal principles of design-William lidwell, kritinaholden, Jill butter, Rockport Publishers
4.	Design the Future, by Shrrutin N Shetty, Norton Press.

NOTE: Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

Product Designing and Simulation

OEL-471-E **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The students will be able to

- Understand the concepts of product designing.
- Familiarize with the process of new product design.
- Understand the process of reverse engineering.
- Familiarize with 2D and 3D modelling and visualization of products.
- Understand the simulation environment to design an electronics product.

Pre-requisite: NA.

Course Outcomes: At the end of this course students will be able to

- Create new designs of products.
- Apply reverse engineering to analyze the product.
- Represent the product in 2D and 3D.
- Apply the knowledge of software tools in designing and simulation of electronics products.

Contents

UNIT- I	**8 Hours**
Introduction to Engineering Product Design: Trigger for Product/ Process/ System, problem solving approach for Product Design, disassembling existing Product and understanding relationship of components with each other, sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components.	
UNIT- II	**8 Hours**
Reverse engineering: History of Reverse Engineering, preserving and preparation for the four-stage process - Evaluation and Verification, Technical Data Generation, Data Verification, Project Implementation. Case studies of products in markets, underlying principles, case studies of product failures, revival of failed products, Public/Society perception of products, and its input into product design.	
UNIT- III	**10 Hours**
Conceptualisation: Computer operation principles and image editing through a graphical composition, computer aided 2D drafting and 3D modelling through simple exercises, designing of components, drawings of parts and synthesis of a product from its component parts, rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, detail Engineering drawings of components.	
UNIT- IV	**10 Hours**
Electronic Design Tools: PCB design process- design rules for analog, digital, high-frequency, power-electronic and MW PCBs. PC based Electronic Design Tools: Schematic capture, circuit Simulation, layout design. Features of popular EDA tools such as Orcad- Designing PCBs for manufacturability, design considerations for power efficiency. Introduction to SPICE simulation of circuits- Circuit description, modeling of active and passive circuit elements.	

Suggested Text Books	
1.	Karl T. Ulrich & Steven D. Eppinger, “Product Design & Development”, MGH.
2.	John R. Lindberg, “Product Design & Manufacturing”, PHI.
3.	A. Ingle, “Reverse Engineering, Katheryn”, McGraw-Hill, 1994
4.	Harry Nystrom, “Creativity and innovation”, John Wiley & Sons, 1979.
5.	R Stillwell, Marcel, “Electronic Product Design for Automated Manufacturing”, Dekker Publishing house.
6.	Mohammed H. Rasheed, “Spice for circuits & Electronics using Pspice”, PHI.
7.	Clyde F. Coombs, “Printed Circuits Handbook”, MGH.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Minor Project

ECP-471 **Total Credits: 3**
L T P **Internal Marks: 20**
0 0 8 **External Marks: 80**
Total Marks: 100

Course Objective: At the end of the course, students will be able to:

- Make use of acquired knowledge for the problem identification and definition,
- Analyze the technical aspects of the project with a comprehensive and systematic approach,
- Propose and select the appropriate solution,
- Appraise the importance of an individual/team for effective execution,
- Compile and conclude the project with effective communication amongst peers, mentors, and society.

Pre-requisite: NA

Course Outcomes: At the end of the course, students will be able to:

- Make use of acquired knowledge for the problem identification and definition related to industry/research/societal need.
- Analyze the technical aspects of the project with a comprehensive and systematic approach.
- Select the appropriate modern tool(s) and technique(s) for problem-solving.
- Propose and select the appropriate and cost-effective solution.
- Appraise the importance of an individual/team for effective execution.
- Value the health, environment, safety, and ethical practices during the project.
- Perceive the possibility of scalability and scope of intellectual property rights.
- Compile and conclude the project with effective communication amongst peers, mentors, and society.
- Develop life-long learning skills for a productive career.

Syllabus:

The student(s) shall carry out the project based on one or more of the following aspects – Prototype Design, Product Preparation / Development, Working Model, Fabrication of Set-up, Laboratory Experiments, Process Modification / Development, Simulation, Software Application / Development, Integration of Software and Hardware, Data Analysis, Survey, etc. The student is required to submit a project report based on the work carried out.

Design and Simulation Lab

ECP-471 **Total Credits: 1**
L T P **Internal Marks: 10**
0 0 2 **External Marks: 40**
Total Marks: 50

COURSE OBJECTIVE: The objective of this course is:

- Each student will compile independently a simulation based project using simulations tools.

Pre-requisites:

Laboratory Outcomes: At the end of the course, students will be able to:

- Build a project using different simulation tools.

List of Experiments

List of experiments will be based on theory syllabus with a minimum of 8 experiments to be incorporated.	
Suggested Text Books	
1.	Paul Barry," Head First Python",2nd edition, O Rielly,2010
2.	Chemical Process Design and Simulation: Aspen Plus and Aspen Hysys Applications, By Juma Haydary, Wiley.
3.	System Design, Modeling, and Simulation Using Ptolemy II, Ptolemy.org

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

Professional Training Assessment– II

IPT-471 **Total Credits: 1**
L T P **Internal Marks: 50**
0 0 0 **External Marks: 00**
Total Marks: 50

Course Objective: The aim of this course is to:

- Develop the capability among the students for handling the implementation of their theoretical knowledge in the practical field.
- Familiarize with the environment of an organization and a company.
- Get a certificate which validates their skills and helps the students in getting a job quickly

Pre-requisite: No

Course Outcomes: After the course is completed the student will:

- Have additional knowledge about professional attributes.
- Develop a more professional outlook.
- Know how to deal with time bound tasks in a more effective way.
- Have more efficient attribute of multi-tasking

At the end of 6th semester each student would undergo four to six weeks Professional Training in an Industry/ Institute/ Professional Organization/Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization. The typed report should be in a prescribed format. The report will be evaluated in the 7th Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization. The student will interact with the committee through presentation to demonstrate his/her learning. Teachers associated with evaluation work will be assigned 2 periods per week load.

The committee of examiners constituted by the Chairperson of the department for the evaluation of the student for Industrial/ Professional Training/Internship is as under:-

1. Chairperson of the Department: Chairperson
2. Coordinator of Concerned Year/ Internal Examiner of the Department: Member
3. Training and Placement Officer (TPO) of the Department: Member