B.Tech. Electronics and Communications Engineering (ECE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f academic session 2025-26

SEMESTER-V

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-HSM-201	Organizational Behaviour	3:0:0	3	3	70	30	--	100	3
2	B23-ECE-301	Digital Signal Processing	3:1:0	4	4	70	30	--	100	3
3	B23-ECE-303	Digital Communication	3:0:0	3	3	70	30	--	100	3
4	B23-ECE-305	Data Structure	3:0:0	3	3	70	30	--	100	3
5	B23-ECE-307	Antenna and Wave Propagation	3:0:0	3	3	70	30	--	100	3
6	B23-ECE-309	Digital Signal Processing Lab	0:0:3	3	1.5	--	40	60	100	3
7	B23-ECE-311	Communication Lab	0:0:3	3	1.5	--	40	60	100	3
8	B23-ECE-313	Data Structure Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECE-315	Industrial Training-I	0:0:2	2	1	--	100	--	100	3
10	B23-MAC-301	Constitution of India	2:0:0	2	1	--	100	--	100	3
TOTAL				**28**	**22**	**350**	**470**	**180**	**1000**	

B.Tech. Electronics and Communications Engineering (ECE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f academic session 2025-26

SEMESTER-VI

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-ECE-302	Computer Networks	3:0:0	3	3	70	30	--	100	3
2	B23-ECE-304	VLSI Design	3:0:0	3	3	70	30	--	100	3
3	B23-ECE-306	Wireless and Mobile Communication	3:0:0	3	3	70	30	--	100	3
4	B23-ECE-308	Control System Engineering	3:0:0	3	3	70	30	--	100	3
5	--	Program Elective-I	3:0:0	3	3	70	30	--	100	3
6	--	Open Elective-I	3:0:0	3	3	70	30	--	100	3
7	B23-ECE-310	Computer Networks Lab	0:0:2	2	1	--	40	60	100	3
8	--	Program Elective-I Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECE-312	Project-I	0:0:4	4	2	--	40	60	100	3
10	*B23-VAC-302/304/306/308/310	Hindi Language Skills/ Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	2:0:0	2	1	--	100	--	100	3
TOTAL				**28**	**23**	**420**	**400**	**180**	**1000**	

Note:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- **All students have to undertake the industrial training for 6 to 8 weeks after 6th semester which will be evaluated in 7th semester.**

*B23-VAC- 302/304/306/308/310 are value added courses that may be offered to students through the departments within university campus or institutes

List of Programme Elective and Open Elective Courses of 6th Semester		
PROGRAMME ELECTIVE-I	**PROGRAM ELECTIVE-I LAB**	**OPEN ELECTIVE-I**
B23-ECP -302 Internet of Things	**B23-ECP -314** Internet of Things Lab	**B23-OEC-302** Consumer Electronics
B23-ECP-304 Microwave Engineering	**B23-ECP-316** Microwave Engineering Lab	**B23-OEC-304** Transducers and their applications
B23-ECP-306 Biomedical Electronics	**B23-ECP-318** Biomedical Electronics Lab	**B23-OEC-306** Information Theory and Coding
B23-ECP-308 Digital Image Processing	**B23-ECP-320** Digital Image Processing Lab	**B23-OEC-308** Intellectual Property Rights (IPR) and Regulatory Framework

B.Tech. Electronics and Communications Engineering (ECE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f academic session 2026-27

SEMESTER-VII

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-ECE-401	Computer Architecture	3:0:0	3	3	70	30	--	100	3
2	B23-ECE-403	Seminar	0:0:2	2	1	--	100	--	100	3
3	B23-ECE-405	Industrial Training-II	0:0:2	2	1	--	100	--	100	3
4	B23-ECE-407	Project-II	0:0:4	4	2	--	40	60	100	3
5	--	Program Elective-II	3:0:0	3	3	70	30	--	100	3
6	--	Program Elective-III	3:0:0	3	3	70	30	--	100	3
7	--	Open Elective-II	3:0:0	3	3	70	30	--	100	3
8	--	Open Elective-III	3:0:0	3	3	70	30	--	100	3
9	--	Program Elective-II Lab	0:0:2	2	1	--	40	60	100	3
10	*B23-VAC-401/403/405/407/409/411	NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities	0:0:2	2	1	--	100	--	100	
TOTAL				**27**	**21**	**350**	**530**	**120**	**1000**	

Note:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- *B23-VAC-401/403/405/407/409/411 are single credit value added courses in which NCC/NSS/Sports/Yoga/Technical or Cultural Club/Society activities will be joined by students in first year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines.

List of Programme Elective and Open Elective Courses of 7th Semester			
PROGRAMME ELECTIVE-II	**PROGRAMME ELECTIVE-III**	**OPEN ELECTIVE-II**	**OPEN ELECTIVE-III**
B23-ECP-405 Microcontroller	**B23-ECP-411** Satellite Communication	**B23-OEC-401** Operating System	**B23-OEC- 413** Artificial Intelligence
B23-ECP-407 Machine Learning	**B23-ECP-413** RF System	**B23-OEC-403** Robotics & Automation	**B23-OEC-415** Blockchain Technology
B23-ECP-409 Bio-medical Signal Processing	**B23-ECP-415** Wireless Sensor Networks	**B23-OEC-405** Soft Computing	**B23-OEC-417** Neuro Fuzzy Systems
	B23-ECP-417 Advanced Mobile Communication	**B23-OEC-407** Mixed Signal Design	**B23-OEC-419** Audio & Speech Processing
	B23-ECP-419 DSP Processors	**B23-OEC-409** Power Electronics	**B23-OEC-421** Introduction to Digital Marketing
	B23-ECP-421 Multimedia Communication		

PROGRAMME ELECTIVE-II Labs

B23-ECP-423 Microcontroller lab
B23-ECP-425 Machine Learning Lab
B23-ECP-427 Bio-medical Signal Processing Lab

B.Tech. Electronics and Communications Engineering (ECE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f academic session 2026-27

SEMESTER-VIII

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam(Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	--	Program Elective-IV	3:0:0	3	3	70	30	--	100	3
2	--	Open Elective-IV	3:0:0	3	3	70	30	--	100	3
3	B23-ECE-412/414/416/418	Project-III/ Industrial Training/ Entrepreneurship/ Start-up	0:0:24	24	12	--	200	200	400	3
TOTAL				**30**	**18**	**140**	**260**	**200**	**600**	

Note:

- **The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**
- **In case of semester-long project work done in industry/external institute, the Program Elective- IV and Open Elective-IV may be offered in online mode through MOOC courses offered by SWAYAM/NPTEL portal. These courses may be done from 3rd semester till completion of the degree.**

List of Programme Elective and Open Elective Courses of 8th Semester	
PROGRAMME ELECTIVE-IV	**OPEN ELECTIVE -IV**
B23-ECP-402 Fiber Optical Communication	**B23-OEC-402** Renewable Energy Resources
B23-ECP-404 Embedded Systems	**B23-OEC-404** Supply Chain Management
B23-ECP-406 Electronic Materials	**B23-OEC-406** Mobile App Development
B23-ECP-408 Radar Engineering	**B23-OEC-408** Electric Vehicles
B23-ECP-410 Adaptive Signal Processing	**B23-OEC-410** Gender Equality at workplace
	B23- BSC-202 Complex Variables and Statistics

B23-HSM-201	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hours**
Course Outcomes							
Purpose	The objective of this Course is to make students conversant with the basic concepts of organization behaviour for nurturing managerial skills.						
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior.						
CO2	Understand the concept and importance of personality, emotions and its importance in decision making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

Unit- I

Introduction to organizational behavior: Concept and importance of organizational behavior, role of Managers in OB, challenges and opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept and types of abilities , concept of values and attitude, types of attitude, attitude and workforce diversity.

Unit- II

Introduction to personality and emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence.

Perception and individual decision making: meaning of perception, factors influencing perception, rational decision making process, concept of bounded rationality. Leadership-trait approaches, behavioural approaches, situational approaches, and emerging approaches to leadership.

Unit-III

Motivation: Concept and theories of motivation, theories of motivation-Maslow, two factor theory, theory X and Y, ERG Theory, McClelland's theory of needs, goal setting theory, application of theories in organizational scenario, linkage between MBO and goal setting theory.

Foundations of group behaviour and conflict management: Defining and classifying of groups, stages of group development, Informal and formal groups- group dynamics, managing conflict and negotiation , causes of group conflicts, managing intergroup conflict through resolution.

Unit-IV

Introduction to Organizational Communication: Meaning and importance of communication process, importance of effective communication, organizational stress: definition and meaning sources and types of stress, impact of stress on organizations, stress management techniques.

Introduction to Organization Culture: Meaning and nature of organization culture, types of culture, managing cultural diversity, managing change and innovation-change at work, resistance to change, a model for managing organizational change.

Text Books:

1. Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGrawHill Education, 2017.

2. Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.

3. Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

Reference Books:

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.

2. Udai Pareek, Understanding Organisational Behaviour, Oxford Higher Education.

3. Mc Shane & Von Glinov, Organisational Behaviour, Tata Mc Graw Hill.

4. Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication.

B23-ECE-301	Digital Signal Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Obtain Z-transformation of discrete time signals.						
CO2	Obtain DFT and FFT of discrete time signals.						
CO3	Implement structures for different discrete time systems.						
CO4	Design of FIR and IIR digital filters for various applications.						

UNIT I

Discrete Transforms: Z- transform and its properties, Inversion of Z-transform, One sided Z- transform and solution of differential equations. Analysis of LTI systems in Z-domain, causality, stability, schur-cohn stability test, relationship between Z-transform and Fourier transform.

Frequency Selective Filters: All pass filters, minimum-phase, maximum-phase and mixed- phase systems, Goertzel algorithm, Chirp Z-transform, applications of Z-Transform.

UNIT 2

Frequency Domain Sampling and DFT: DTFT, DFT, properties, Linear filtering using DFT, Frequency analysis of signals using DFT, radix 2 and radix-4 FFT, computation of DFT of real sequences.

Implementation Structures of Discrete Time Systems: Direct form, cascade form, frequency sampling and lattice structures for FIR systems. Direct forms, transposed form, cascade form parallel form. Lattice and lattice ladder structures for IIR systems.

UNIT 3

Design of FIR Filters: Characteristics of practical frequency selective filters, types of FIR filters, filter design specifications such as peak pass band ripple, minimum stop band attenuation etc., alternation theorem. Design of FIR filters using windowing method, frequency sampling method and Park-McClellan's method. Design of optimum equiripple FIR filters.

UNIT 4

Design of IIR Filters: Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse Invariance Method, Bilinear Transformation Method, Least Square Methods. Characteristics of Butterworth, Chebyshev and Elliptical analog filters, Frequency transformations, design of IIR filters in frequency domain.

Text Books

1. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", 4th ed. Prentice Hall.
2. S. Salivahanan, "Digital Signal Processing", 3rd edition, McGraw Hill

Reference Books

1. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
2. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
3. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
4. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.

B23-ECE-303	Digital Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To learn digitization of analog signal by pulse modulation system and analyze their system performance**						
CO2	**To analyze different baseband transmission schemes and their performance**						
CO3	**To learn and understand different digital modulation schemes and compute the bit error performance**						
CO4	**To analyze different modulation tradeoffs and different equalization techniques .**						

UNIT-I

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse codemodulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing. Quantization noise in delta modulation, The O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation, Digital Multiplexers.

UNIT-II

Base Band Pulse Transmission: Matched filter and its properties, average probability of symbol error in binary enclosed PCM receiver, Intersymbol interference, Nyquist criterion for distortionless base band binary transmission, ideal Nyquist channel raised cosine spectrum, correlative level coding Duo binary signalling,

UNIT-III

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations.

Pass band Digital Modulation schemes- ASK, Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

UNIT-IV

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver).Equalization Techniques—Tapped delay line equalizer, Adaptive equalizer. LMS algorithm, Eye pattern.

Synchronization and Carrier Recovery for Digital modulation.

Text Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Reference Books:

1. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
2. Lathi B.P., " Modern Digital and Analog Communication", 4th edition, Oxford university Press,2010

B23-ECE-305	Data Structure						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3 Hr.
Course Outcomes (CO)							
CO1	Student will be able to understand the concept of data structure and arrays.						
CO2	Student will be able to conceptualize stacks and queues.						
CO3	Student will be able to implement linked list and its operations.						
CO4	Student will be able to implement the binary trees and graphs.						

Unit- I

Introduction: Concept of Data Structures, Design of suitable algorithm, algorithm analysis.
Arrays: 1-D arrays: Traversal, Selection, Searching, Insertion, Deletion and Sorting. Multi-D arrays, representation of arrays in physical memory, application of arrays

Unit- II

Stacks and Queues: Stacks: Stack operations, Application of Stacks, Queues: operations, circular queue, priority queue, deque
Pointers: Introduction, pointer variable, pointers and arrays, array of pointers, pointers and structures

Unit -III

Linked Lists: Introduction, Operations: Creation, Traversal, Searching, Insertion and Deletion. Circular and Doubly linked list, linked stacks and queues.

Unit-IV

Trees: Basic terminology, binary trees, representation of binary trees: linear and linked, traversal of binary trees
Graphs: Graph terminology, representation of graphs: array based, linked list based, set based.

Text Books:
1.Data Structures using C by A. K. Sharma , Pearson Publication
2.Theory & Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline by TMH.

Reference Books:
1.Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub
2.Data Structures and program design in C by Robert Kruse, PHI Expert Data Structures with C by R.B. Patel

Note: Question paper template will be provided to the paper setter.

B23-ECE-307	Antenna and Wave Propagation						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	*To familiarize the students with: Antennas used for various applications, performance parameters of antenna, methods of analysis of antenna, and different ways of propagating the signal.*						
CO1	*To Understand the structure and properties of various antennas.*						
CO2	*To understand the performance parameters of antenna.*						
CO3	*To design antenna of required specifications.*						
CO4	*To understand the different ways of signal propagation.*						

Unit-I

Fundamental concept: Physical concept of radiation, Retarded potential, Radiation pattern, near- and far- field regions. **Antenna Parameters:** Radiation Resistance, Gain, Directive Gain, Power Gain, Directivity, Efficiency, Beam width, Effective Height, Effective Aperture, Bandwidth and Antenna Temperature.

Radiation from Wires: Radiation from Hertzian Dipole, Short Dipole, Monopole Antenna, Folded Dipole Antenna and Half Wave Dipole.

Unit-II

Antenna Arrays: Uniform Linear Arrays - Broadside Arrays, Endfire Arrays. Analysis of arrays of 2 Isotropic Sources - Different Cases, Analysis of arrays of N Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Binomial Array, Chebyshev Array. **TV Transmission & Reception Antennas:** Turnstile Antennas, Yagi-Uda antennas. **Standard Antennas:** Loop Antenna (Rectangular & Circular), Helical Antenna, Biconical Antenna.

Unit-III

Aperture & Slot Antennas: Radiation from Rectangular Apertures, Uniform and Tapered Aperture, Horn antenna, Reflector Antenna , Cassegrain and Gregorian Feeding Structures, Rectangular Slot Antenna, Lens Antenna

Broadband Antennas: Huygens' Principle, The frequency independent concept: Rumsey's principle, Frequency Independent Planar Log Spiral Antenna, Frequency independent conical spiral antenna, Log periodic antenna, Lens Antenna.

Microstrip/Patch Antennas: Basic configurations of patch antennas: Rectangular, Circular. Different Feeding Techniques. Method to Analyze Patch antenna: Transmission Line Model.

Unit-IV

Propagation of Radio Waves: Introduction, Ground Wave Propagation, Space Wave Propagation and Sky Wave Propagation: Virtual Height, Critical Frequency, Maximum Usable Frequency (MUF) – Skip Distance, Fading, Multi Hop Propagation, Duct Propagation, Troposcatter Propagation, Flat Earth and Curved Earth Concept,.

REFERENCES:

1. J. D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. Antenna & Wave Propagation- K.D. Prasad, Satya Parkashan.
4. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. A.R. Harish, M. Sachidananda, Antenna and Wave Propagation, Oxford University Press.

B23-ECE-309	Digital Signal Processing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
0	**0**	**3**	**1.5**	**60**	**40**	**100**	**3 Hr.**
Course Outcomes							
CO1	Plot different discrete time signals.						
CO2	Verify the aliasing effects.						
CO3	Design digital FIR filters for various applications.						
CO4	Design digital IIR filters for various applications.						

List of Experiments

1. Write a program to plot the following functions: a) impulse function b) unit step c) unit ramp d) exponential and e) sinusoidal
2. Write a program to plot real part, imaginary part, magnitude and phase spectra of an exponential function.
3. Study the aliasing effect by using a sinusoidal signal. Show the plots of' continuous time signal, sampled signal and reconstructed signals by using subplot.
4. Write a program to compute and plot the convolution of two signals.
5. Define a function to compute the Z-transform of a finite length signal.
6. Verify the properties of Discrete Fourier Transform (DFT).
7. Study of different window functions available for design of FIR filters.
8. Design of FIR filters by using windowing method.
9. Design of equiripple High Pass and Low Pass FIR filters.
10. Study of magnitude and phase response of Butterworth, Chebyshev and Elliptic filters.
11. Design of IIR filters by using different analog filter approximation method.

Reference Books

1. J. G. Proakis and D.G. Manolakis, ‘‘Digital Signal Processing: Principles, Algorithms and Applications’’, 4th ed. Prentice Hall.
2. S. Salivahanan, ‘‘Digital Signal Processing’’, 3rd edition, McGraw Hill
3. John G Proakis and Vinay K. Ingle, ‘‘Digital Signal Processing using MATLAB’’, Cengage India Private Limited, 2017

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

B23-ECE-311	COMMUNICATION LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**3**	**1.5**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO) **Upon completion of the course, students will be able to**							
CO1	**Generate and analyze Analog Modulated and demodulated Signals.**						
CO2	**Test & observe the outputs of different types of analog detectors.**						
CO3	**Generate and analyze digital Modulated and demodulated Signals.**						
CO4	**Test & observe the outputs of different types of digital detectors.**						

List of experiments:

1: To study and Perform Amplitude Modulation & Demodulation.
2: To study and Perform Frequency Modulation and Demodulation.
3: To study and Perform Pulse Amplitude Modulation and Demodulation.
4: To study and Perform Pulse Width Modulation and Demodulation.
5: To study and Perform Pulse Position Modulation and Demodulation.
6: To study and Perform Pulse Code Modulation and Demodulation.
7: To study and Perform Time Division Multiplexing (TDM) system.
8: To study and Perform Amplitude Shift Keying (ASK) Modulation and Demodulation.
9: To study and Perform Frequency Shift Keying (FSK) Modulation and Demodulation.
10: To study and Perform Phase Shift Keying (PSK) Modulation and Demodulation.
11: To study and Perform Quadrature Phase Shift Keying (QPSK) Modulation and De-Modulation.
12: To study and perform Adaptive Delta Modulation and demodulation.
13. To study Base Band Transmission and calculate bit error rate.

Note: At least ten (10) experiments from the above list are mandatory to perform forthe students.

Reference Books:

1. Taub & Schilling, Principles of Communication Systems, McGraw Hill Publications,(1998) 2nd ed.
2. Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.
3. Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.
4. Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press,(1998) 3rd

B23-ECE-313	Data Structure Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hr.**
Course Outcomes (CO)							
CO1	Students will be able to implement various sorting and searching algorithms.						
CO2	Students will be able to implement various stack and queue operations.						
CO3	Students will be able to implement various tree operations.						
CO4	Students will be able to implement various graph operations.						

List of Experiments:

1. Write a program in C to create and traverse an array of N numbers.
2. Write a program in C implement linear and binary search in an array.
3. Write a program in C implement selection sort.
4. Write a program in C implement bubble sort.
5. Write a Program in C to implement stacks using arrays.
6. Write a program in C to create and traverse linked list.
7. Write a program in C to insert and delete node from linked list.
8. Write a program in C to implement stacks using linked list.
9. Write a Program in C to implement binary tree.
10. Write a program to implement the tree traversal methods.
11. Write a Program in C to implement graph.
12. Write a Program in C to traverse graph.

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

Reference Books:

1. Data Structures using C by A. K. Sharma , Pearson Publication
2. Theory & Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline by TMH.
3. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub
4. Data Structures and program design in C by Robert Kruse, PHI Expert Data Structures with C by R.B. Patel

B23-ECE-315	Industrial Training-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**--**	**100**	**100**	**3 Hrs.**

It is course in which the students will be evaluated for the industrial training undergone after 4th semester and students will be required to get passing marks to qualify.

B23-MAC-301	Constitution of India						
				Examination Schedule (Marks)			
Lecture	Tutorial	Practical	Credit	End semester exam	Internal assessment	Total	Duration of Exam (Hours)
2	-	-	1		100	100	3
Purpose	This course introduces students to the basic Philosophy of Indian Constitution.						
Course Outcomes: After completion of course the students will be able							
CO1	To explain the basic structure of Indian Constitution						
CO 2	To understand the structure of Indian Union						
CO 3	To write down roles and powers of Governor						
CO 4	To explain the election process under Indian Constitution.						

Unit 1

The Constitution - Introduction , The History of the Making of the Indian Constitution ,Preamble and the Basic Structure, and its interpretation , Fundamental Rights and Duties , Brief overview of Directive principles of State Policy.

Unit 2

Union Government, Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Brief overview of Lok Sabha and Rajya Sabha.

Unit 3

State Government , Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat, distributions of powers between state and centre under Indian Constitution.

Unit 4

Local Administration, District Administration, Municipal Corporation, Zila Panchayat.

Election Commission a. Role and Functioning b. Chief Election Commissioner c. State Election Commission

Suggested Learning Resources: 1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008

2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)

3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition Suggested Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

B23-ECE-302	Computer Networks							
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End Semester exam	Internal Assessment	Practical	Total	Time
3	-	-	3	70	30	-	100	3 Hrs.
Course Outcomes At the end of this course students will demonstrate the ability to								
CO1	Understand data communication and the functions of each layer of ISO-OSI protocols							
CO2	Perform computations and solve networking and routing problems.							
CO3	Find differences between Real time and Non Real time protocols using different techniques.							
CO4	Implement small connections between two or more processes running in single or different computing systems.							

UNIT-1

Introduction to computer networks and Internet: Introduction to Data Network and ISO-OSI protocol, Fundamentals of Physical Layer and different modes of data communication.

Link layer: ALOHA, Multiple access protocols, Local Area Networks, addressing, Ethernet, Hubs, Switches.

UNIT-2

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting.

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.

UNIT-3

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

UNIT-4

Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing.

Text/ Reference books:

1. Andrew Tanenbaum, “Computer networks”, Prentice Hall
2. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition
3. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
4. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publications.
5. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall
6. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall
7. William Stallings, “Data and computer communications”, Prentice Hall

B23-ECE-304	VLSI Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Students will be able to understand basic MOS digital circuits concepts						
CO2	Students will be able to understand the MOS inverter and its design						
CO3	Students will be able to design MOS combinational circuit design						
CO4	Students will be able to design MOS combinational circuit design						

Unit - I

Introduction: Introduction to MOSFETs : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up

Unit - II

MOS Inverter: MOS Inverter, MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics; MOS Capacitor.

Unit - III

MOS Combinational circuits: Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates; Complex Logic Circuits.

Unit - IV

MOS Sequential Circuits: Sequential MOS Logic Circuits: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop.

Text Books:

1. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition, MH, 2002.

Reference Books:

1. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design : A Systems Perspective, Second Edition (Expanded), AW/Pearson, 2001.
2. J. P. Uyemura, CMOS Logic Circuit Design, Kluwer, 1999.

B23-ECE-306	WIRELESS AND MOBILE COMMUNICATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes (CO)

Upon completion of the course, students will be able to

CO1	It deals with introduction of Wireless Communication Systems and different generations of cellular networks.
CO2	Understand and analyze operations of cellular system and cellular design fundamentals.
CO3	It provides different Multiple Access Techniques used in Mobile Wireless Communications.
CO4	It presents different ways to wireless standards and mobility management.

UNIT – I:

Introduction to Wireless Communication Systems: Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

Modern Wireless Communication Systems: Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area Networks.

UNIT – II:

IntroductiontoCellularMobileSystems:SpectrumAllocation,basicCellularSystems,performance Criteria, Operation of cellular systems analog cellular systems, digital Cellular Systems.

The Cellular Design Fundamentals: Frequency Reuse, channel allocation schemes, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity

UNIT – III:

Introduction to Multiple Access Techniques used in Mobile Wireless Communications: FDMA/TDMA/CDMA. Spread Spectrum Communication Multiple Access, Space Division Multiple Access, Packet Radio, Capacity of cellular System

UNIT – IV:

Wireless standards-GSM, IS-95, UMTS-IMT-2000, Signaling, Call Control, Mobility Management and location Tracing.

Text Books

1. T. S. Rappaport: Wireless Communications, PHI, 2002.
2. Jochen Schiller : Mobile Communication , Pearson. 3. Raymond Steel : GSM, cdma one and cdma 2000, Wiley.

Reference Books:

4. Andrea Goldsmith : Wireless Communications , Cambridge University Press.
5. William C.Y.Lec, Mobile Cellular Telecommunications, Analog and Digital Systems, McGraw Hill Inc.
6. David Tse & Pramod Viswanath: Fundamentals of Wireless Communication , Cambridge University Press.
7. Kamilo Feher, Wireless Digital Communications, Modernization & Spread Spectrum Applications, Prentice Hall of India, New Delhi.

B23-ECE-308	Control System Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hours**
Purpose	The purpose of this course is to create awareness about the various types of control systems with the techniques to analyze them so that the learner is able to mathematically design and evaluate the conditions for which a control system can provide stable output with improved performance.						
CO1	Learner will be able to design and simplify the mathematical and graphical models of a control system through block diagram and signal flow graph method.						
CO2	Learner can evaluate the conditions for which a system can work under stable conditions in time domain.						
CO3	Learner will know about easier graphically methods to evaluate the conditions of stability in frequency domain.						
CO4	Learner will able to apply the compensation technique using state variable approach to convert an unstable system into a stable system under certain conditions.						

UNIT-I

Introduction: The Control system-Open loop & Closed loop, servomechanism, Stepper motor. Mathematical Models of Physical Systems: Differential equation of physical systems, Transfer Function, Block Diagram Algebra, Signal Flow-Graphs, Mason's Formula & its application. Feedback Characteristics of Control Systems: Feedback and Non-Feedback systems, Effects of Feedback on sensitivity (to parameter variations), Stability, Overall gain etc.

UNIT-II

Time Response Analysis: Standard test signals, Time response of first order and second order systems, Steady-State Errors and Error Constants, Design Specification of second-order- systems. Stability: The concept of stability, necessary conditions for stability, Hurwitz Stability Criterion, Routh Stability Criterion, Relative Stability Analysis. The Root Locus Technique: The Root Locus Concept, Construction /development of Root loci for various systems, Stability considerations. Proportional, Integral and Derivative Controllers.

UNIT-III

Frequency Response & Stability Analysis: Correlation between Time and Frequency response, Polar Plots, Nyquist plots, Bode Plots, Nyquist Stability criterion, Gain margin & Phase margin, relative stability using Nyquist Criterion, frequency response specifications.

UNIT-IV

Compensation of Control Systems: Necessity of Compensation, Phase Lag compensation, Phase Lead Compensation, Phase Lag Lead Compensation, Feedback Compensation. State Variable Analysis: Concept of State, State Variable and State Model, State Models for Linear Continuous Time Systems, Diagonalization, Solution of state equations, Concept of Controllability and Observability.

Text Book: Control System Engg.: I. J. Nagrath & M.Gopal; New Age India.

Reference Books:

1. Automatic Control Systems: B.C. Kuo; PHI.
2. Modern Control Engg: K. Ogata; PHI.

B23-ECP -302	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3Hr.**
Course Outcomes							
CO1	Understand what IoT technologies are used for today, and what is required in certain scenarios.						
CO2	Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.						
CO3	Understand the type of protocols and challenges for designing IoT systems.						
CO4	Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications. Understand operating system requirements of IOT.						

Unit 1

Introduction to IoT: Defining IoT, Characteristics of IoT, benefits/Challenges of deploying an IoT, Functional blocks of IoT, Physical and logical design of IoT, Smart cities and IoT revolution, Difference between IoT and M2M, M2M and peer networking concepts, Software Defined Networks SDN, Cloud for IoT: IoT withcloud, challenges, introduction to fog computing, cloud computing

Unit 2

Developing IoTs: IoT design methodology, case study on IoT system for weather monitoring. IoT systemManagement,

Developing IoT applications through embedded system platform: Introduction to sensors & transducers, Introduction to electrodes & biosensors, Static and dynamic characteristics of sensors, Different types of sensors, Selection criteria's for sensors / transducers

IoT physicaldevices and endpoints, Raspberry pi, Raspberry pi interfaces, Arduino, arduino interfaces.

Unit 3

Protocols for IoT- Data transmission, Choice of channel (wired/wireless), messaging protocols, Communication and Networking in IoT: Review of Communication Protocols and Network protocols, Challenges in Networking of IoT Nodes, range, bandwidth, Medium Access Control (MAC) Protocols, transport protocols 6LoWPAN, IPv4, IPv6, URI,

Challenges in IoT: Design challenges, development challenges, security and legal considerations.

Unit 4

Logic design using Python: Introduction to python, data types, data structures, control flow, functions, modules, file handling and classes., implementing IoT concepts with python,

Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Home Automation, Precision Agriculture, Industry 5.0

References:

1) A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", University press,2014.
2) S.K.Vasudevan, A.S.Nagarajan, "Internet of Things", Wiley, 2019.
3) CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition,2011. Samuel Greenguard, "Internet of things", MIT Press, 2015.
4) Pethuru Raj, Anupama C. Raman, "The Internet of Things Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor And Francis Group, 2017

B23-ECP-304	Microwave Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	*To familiarize the students with: Antennas used for various applications, performance parameters of antenna, methods of analysis of antenna, and different ways of propagating the signal.*						
CO1	*Study and analyze the behavior of various types of waveguides, Cavity resonator, Quality factor and gain knowledge of measuring microwave power, frequency, impedance, and VSWR.*						
CO2	*Learn about various microwave generators and amplifiers such as Klystron, Magnetron and Travelling Wave Tube.*						
CO3	*Learn about Scattering Matrix, its properties and study about various microwave components like Tees, couplers, isolators and filters.*						
CO4	*Study about solid state microwave devices such as microwave diodes including GUNN, TRAPATT and BARITT etc.*						

UNIT – I:

Microwave Resonators: Brief description of waveguides, coplanar waveguides, cavity resonators: rectangular, cylindrical, spherical and coaxial, excitation and coupling of cavities, Q factor.

Microwave Measurements: Measurement of frequency, impedance (using slotted section) attenuation, power, dielectric constant, measurement of V.S. W. R., insertion loss and permeability.

UNIT – II:

Microwave Generators: Construction, characteristics, operating principle and typical applications of Klystron (two cavity, multicavity), Reflex Klystron, magnetron (Cylindrical magnetron and description of Π mode applications) and Traveling Wave Tube (TWT).

UNIT – III:

Matrix Description of Microwave Circuits: Scattering matrix-its properties, measurement of scattering coefficients, scattering matrices for common microwave systems.

Microwave Components: Waveguide tees- E-plane, H-plane, magic tee, rat race, directional coupler, tuning screws and stubs, isolators and circulators-their constructional features and applications. Microwave filters, Phase shifters, attenuators, Wavemeters.

UNIT-IV.

Solid State Microwave Devices:

Transferred electron devices- GUNN EFFECT; negative differential resistance phenomenon, field domain formation, GUNN diode structure. Avalanche transit time devices: IMPATT, TRAPATT, BARITT diodes, parametric amplifiers

Suggested Books:

1. Samuel Y. Liao, Microwave Devices and Circuits, Prentice-Hall of India.
2. David M. Pozar, Microwave Engineering, John Wiley and sons Inc.
3. Das, Annapurna & Sisir K. Das, Microwave Engineering, Tata McGraw-Hill.
4. POZAR DM, Microwave Engg, John Wiley & Sons Inc.

B23-ECP-306		Biomedical Electronics						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End Semester Exam	Internal Assessment	Practical	Total	Time
3	-	-	3	70	30	-	100	3

Course Outcomes

At the end of this course students will demonstrate the ability to

CO1	Understand and explain the concept of biomedical signals, electrodes and Instrumentation
CO2	Understand and explain the physiological transducers and recording systems
CO3	Understand and explain biomedical recorders and patient monitoring systems
CO4	Understand and explain cardiac pacemakers, defibrillator and patient safety

UNIT-I

Medical Instrumentation: Basic Medical Instrumentation System, Static and dynamic characteristics of medical instruments, Bio-signals and characteristics. Problems encountered with measurements from human beings. Sources of Bioelectric Potentials, Resting and Action Potentials.

UNIT-II

Bio- Potential Electrodes and Physiological Transducers: Electrode potential, Electrode equivalent circuit, Types of Electrodes - Surface Electrodes, Needle Electrodes, Micro Electrodes. Transducers for Biomedical Applications.

BIO-SIGNAL ACQUISITION: Electrical Conduction system of the heart, Electrocardiogram, ECG leads, Einthoven triangle, ECG amplifier, EEG 10-20 lead system and EMG.

UNIT-III

Bio- Signal Measurements: Blood flow meters - Electromagnetic blood flow meter, Ultrasonic Doppler blood flow meter. Blood pressure measurement - Ultrasonic blood pressure monitoring.

Physiological Assist Devices and Therapeutic Equipment: Pacemakers - External & internal, Defibrillators - External & internal, Hemodialysis machine.

UNIT-IV

Operation Theatre Equipment: Spirometry, Anesthesia machine, Ventilators.

Monitoring Equipment: Arrhythmia Monitor, Foetal Monitor, and Incubator.

Medical Imaging Equipment: X-ray machine, Computed Tomography (CT), Ultrasound Imaging system.

TEXT BOOKS:

1. R.S. Khandpur, “Handbook of Biomedical Instrumentation”, TMH, 2nd Ed., 2003.
2. Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, “Biomedical Instrumentation and Measurements”, PHI, 2nd ed, 1980.
3. Dr. M. Arumugam, “Biomedical Instrumentation”, Anuradha publications, 2nd ed, 1994.

REFERENCE BOOKS:

1. Onkar N. Pandey, Rakesh Kumar, “Bio-Medical Electronics and Instrumentation”, Katson Books, 2011.
2. John G. Webster, “Medical Instrumentation, Application and Design”, John Wiley, 3rd ed., 2009.

B23-ECP-308	Digital Image Processing							
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Practical Exam**	**Total**	**Time (Hrs.)**
3	-	-	3	70	30	-	100	3
Course Outcomes								
CO1	Student will be able to explain basic concepts of image processing							
CO2	Student will be able to describe various video processing systems							
CO3	Student will be able to analyze various compression and morphological operations							
CO4	Student will be able to describe various video processing systems							

Unit – I

Digital image processing fundamentals: Introduction, Image processing applications, Fundamental Steps in Digital Image Processing, Image Sampling and Quantization, Relationships between pixels, Color Fundamentals, color models.

Unit - II

Image Enhancement: Basics of intensity Transformations, Histogram processing, Spatial Domain filtering – Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering.

Frequency Domain Filtering- Sampling and Fourier Transform of sampled functions, 2-D Sampling, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

Unit - III

Image Compression: Fundamentals, Image Compression models, Error Free Compression – Huffman Coding, Arithmetic Coding, LZW Coding, Lossy Compression – Block transform coding.

Morphological Image Processing: Introduction, Erosion and Dilation, Opening and Closing, Hit or Miss Transformations, Boundary Extraction. Image Segmentation: Fundamentals of image segmentation, Point, Line, and Edge Detection.

Unit - IV

Video Processing: video formation, Video Frame classifications- I, P and B frames, Application of motion estimation in video coding, Patterns and Pattern classes - Recognition based on matching.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2018.

Reference Books:

1.Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011

2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

3. M. Tekalp, Digital Video Processing. Signal Processing Series, Prentice Hall, 1995.

4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

Note: Question paper template will be provided to the paper setter.

B23-OEC-302	Consumer Electronics						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End Semester Exam	Internal Assessment	Total	Time
3	---	-------	3	70	30	100	3 Hrs
PO	To familiarize the students with the concepts of basic television systems, advanced high definition television systems and different advanced electronic home appliances.						
Course Outcomes (CO)							
CO1	To understand fundamentals of Monochrome and Colour TV systems.						
CO2	To understand television receivers and digital TV system						
CO3	To understand audio fundamentals and systems.						
CO4	To maintain various electronic home appliances.						

UNIT-I

Monochrome TV Systems and Colour TV Systems: Monochrome picture signal transmission and reception, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, Composite video signal, vestigial sideband transmission.

Colour theory, Grassman's Law, hue, brightness, saturation, Different types of TV camera tube, channel bandwidth.

UNIT-II

Television Receivers: Monochrome and colour picture tube, receiver controls.

Television standards: PAL, SECAM, NTSC. Digital TVs: working principle of HDTV, Principle and working of LCD and LED TV, Block diagram and working principle of OLED.

UNIT-III

Audio Fundamentals: Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity.

Microphone: working principle, characteristics, Types: carbon, crystal.

Loudspeakers: working principle, Types: electrostatic, dynamic, permanent magnet.

UNIT-IV

FAX, Microwave Oven, Washing Machine: wiring diagram, types of washing machine,

Air conditioner: Components features, types and applications, Digital camera.

TEXT BOOKS:

1 R.R. Gulati "Modern Television practices", New Age International Publication (P) Ltd. New Delhi• Year 2011, latest edition.

2 S.P. Bali., “Consumer Electronics”, Pearson Education, 2010, latest edition.•

B23-OEC-304	Transducers and their Applications						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3 Hrs.

Course Outcomes (CO) Upon completion of the course, students will be able to	
CO1	Understand the fundamentals of transducers, their classifications, and the importance of electrical signal output.
CO2	Learn different types of transducers, including resistive, inductive, capacitive, piezoelectric, photoelectric, and Hall effect sensors.
CO3	Gain knowledge of measurement techniques for displacement, pressure, temperature, force, velocity, and torque using transducers.
CO4	Develop skills to analyze, compare, and select appropriate transducers for various engineering applications.

UNIT-I

Definition of transducer. Advantages of an electrical signal as out-put. basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers.
Resistive, inductive, capacitive, piezoelectric, photoelectric and hall effect transducers.

UNIT-II

Measurement of pressure – Manometers, Force summing devices and electrical transducers
Measurement of temperature – Metallic resistance thermometers, semi-conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.

UNIT-III

Measurement of displacement – Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers.
Measurement of velocity – variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator..

UNIT-IV

Measurement of Force – Strain-gage load cells, pneumatic load cell, LVDT type force transducer.
Measurement of Torque – Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods.

Text Books:

1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation," Dhanpat Rai & Sons, Delhi-6.

Reference Books:

1. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.

B23-OEC-306	Information Theory and Coding						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Students will be able to construct codes for given source.						
CO2	Students will be able to justify the various Linear Block Codes.						
CO3	Students will be able to produce convolutional codes for given input.						
CO4	Students will be able to compare various encryption algorithms.						

UNIT – I

Source Coding : Introduction to Information theory, uncertainty and information, entropy, source coding theorem, Huffman coding.

Channel Capacity and Coding : Channel model, channel capacity, channel coding.

UNIT-II

Linear Block Codes for Error Correction: Introduction to error correcting codes, matrix description of LBC, Parity check matrix, decoding of linear block codes, Syndrome decoding.

Cyclic Codes: Polynomials, division algorithm, generating cyclic codes, matrix description of cyclic codes.

UNIT – III

Convolutional Codes: Introduction, trellis codes, polynomial description of convolutional codes, distance notation for convolutional codes, matrix description, viterbi decoding, distance bounds for convolutional codes.

UNIT – IV

Cryptography: Introduction, overview of encryption techniques, operations used by encryption algorithm, symmetric cryptography, DES, IDEA, Assymetric encryption, RSA Algorithm.

Text Books:

1. Ranjan Bose, Information theory, coding and cryptography, Tata McGraw Hill, 2nd Edition
2. N. Abramson, Information and Coding, McGraw Hill, 1963.

Reference Books :

1. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
2. R.B. Ash, Information Theory, Prentice Hall, 1970.
3. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Note: Question paper template will be provided to the paper setter.

B23-OEC 308	Intellectual Property Rights (IPR) & Regulatory Framework						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hours**
Course Outcomes							
Purpose	The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concept and Theories, International Regime Relating to IPR						
CO1	Students will be familiarized with the introduction about patent concept and legal implications						
CO2	Students will be able understand the concept of copyright in detail						
CO3	Students will be able to understand trademark and law associated with it						
CO4	Students will be able to know about geographical Indications, industrial design and IPR in information Technology						

Unit-I

Indian patent law: The patents act, 1970, amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. procedure of obtaining patents, working of patents. infringement.

Unit-II

Copyrights: Introduction, works protected under copyright law, infringement. introduction to copyright, international protection of copyright and related rights- an overview Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright

Industrial Designs : Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000,procedure for obtaining design protection, revocation, infringement and remedies.

Unit-III

Trademarks : Objectives, types, rights, protection of goodwill, infringement, passing off, need for protection of trademark, kinds of trademark , Indian trademarks law, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

Unit-IV

Geographical Indications: Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. Industrial Designs: Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Protection of Semi conductor chips, Domain Name Protection, Implications of intellectual property rights on the commercialization of Biotechnology products.

References:

- N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
- David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012
- Susan K Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge University Press, 2003
- N.S. Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company,2nd Edition , 2014
- Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
- Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008
- Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual Property Rights, Universal Publishing House, 2014
- Paul Torremans, Intellectual Property And Human Rights, Kluwer Law International, 2008
- Steven D Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
- Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005

B23-ECE-310	Computer Networks Lab							
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End semester Exam	Internal Assessment	Practical exam	Total	Time
0	-	2	1	-	40	60	100	3 Hrs.
Course Outcomes At the end of this course students will demonstrate the ability to								
CO1	Do problem solving using algorithms							
CO2	Design and test simple programs using Java for networking concepts							
CO3	Document artifacts using applied addressing & quality standards							
CO4	Design simple data transmission using networking concepts							

LIST OF PRACTICALS

1. Create a socket for HTTP for web page upload and download.
2. Write a code simulating ARP/RARP protocols.
3. Study of TCP/UDP performance.
4. Performance comparison of MAC protocols.
5. Performance comparison of routing protocols.
6. WAP to implement data server and client in java using TCP sockets.
7. WAP to implement a chat server and client in java using UDP sockets.
8. To implement a simple calculator and invoke arithmetic operations from a remote client.
9. To implement bubble sort and sort data data using a remote client.
10. To implement a sliding window protocol using Go back N ARQ.

Text Books

1. Andrew Tanenbaum, “Computer networks”, Prentice Hall
2. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition
3. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
4. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publications.
5. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall
6. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall
7. William Stallings, “Data and computer communications”, Prentice Hall

B23-ECE-312	Project-I						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Time
-	-	4	2	60	40	100	3 Hrs.

Course Outcomes (CO)

Upon completion of the course, students will be able to

CO1	Identify and define a problem statement from the requirements raised from literature survey /need analysis
CO2	Build and Test electronic circuits/prototype for developing real life small electronic applications
CO3	Work in teams, write comprehensive report and effective presentation of the project work
CO4	Rapid prototyping which will lead them towards entrepreneurship.

Project-I Guidelines: The project-I is a team activity having 3-4 students in a team. This is electronic circuit building and testing for developing small electronic applications. The project may be a complete hardware or hardware with software aspect. It should encompass electronics components, devices, analog or digital ICs, micro controller etc. Based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of project-I.

B23-ECP-314	Internet of Things Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**0**	**2**	**1**	**60**	**40**	**100**	**3 Hr.**
Course Outcome: Students will be able to get the idea of Internet of Things technology.							
CO1	**Student will be able to get familiarize with Arduino and Raspberry Pi**						
CO2	**Student will be able to implement interfacing different sensorss with Arduino and Raspberry Pi**						
CO3	**Student will be able to understand the concept of cloud**						
CO4	**Student will be able to design module based on Internet of Things application**						

List of Experiments

1. Familiarization with concept of IoT, Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/ Buzzer using relay with Arduino/Raspberry Pi and write a program to turn ON/OFF LED/Buzzer.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a programto turn ON LED when push button is pressed.
4. To interface Analog sensors (Temperature/Humidity/ Ultrasonic) with Arduino/Raspberry Pi andwrite a program to display sensors data on the computer screen.
5. To interface OLED with Arduino/Raspberry Pi and write a program to print sensor data on it.
6. To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Relay whensensor data is detected.
7. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON/OFF motor when push button is pressed.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data on smartphone using Bluetooth.
9. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF whena 1/0 is received from smartphone using Bluetooth.
10. Write a program to upload sensor data on cloud.
11. Write a program to retrieve sensor data from cloud.

B23-ECP-316	Microwave Engineering Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
	0	**2**	**1**	**60**	**40**	**100**	**3 Hours**
Purpose	The purpose of these experiments is to provide hands-on experience in understanding and analyzing microwave components and systems. Through practical experimentation, students will gain insights into the properties, performance, and behavior of various microwave devices like waveguides, antennas, and active devices such as klystrons, Gunn diodes, and microwave attenuators.						
CO1	Learner will be able to understand the functionality and application of various microwave components						
CO2	Learner will be able to gain an understanding of the Klystron tube's role in microwave systems and its tuning characteristics for frequency control.						
CO3	Learner will be able to measure and analyze key waveguide parameters such as frequency, wavelength, and standing wave ratio, understanding their impact on signal propagation.						
CO4	Learner will be able to measure the insertion loss and attenuation in microwave components, understanding their effects on signal integrity and system performance.						

LIST OF EXPERIMENTS

1. To study the microwave components.
2. To study the characteristics of the reflex Klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working in TE IO mode. To determine the standing wave ratio and reflection coefficient.
4. To study the I-V characteristics of Gunn diode. To study the magic tee.
5. To study the isolator and attenuator.
6. To measure the coupling coefficient and directivity of a wave guide directional coupler To measure the polar pattern and the gain of a waveguide horn antenna.
7. To measure the insertion loss and attenuation.

B23-ECP-318	Biomedical Electronics Lab						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO) **At the end of the course, student will be able to**							
CO1	**Elaborate various biomedical signals**						
CO2	**Acquire and simulate ECG ,EMG and EEG biomedical signals**						
CO3	**Simulate ECG Pulse missing detector**						
CO4	**Demonstrate the functions of defibrillator and pacemaker**						

List of Experiments:

1. Familiarization of various biomedical signals.
2. To simulate Electrocardiogram Waveform
3. To simulate Electroencephalogram Signal
4. To simulate Electromyogram Signal
5. To Simulate Defibrillator
6. To simulate Pacemaker
7. To simulate Haemodialysis Machine
8. To simulate Biopotential Amplifier
9. To simulate ECG Pulse missing detector.
10. To simulate 12 Lead ECG Signals.

B23-ECP-320	Digital Image Processing Lab						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	-	2	1	60	40	100	3 Hrs.

Course Outcomes (CO)

To give the students an idea about the study and analysis of digital image processing

CO1	Students will be able to explain the basics of Digital Image processing
CO2	Students will be able to explain sampling and quantization of digital image.
CO3	Students will be able to analyze the image enhancement operations on digital image.
CO4	Students will be able to analyze various image analysis and computer vision algorithm

List of Experiments

1. Study of Image processing toolbox of MATLAB.
2. WAP to read and show various images of at least five different formats.
3. WAP to extract R, G, B component of Color Image.
4. WAP to convert a color image into gray scale and save it in new format.
5. WAP to invert a gray scale image.
6. WAP to implement Morphological operations on an image.
7. WAP to implement Histogram equalization.
8. WAP to implement various edge detection algorithms.
9. WAP to implement image segmentation.
10. WAP to implement boundary extraction of basic structure.

B23-VAC-302	Hindi Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
2	**-**	**-**	**1**	**--**	**100**	**100**	**3**

This course will be offered through NPTEL/MOOC online courses with the following link - https://onlinecourses.nptel.ac.in/noc23_hs125/preview.
The syllabus of NPTEL/MOOC platform will be acceptable. Students can also learn online from videos and internal assessment can be made in the Institute by taking an internal exam of 100 marks.

B23-VAC-304	Sanskrit Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
2	**-**	**-**	**1**	**--**	**100**	**100**	**3 Hrs**
Course Outcomes **At the end of this course, student will**							
CO 1	Learn behavioural science from Bhagwat Gita						
CO 2	Learn self awareness and spirituality from Bhagwat Gita						
CO 3	Learn mind management from Bhagwat Gita						
CO 4	Learn responsible behaviour from Bhagwat Gita						

SYLLABUS FOR SANSKRIT STUDIES

Unit 1	**<u>BEHAVIOURAL SCIENCE</u>** ● **Learning different personality types from Gita.** BG 14.6-8 ● Dealing with stress, depression and **self-destructive** urges. BG 2.14 ● Overcoming **procrastination and hyperactivity.** BG 18.35-36 ● **Developing *sattva* - platform of controlled action.** BG 18.33 ● Balancing physical, mental and emotional health. BG 6.16-17, 6.5 ● Increasing productivity in activity through spirituality. BG 2.47 ● **Mind Intelligence mechanism.** BG 3.42-43 ● **Tapping the power of meditation**. BG 6.10-15

Unit 2	**SELF-AWARENESS** ● **Understanding Different Layers of Self - Physical, Mental and Spiritual** – BG 2.13 ● Becoming Sensitive Towards Other Beings and Nature at Large – BG 5.18, 6.29-32 ● **Cultivating Culture of Respect** – BG 13.8-12 ● Dealing with Grief – BG 2.11, 2.27 ● **Holistic Wellbeing Through Self-Awareness** – BG 6.5, 6.7 ● Recognizing the Impermanence of the Body – BG 2.14 ● Cultivating Detachment for True Self-Awareness – BG 2.71, 5.29 ● **Connecting with the Higher Self Through Meditation** – BG 6.10 ● Transcending Ego for Inner Peace – BG 3.27 ● Self-Reflection for Personal Growth – BG 6.5 ● Overcoming False Identification with the Body – BG 2.30 ● Seeing the Divine in All Beings – BG 9.22
Unit 3	**MIND MANAGEMENT - ART OF MIND CONTROL** ● **The Root of Frustration & Anger** – BG 2.62-63 ● Discover the Real Reason Behind Lack of Motivation – BG 3.36, 3.41 ● **Controlling the Uncontrolled Mind** – BG 6.26 ● **Understanding the Mind & Its Power** – BG 6.6, 3.42 ● Mind Like a Boat in Stormy Waters – BG 2.67 ● **Learn to Stay Calm Under Pressure** – BG 2.14, 2.56 ● The Peaceful Mind of a Wise Person – BG 2.70, 2.56 ● Freedom from Attachment = Peace – BG 2.71, 5.26 ● Peace Through Detachment – BG 2.71, 5.20
Unit 4	**RESPONSIBLE ACTION** ● **Understanding Intricacies of Action and Reaction - Karma, Vikarma & Akarma** – BG 4.17 ● Principles of Forbearance and Tolerance – BG 2.14, 12.13-14 ● Coping with Adversities and Reversals in Life – BG 2.14-15, 18.11 ● **Becoming Responsible in Action - Karma Yogi** – BG 3.7, 3.19, 3.30, 5.10 ● Performing Actions Without Attachment to Results – BG 2.47, 3.19 ● Acting in Accordance with Dharma – BG 3.35 ● Surrendering the Fruits of Actions to God – BG 9.22, 18.66

	• Selflessness in Actions – BG 18.9 • Discerning Between Right and Wrong Actions – BG 18.63 • **Balanced Approach to Work and Rest** – BG 6.17 • Purifying Intentions Behind Actions – BG 18.11 • **Taking Responsibility for One's Actions and Their Impact** – BG 3.16

B23-VAC-306	German Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about German Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic German language.**						
CO2	**Enable basic communication in German (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking.**						

Course Outline

Unit 1: Introduction & Basics

- German alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite (der/die/das), indefinite (ein/eine)
- Personal pronouns (ich, du, er, etc.)
- Verb conjugation (regular verbs in Präsens)
- Sentence structure: main clause word order

Grammar II

- Verbs: haben, sein, modal verbs (möchten, können)
- Question words (wer, was, wo, etc.)
- Negation (nicht, kein)
- Possessive pronouns (mein, dein, etc.)
- Accusative case basics

Unit 4: Vocabulary Building II

- Food and drink

- Daily routine
- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B23-VAC-308	Japanese Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about Japanese Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic Japanese language.**						
CO2	**Enable basic communication in Japanese (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking.**						

Course Outline

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine

- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B23-VAC-310	French Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Examination**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about French Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic French language.**						
CO2	**Enable basic communication in French (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking**						

Course Outline

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine
- Time and date

- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B23-ECE-401	Computer Architecture							
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End semester exam	Internal Assessment	Practical	Total	Time
3	-	-	3	70	30	-	100	3 Hrs.

Course Outcomes

At the end of this course students will demonstrate the ability to

CO1	Analyze the computing systems and their development processes.
CO2	Analyze the performance of computers and the role of software and hardware in it.
CO3	Interface memory and I/O devices to CPU to make a complete system.
CO4	Understand the architecture of modern CPUs and input-output organization of CPU.

UNIT-1

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Macros and Subroutines, addressing modes, Register transfer, bus and memory transfer, Logical and shift Micro-operations.

UNIT-2

Processor organisation, Information representation, number formats, BCD Adder, Addition and subtraction in BCD, Flynns architecture

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit.

UNIT-3

Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory, Main memory allocation, memory management hardware.

UNIT-4

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces Concept of parallel processing, Pipelining, Forms of parallel processing, interconnection network.

Text/Reference Books

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI,Third edition
3. Y.Chu, "Computer Organisation and Microprogramming”, II, Englewood Chiffs, N.J.,Prentice Hall,Edition
4. M.M.Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organisation and Programming”, McGraw Hill, N.V,Edition
6. Hayes J.P, “Computer Architecture and Organisation”, PHI,Second edition
7. Ikvinderpal Singh, “Computer Organisation and Architecture”, Khanna Book Publishing.

B23-ECE-403	Seminar						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Time
-	-	2	1	-	100	100	3 Hrs.
Course Outcomes (CO) Upon completion of the course, students will be able to							
CO1	Identify contemporary topics/concepts pertaining to recent trends in electronics and communication engineering and prepare documentation						
CO2	Present the selected topic with superiority demonstrating good communication skills.						

Seminar Guidelines: Select a topic relevant to ECE domain and suitable for UG level presentation. For selection topics refer to internationally reputed journals. The primary reference should be published during the last two or three years. - Some of the journals/publications suitable for reference are: IEEE/the IET/IETE/Springer/Science Direct/ACM journals.

B23-ECE-405	Industrial Training-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**		**100**	**100**	**3 Hrs.**

It is course in which the students will be evaluated for the industrial training undergone after 6thsemester and students will be required to get passing marks to qualify.

B23-ECE-407	**Project-II**						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Time
-	-	4	2	60	40	100	3 Hrs.

Course Outcomes (CO) Upon completion of the course, students will be able to	
CO1	Identify a problem statement either from a rigorous literature survey or the industry requirements analysis.
CO2	Design a solution for the identified problem by applying acquired technical knowledge.
CO3	Simulate, Develop and Test the Prototype with a standard solution/ process.
CO4	Learn to work in a team and coordinate within the group for timely completion of targeted work

Project-II Guidelines: The project-II is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design. The project-II may be a complete hardware or a combination of hardware and software. Mini Project should cater to a small system required in laboratory or real life. It should encompass components, devices, analog or digital ICs, micro controllers with which functional familiarity is introduced. Based on comprehensive literature survey/ Industry requirements analysis, the student shall identify the title and define the aim and objectives of the mini project. Students are expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within the first week of the semester. The student is expected to exert on design, development, and testing of the proposed work as per the schedule. Layout should be made using simulation software. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

B23-ECP-405	**MICROCONTROLLER**						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time (Hrs)
3	0	0	3	70	30	100	3
Course Prerequisites	Microprocessors						
Course Objectives	*1. The course is designed to understand the architecture, instruction sets and various techniques to interface them with different real-world I/O devices to accomplish certain tasks.* *2. To study the architecture and pin diagram of the 8051 Microcontroller.* *3. To understand the instruction set and programming concepts of the above.* *4. To know the techniques of interfacing them to real-world peripheral devices.* *5. To use all the above in the design of microcontroller-based systems.* 6. *To impart practical knowledge of 8051.*						

Course Outcomes

CO1	*Acquired knowledge about the different types of microcontrollers and their features.*
CO2	*Acquired knowledge about the architecture of the 8051 microcontrollers.*
CO3	*Acquired knowledge about instruction set and programming concepts of 8051.*
CO4	*To design the systems /models based on microcontrollers*

SYLLABUS

UNIT I

INTRODUCTION: Compare Microprocessor and Microcontroller, Classification of microcontrollers: 4-bit, 8-bit, 16-bit and 32-bit, Embedded Microcontrollers and External memory microcontrollers, RISC and CICC, and Processor architectures; Microcontroller memory types, Microcontroller features: Clocking, I/O pins, Interrupts, Timers, Peripherals; Criteria for Choosing a Microcontroller, Applications of Microcontrollers. Introduction of 8051, PIC, AVR and ARM microcontrollers.

UNIT II

8051 ARCHITECTURES: Block diagram of 8051, Programming modal of 8051, On-chip memory organization – general purpose registers, SFR registers, internal RAM and ROM, Oscillator and Clock circuits. Pin Diagram of 8051, I/O Pins, Ports and Circuits, Connecting external memory, Counters and Timers, Serial data transmission/reception and transmission modes, Interrupts, Interrupt handler subroutine, Timer flag interrupt, Serial port interrupt, External interrupt, Software generated interrupts.

UNIT III

8051 INSTRUCTIONS SET AND PROGRAMMING: Instruction syntax, Assembler directives, addressing modes, Data transfer instructions, arithmetic instructions, logical instructions, Jump and Call instructions, I/O port programming, Timer and counter-programming, Serial port and Interrupt programming.

UNIT IV

APPLICATION DESIGN & HARDWARE INTERFACING WITH 8051: Interfacing 4x4 Matrix Keyboards, LED, LCDs, ADC, DAC, Relays, PWM, Stepper and DC motor, RTC, Temperature Sensor, Interfacing with 8255 and external memory.

Text Books:

1. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.
2. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded Systems using assembly and C" -2nd Ed, Pearson Education.
3. Myke Predko, "Programming and Customizing the 8051 Microcontroller", TMH.
4. Intel's manual on "Embedded Microcontrollers".
5. Manish K Patel," Microcontroller based embedded system", McGraw Hill Education.

References Books:

1. Myke Predko, "Programming and customizing PIC microcontroller" Mc-Graw Hill.
2. M.A. Mazidi, R. D. McKinlay, Causey," The PIC microcontroller and Embedded Systems using assembly and C for PIC18" -2nd Ed, Pearson.
3. M.A. Mazidi, Naimi" The AVR microcontroller and Embedded Systems using assembly and C" -2nd Ed, Pearson.

B23-ECP-407	Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Recite and understand the knowledge of classification and associated algorithms						
CO2	Explain and apply algorithms of statistical pattern recognition and supervised Learning						
CO3	Explain, implement and apply algorithms of non-parametric learning, feature extraction and selection						
CO4	Understand, explain and apply un-supervised learning, estimation and comparison of different classifiers						

UNIT-I

Classification: The Classification Process, Features, Training and Learning, Supervised Learning and Algorithm Selection, Approaches to Classification, Examples.
Nonmetric Methods: Introduction, Decision Tree Classifier, Information, Entropy, Impurity, Information Gain, Decision Tree Issues, Strengths and Weaknesses, Rule-Based Classifier, Other Methods.

UNIT-II

Statistical Pattern Recognition: Measured Data and Measurement Errors, Probability Theory, Simple Probability Theory, Conditional Probability and Bayes' Rule, Naive Bayes Classifier, Continuous Random Variables, The Multivariate Gaussian, The Covariance Matrix, The Mahalanobis Distance.
Supervised Learning: Parametric and Non-parametric Learning, Parametric Learning, Bayesian Decision Theory, Discriminant Functions and Decision Boundaries, MAP (Maximum A Posteriori) Estimator.

UNIT-III

Nonparametric Learning: Histogram Estimator and Parzen Windows, k-Nearest Neighbor (k- NN) Classification, Artificial Neural Networks, Kernel Machines.
Feature Extraction and Selection: Reducing Dimensionality, Preprocessing, Feature Selection, Inter/Intraclass Distance, Subset Selection, Feature Extraction, Principal Component Analysis, Linear Discriminant Analysis.

UNIT-IV

Unsupervised Learning: Clustering, k-Means Clustering, Fuzzy c-Means Clustering, (Agglomerative) Hierarchical Clustering.

Estimating and Comparing Classifiers: Comparing Classifiers and the No Free Lunch Theorem , Bias and Variance, Cross-Validation and Resampling Methods: The Holdout Method , k-Fold Cross-Validation, Bootstrap, Measuring Classifier Performance, Comparing Classifiers, ROC Curves,

McNemar’s Test, Other Statistical Tests, The Classification Toolbox, Combining Classifiers.

Text/References Books:

1. Geoff Dougherty: Pattern Recognition and Classification An Introduction, 2013, Springer.

2. Christopher M. Bishop: Pattern Recognition and Machine Learning, Springer.

B23-ECP-409	Bio-Medical Signal Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3**
Purpose	**To understand the concept of Bio-Medical Signal Processing.**						
Course Outcomes **At the end of this course, student will be able to**							
CO 1	Interpret signals and systems						
CO 2	Acquire Biomedical Signals such as ECG						
CO 3	Apply adaptive filtering algorithms in biomedical applications						
CO 4	Analyze different kinds of events and waveforms of biomedical origin						

Unit – I

Signals and Information: Definitions and properties of Laplace transform, Basic of DFT and FFT, z-transform, Sampling theorem.

Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, frequency response, group delay, phase delay, Applications of Digital Signal Processing.

Unit – II

Introduction to Biomedical Signal: General measurement and diagnostic system, classification of signals, introduction to biomedical signals, Biomedical signal acquisition and processing.

ECG: ECG signal origin, ECG parameters-QRS detection different techniques, ST segment analysis, Arrhythmia, Arrhythmia analysis, Arrhythmia monitoring system.

Unit – III

Adaptive Filtering: Introduction, General structure of adaptive filters, LMS adaptive filter, adaptive noise cancellation, cancellation of ECG from EMG signal, Cancellation of maternal ECG in fetal ECG.

EEG: EEG signal characteristics, Sleep EEG classification and epilepsy.

Unit – IV

Event Detection and waveform analysis: Need for event detection, Detection of events & waves, Correlation analysis of EEG signals, Identification of heart sounds, Morphological analysis of ECG waves.

Frequency Domain Analysis: Introduction, Spectral analysis, linear filtering, Removal of high frequency noise (power line interference), motion artifacts (low frequency) and power line interference in ECG.

Text Book:

1. Biomedical Signal Analysis" A case study approach, Rangaraj M Rangayyan, John Wiley publications.

Reference Books:

1. “Biomedical Signal Processing Time and Frequency Domains Analysis (Volume I)”, Arnon Cohen, CRC press.
2. “Biomedical Signal Processing Principles and Techniques” D.C.Reddy, Tata Mc Graw-Hill
3. “Biomedical Digital Signal Processing”, Willis J. Tompkins, PHI

B23-ECP-411	Satellite Communication							
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End semester exam	Internal Assessment	Practical	Total	Time
3	-	-	3	70	30	-	100	3 Hrs.

Course Outcomes

At the end of this course students will demonstrate the ability to

CO1	Compute parameters of orbital motions and understand communication with non-geosynchronous satellite
CO2	Understand the sub-systems of satellite communication systems and ground stations.
CO3	Understand the signal power calculation and issues in communication satellite tracking
CO4	Understand different modulation types and interfacing the modems in satellite receivers.

UNIT-1

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. IRNSS-NAVIC: Navigation with Indian Constellation

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concepts of Solar day and Sidereal day.

UNIT-2

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems.

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

UNIT-3

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT-4

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt and Jeremy Allnutt: "Satellite Communications": Ed 3, 2021.Wiley India.
2. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2001
3. Varsha Agrawal, Anil K. Maini, "Satellite Communications" Wiley India 2010.
4. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill.

B23-ECP-413	RF Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hours**
Purpose	This course aims to provide students with a comprehensive understanding of Radio Frequency (RF) systems, including the principles of signal transmission, modulation, and communication. It equips students with the necessary skills to design, analyze, and implement RF circuits, antennas, amplifiers, and communication systems, preparing them for careers in telecommunications, wireless technologies, and related fields. .						
CO1	Learner will gain the knowledge about frequency spectrum and radio wav e propagation.						
CO2	Learner will apply transmission line theory to calculate impedance, reflection coefficients, and standing wave ratio (VSWR) and use tools like the Smith Chart to solve real-world RF problems related to impedance matching and wave propagation. They can Understand and implement both analog and digital RF modulation schemes.						
CO3	Learner will able to design RF amplifiers for various classes (A, B, C) and analyze their performance with respect to gain, bandwidth, and noise and analyze different types of antennas and their radiation patterns, gain, and directivity.						
CO4	Learner will able to design the filters, study the measurement tools and the microwave diodes and tubes.						

UNIT-I

Introduction to RF Systems: RF basics and frequency spectrum, RF spectrum allocation, Radio wave propagation: Ground Wave Propagation, Space Wave Propagation and Sky Wave Propagation, Applications of RF systems (communications, radar, wireless systems).

UNIT-II

Transmission Line Theory: Types of transmission lines: coaxial, microstrip, stripline, waveguides, Transmission line equations (voltage, current, impedance), Impedance matching and the Smith Chart Reflection coefficients, standing wave ratio (VSWR).

RF Modulation and Demodulation: Amplitude modulation (AM), Frequency modulation (FM), Phase modulation (PM), Digital modulation techniques (QPSK, QAM, FSK), Modulator and demodulator design

UNIT-III

RF Amplifiers and Oscillators: Types of RF amplifiers (class A, B, C, etc.), Gain, bandwidth, and efficiency of amplifiers, Noise figure and distortion in amplifiers, RF oscillators: Colpitts, Hartley, and crystal oscillators.

Antennas and Propagation: Types of antennas (dipoles, monopoles, arrays), Antenna parameters (gain, directivity, radiation pattern, Effective Aperture, Efficiency etc.), RF propagation models: free space, ground-wave, line-of-sight, Link budget calculations.

UNIT-IV

RF Filters and Components: Types of filters: low-pass, high-pass, band-pass, and band-stop, Filter design using lumped and distributed elements, RF components (capacitors, inductors, resistors, transformers). Measurements Tools: Spectrum analyzers, signal generators, network analyzers, Power meters, vector network analyzers (VNA)

Higher-frequency aspects of RF systems (Microwave region): Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes: GUNN, IMPATT, TRAPATT, Mixers. Microwave Tubes (Brief): Klystron, TWT, Magnetron.

Text Book: 1. Microwave Engineering by David M. Pozar

Reference Books:

1. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
2. Antenna & Wave Propagation- K.D. Prasad, Satya Parkashan.
3. RF and Microwave Engineering - Fundamentals of Wireless Communications-Frank Gustrau, Wiley-Blackwell 1st (ISSN: 978-1119951711), 2012.
4. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", Author House, 2009.

B23-ECP-415	Wireless Sensor Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Understand principles of sensor networks and its difference with mobile ad hoc networks						
CO2	Evaluate computations related to energy saving using different routing schemes.						
CO3	Analyze different MAC protocols used for different communication standards in WSN.						
CO4	Design small sensor networks for different applications.						

Unit-I

Introduction to Sensor Networks: unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Localization and tracking of objects. Mobile Adhoc Networks (MANETs): Multi-hop networks and its advantages, Introduction to routing in ad hoc multi-hop networks, Applications of MANET.

Unit-II

Enabling technologies for Wireless Sensor Networks: Issues and challenges in wireless sensor networks, routing protocols in sensor networks, energy aware schemes, etc.

MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

Unit-III

Dissemination protocol for large sensor network: Data dissemination, data aggregation, data accumulation and data fusion; Quality of a sensor network; Real-time traffic support and security protocols,

Unit-IV

Data Design Principles for WSNs: Gateway Concepts Need for gateway, WSN to Internet Communication, Internet to WSN Communication.

Architecture: Single-node architecture, Hardware components & design constraints, operating systems and execution environments, introduction to TinyOS and nesC.

Text Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications
2. Sabrie Soloman, “SENSORS” HANDBOOK by Mc Graw Hill publication.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications.
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inderscience
5. Philip Levis, And David Gay Tinyos “Programming” by Cambridge University Press Course Outcomes

B23-ECP-417	ADVANCED MOBILE COMMUNICATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes (CO)

Upon completion of the course, students will be able to

CO1	It deals with introduction of Wireless Communication Systems and different generations of cellular networks. Also Understand cellular design fundamentals.
CO2	Understand the fading and shadowing concept in wireless communication system.
CO3	Understand the diversity and equalization concepts in wireless channel.
CO4	Understand the GSM mobile communication standard, its architecture, logical channels, advantages and limitations and get knowledge of 3G and 4G mobile standards and their architectures.

UNIT-I

The cellular Concept – System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity: co-channel interference, adjacent channel interference, Trunking and Grade of Services, Improving Coverage & Capacity in Cellular System: cell splitting, sectoring and microcell concept.

UNIT-II

Mobile Radio Propagation-Path Loss & Shadowing: Radio Wave Propagation, Transmit and Receive Signal Models, Free Space Path Loss, Indoor and Outdoor Propagation Models, Combined Path Loss & Shadowing, Outage Probability under Path Loss & Shadowing.

Mobile Radio Propagation-Small Scale Fading and Multipath: Small Scale Multipath Propagation, Factors affecting Small Scale Fading, Doppler Shift, Impulse Response Model of a Multipath Channel, Parameters of Mobile Multipath Channel, Types of Small Scale Fading: flat fading, frequency selective fading, slow fading and fast fading, Capacity of AWGN, Flat Fading and Frequency Selective Channels.

UNIT-III

Diversity & Equalization: Diversity System Model, Receiver Diversity: selection diversity, feedback diversity, maximal ratio combining, equal gain combining, Equalizers, Types of Equalizers: linear equalizers, non-linear equalizers.

UNIT-IV

GSM System Architecture: GSM Channel Types, Traffic Channel, Control Channel, Frame Structure for GSM, Authentication Mechanism in GSM.

3G and 4G Networks Architecture: UMTS Network Architecture, UMTS Radio Interface, UTRAN, Handover, LTE Network Architecture, Air Interface and Radio Network, LTE Advanced.

Text Books:

1. T. S. Rappaport: Wireless Communications, PHI, 2002.
2. Jochen Schiller : Mobile Communication , Pearson. 3. Raymond Steel : GSM, cdma one and cdma 2000, Wiley.

Reference Books:

4. Andrea Goldsmith : Wireless Communications , Cambridge University Press.
5. Jochim Tisal : GSM Network: GPRS evolution one step towards UMTS , John Wiley & Sons.
6. David Tse & Pramod Viswanath: Fundamentals of Wireless Communication , Cambridge University Press.
7. Ezio Biglieri : MIMO Wireless Communications, Cambridge University Press.

B23-ECP-419	DSP Processors						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	To write program of DSP processor.						
CO2	To describe the detailed architecture, addressing mode, instruction sets of TMS320C5X.						
CO3	To describe the detailed architecture, addressing mode, instruction sets of TMS320C54X.						
CO4	To design DSP systems using FPGA.						

UNIT -1

INTRODUCTION: Digital Signal Processing, Advantages of DSP, Applications of DSP. FUNDAMENTALS OF PROGRAMMABLE DSPs: Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special Addressing modes in P- DSPs, On chip Peripherals.

UNIT -2

ARCHITECTURE OF TMS320C5X: Architecture, Bus Structure & memory, CPU, addressing modes. Programming TMS320C5X: Assembly language syntax, Assembly language Instructions, Simple ALP – Pipeline structure, Operation Block Diagram of DSP starter kit, Application Programs for processing real time signals.

UNIT-3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Block diagrams of 54X internal Hardware, buses, internal memory organization, Data Addressing modes of S320C54XX Processors, Program Control, On-chip peripheral, Interrupts ofTMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT-4

ADVANCED PROCESSORS and FPGA: Code composer studio - Architecture of TMS320C6X, Introduction to FPGA, Design flow for an FPGA based system design, FPGA based DSP system design. Comparison of the performance of the system designed using FPGA and Digital signal processors, Application note on DSP systems.

Text Books

1. B. Venkataramani and M. Bhaskar, Digital Signal Processors -Architecture, Programming and Applications 2nd edition, Mc Graw Hills 2011.
2. Avtar Singh, S. Srinivasan DSP Implementation using DSP microprocessor with Examples from TMS32C54XX –Thamson.

Reference Books

1. DSP Processor Fundamentals, Architectures & Features – Lapsley et al., S. Chand & Co, 2000.
2. Digital signal processing-Jonathen Stein John Wiley 2005.
3. S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001.
4. B. Venkataramani, M. Bhaskar, Digital Signal Processors, McGraw Hil

B23-ECP-421	Multimedia Communications						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**
Purpose	**To familiarize the students with the concepts of basic multimedia communication systems and various compression algorithms of text, audio, image and video.**						
Course Outcomes							
CO1	**To understand the concept of basic multimedia comm. System and various types of networks and applications.**						
CO2	**To understand the concept text and image compression.**						
CO3	**To understand the concept of audio and video compression.**						
CO4	**To understand the concept of multimedia synchronization and video indexing.**						

UNIT1

MULTIMEDIA COMMUNICATION: Introduction, Multimedia networks: Telephone networks, Data networks, ISDN, B-ISDN.

Multimedia Applications: Interactive applications over the internet and entertainment applications. Digitization Principles.

UNIT 2

TEXT COMPRESSION: Compression principles, Text Compression techniques: Static Huffman Coding, Dynamic Huffman Coding, Arithmetic Coding, Lempel Ziv and Lempel Ziv welsh coding.

IMAGE COMPRESSION: Graphics interchange format, Tagged image file format, JPEG in detail.

UNIT 3

AUDIO COMPRESSION: Differential Pulse Code Modulation, Adaptive Differential PCM, Adaptive Predictive coding, Linear predictive coding.

VIDEO COMPRESSION: Video Compression principles, Frame types, Motion estimation and compensation, H.261 standard.

UNIT 4

MULTIMEDIA SYNCHRONIZATION: Basic definitions and requirements Time stamping and Pack architecture,

VIDEO INDEXING: Basics of content based image retrieval and video content representation.

Reference Books:

- Multimedia communications: Fred Halsall; Pearson Education Asia.
- Multimedia Systems" by Ralf Steinmetz and Klara Nahrstedt
- Multimedia Systems, Standards, and Networks" by A. Puri and T. Chen

B23-OEC-401	Operating System						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Sem. Exam**	**Internal assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3Hrs**
Course Outcomes							
CO1	**Student will be able to understand structure and function of OS.**						
CO2	**Student will be able to understand the concept of OS.**						
CO3	**Student will be able to understand the concurrent processing.**						
CO4	**Student will be able to understand scheduling and deadlock in OS.**						

Unit- I

Introduction:OS functions: as user/computer interface, interaction with OS, commands, efficient resource manager, security and protection, evolution of OS, OS structure and future trends.

Unit- II

OS Prerequisites: Important software resources, interaction with OS in mainframe systems: PSW,controlling i/o, interrupt, interrupt priority, interrupt cycle. Fundamental concept related to IPC.

Unit –III

Concurrent Processing : Introduction, process concept, process control block, exec sys, concurrent program, process state transitions, hierarchy of processes.

Unit-IV

Scheduling: CPU scheduling algorithms: allocation of different resources, scheduling queues, different scheduling algorithms.

Deadlock: Introduction, deadlock and starvation, resource allocation graph, way to solve deadlock.

Text Books: 1. P. P Choudhary, Operating Systems by PHI Learning Pvt Ltd.

Reference Books: 1. Operating Systems : Internals and Design Principles, WilliamStallings,Pearson 2.Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley

B23-OEC-403	Robotics & Automation						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Course Prerequisites	*Transducers and Microprocessors.*						
Course Objectives	*To enlighten the students about the fundamentals of robotic and automation systems.*						

Course Outcomes

At the end of this course, the student should be able to understand

CO1	*The basic concepts related to Robotics, parts of Robots, End Effectors and to make familiar with the various Drive systems for Robot.*
CO2	*The operation of various Sensors and their Applications in Robots.*
CO3	*The Machine Vision and its Applications, and various Control Systems used in Robots.*
CO4	*The Robot Programming, Artificial Intelligence, Fuzzy Logic, Safety Standards of Robots, Automation and Industrial and Non-Industrial Applications of Robots.*

SYLLABUS

UNIT I

FUNDAMENTALS OF ROBOTICS: Definition, History and Development in Robot Technology, Robot Technology: Characteristics, Basic Components, Robot Anatomy and its working; Robot Generations, Robot Selection, Present and Future Applications.

ROBOTS DRIVE SYSTEMS AND END EFFECTORS: Robot Classification: Arm Geometry, Degrees of Freedom, Power Sources, Types of Motion, Path Control; Robot End Effectors: Mechanical Grippers, Vacuum, Magnetic, Adhesive; Special Purpose Grippers, Process Tooling, Compliance, Robot Drive Systems: Hydraulic, Pneumatic and Electric System.

UNIT II

SENSORS: Requirements of a Sensor, Sensor Classification; Principle and Applications of the following Sensors: Position Sensors - Potentiometer, LVDT, Resolvers, LMDT and Hall–Effect Sensors; Velocity Sensors: Encoder, Tachometer and Differentiation of position signal; Acceleration Sensors, Force, Pressure Sensors: Piezoelectric, Force Sensing Resistor, Strain Gauge and Antistatic Foam; Torque Sensors, Micro Switches, Visible Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors: Magnetic, Optical, Ultrasonic, Inductive, Capacitive and Eddy Current; Range Finder: Ultrasonic, Light-base and GPS; Sniff Sensors, Taste Sensors, Vision Sensors, Voice Recognition Devices, Voice Synthesizers, RCC.

UNIT III

MACHINE VISION, CONTROL SYSTEM AND ROBOT PROGRAMMING: Architecture of Robotics Vision System, Machine Vision: Image Acquisition - Vidicon Tube and CCD; Digitization, Image Processing: Spatial Domain Operations, Noise Reduction and Edge Detection etc.; Image Analysis: Object Recognition by Features- Template Matching, Discrete Fourier Descriptors and Computed Tomography; Machine Vision Application, Control Systems: PLC, PID, CNC, MPU, and URC. Robot Programming: Programming Methods and Languages, Levels of Robot Programming.

UNIT IV

ARTIFICIAL INTELLIGENCE, AUTOMATION AND INDUSTRIAL APPLICATIONS: Artificial Intelligence, System Architecture; Fuzzy Logic Control, Application of Fuzzy Logic in Robotics; Robot Safety, Safety Standards; Basic elements of the automated system, advanced automation functions, levels of automation; Industrial Applications: Automation in Manufacturing, Robot Applications: Material Handling, Processing Application, Assembly Application and Inspection Application; Evaluating the Potential of a Robot Application, Future Applications, Challenge, Innovations; Non-Industrial Application.

Text Books:

1. *James G. Keramas, "Robot technology fundamentals", Delmar Publishers.*
2. *Saeed B. Niku, "Introduction to robotics analysis, control and applications", 2nd ed., Wiley India.*
3. *R. K. Mittal, I. J. Nagrath, "Robotics and Control", TMH Education Pvt.*
4. *Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", 4th ed., Pearson.*

.

B23-OEC-405	Soft Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3.0**	**70**	**30**	**100**	**3 Hour**
Purpose	To familiarize the students with the basics of Soft Computing						
Course Outcomes (CO)							
CO 1	Motivation and historical background of Soft Computing.						
CO 2	Artificial neural networks and its applications.						
CO 3	Fuzzy logic and its applications.						
CO 4	Nature Inspired algorithms such as genetic algorithms, Evolutionary Programming, ant colony optimization, particle Swarm Optimization and bee colony optimization.						

Unit-I

Soft Computing and Artificial Intelligence: Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Interference, Semantic Networks, Frames, Hybrid Models.

Unit-II

Artificial Neural Networks and Paradigms: Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptrons, Multilayer Perceptrons, Back propagation Networks, Kohnen's self-organizing networks, Hopfield network, Applications of NN.

Unit-III

Fuzzy Logic: Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule-based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.

Unit-IV

Genetic Algorithms and Optimizations Techniques: Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.

Text Books:

1. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill.
3. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.

Reference Books:

1. Zimmermann, “Fuzzy Set Theory and its Application”, 3rd Edition.
2. B. Yegnanrayana , “Artificial Neural Networks” , PHI.
3. Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
4. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall.

B23-OEC-407	Mixed Signal Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Analyze the general considerations of MOSFETs and switches.						
CO2	Understand the concepts of Switched-Capacitor circuits.						
CO3	Understand comparator designs and various PLL circuits.						
CO4	Analyze the architecture of various D/A and A/D converters.						

UNIT I

MOSFET general considerations, MOS I/V characteristics, second order effects, MOSFETs as switches, speed considerations, precision considerations, charge injection cancellations, Sample-and-Hold Circuits.

UNIT 2

Switched-Capacitor Amplifiers: Unity Gain Sampler-Buffer, Noninverting Amplifier, Precision multiply-by-two circuit, Switched-Capacitor Integrator, Switched-Capacitor Common-Mode Feedback.

UNIT 3

Characterization of a comparator, Basic CMOS comparator design, analog multiplier design, Basics of PLL, Simple PLLs; Charge-pump PLLs, Delay-Locked Loops.

UNIT 4

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, DACs, R-2R Ladder Networks, Charge-Scaling DACs.

Text/Reference Books

1. R.Jacob Baker,"CMOS Circuit Design, Layout and Simulation", Wiley India, IEEE Press.
2. Behzad Razavi,"Design of Analog CMOS Integrated Circuits" McGraw Hill

Reference Books

1. R.Jacob Baker, "CMOS Mixed Signal Circuit Design", Wiley India, IEEE Press.
2. P.E. Allen, D.R. Hollberg, "CMOS Analog Circuit Design", Oxford University Press, 2nd Edition

B23-OEC-409	POWER ELECTRONICS						
Lecture	**Tutorial**	**Practical**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**	**Credit**
3	**0**	**0**	**70**	**30**	**100**	**3 Hr.**	**3**
Course Outcomes							
CO1	**Acquire knowledge about Build and test circuits using power devices such as SCR**						
CO2	**Ability to analyze Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters**						
CO3	**Foster ability to Learn how to analyze these inverters and some basic applications**						
CO4	**To develop skills to build, and Design SMPS.**						

UNIT-I

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT : structure, Characteristics, operation, Brief introduction to power devices: TRIAC, MOS controlled thyristor (MCT), Thyristor Triggering circuit, Thyristor commutation circuit, Uses and design of snubber circuits for thyristor, power MOSFETs and IGBT. Fast recovery diodes and schottky diodes.

UNIT-II

Rectifiers types: Controlled and Uncontrolled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE loads. Analysis of load voltage, load current and derivation of load form factor and ripple factor, Effect of source impedance on the performance of the controlled rectifiers, Analysis of three phase half wave controlled rectifiers with R load, Analysis of three phase half wave controlled rectifiers with R load.

UNIT-III

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control strategies for choppers, Detailed analysis of Type A chopper. Step up chopper. Inverters: Types of inverters, operating principle, Single phase half bridge inverter, Single phase full bridge inverter.

UNIT-IV

AC Voltage Controllers: Types of AC voltage controllers: symmetrical and asymmetrical controllers, Principle of phase control, ON-OFF control, Single phase ac voltage controller with R load. Cycloconverters: Principle of cycloconverter operation, step up and step down cycloconverters, Output voltage equation for a cycloconverter, Applications: Switching Power Supplies, SMPS, UPS.

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.

B23-OEC-413	Artificial Intelligence						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**

Course Outcomes	
CO1	To familiarize the students with the fundamental concepts of Artificial Intelligance.
CO2	Students will able to learn the detail knowledge of Supervised and Unsupervised Learning.
CO3	After this unit students will be able to understand the concepts of Genetic Algorithm and Object Detection and Tracking
CO4	Students will be able to understand the concept of Artificial Neural Networks and reinforcement learning.

UNIT-I

Introduction to Artificial Intelligence, need of AI, Applications of AI, Branches of AI, Defining intelligence using Turing Test, Classification, Preprocessing data, Label encoding, Logistic Regression classifier, Naïve Bayes classifier, Support Vector Machines.

UNIT-II

Regression, Building a single variable regressor, Building a multivariable regressor, Supervised and Unsupervised Learning, Detecting Patterns with Unsupervised Learning, Clustering data with K-Means algorithm, Estimating the number of clusters with Mean Shift algorithm,

UNIT-III

Genetic Algorithms, Fundamental concepts in genetic algorithms, Generating a bit pattern with predefined parameters Object Detection and Tracking: Frame differencing, Tracking objects using colorspaces, Object tracking using background subtraction, Face detection and tracking, Eye detection and tracking.

UNIT-IV

Artificial Neural Networks, Building a Perceptron based classifier, Constructing a single layer neural network, Constructing a multilayer neural network, Reinforcement Learning, Reinforcement learning versus supervised learning, Building blocks of reinforcement learning.

Text Book:

1. Introduction to Artificial Intelligence by Philip C. Jackson · 1974

Reference Book:

2. Artificial Intelligence by Chris Neil · 2020
3. Artificial Intelligence with Python by Prateek Joshi.

B23-OEC-415	**Blockchain Technology**						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3Hr
Course Outcomes							
CO1	Understand how blockchain systems (mainly Bitcoin and Ethereum) work						
CO 2	To securely interact with them						
CO 3	Design, build, and deploy smart contracts and distributed applications						
CO 4	Integrate ideas from blockchain technology into their own projects.						

Unit I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance,Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. • Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero KnowledgeProof.

Unit II

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, MiningMechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit III

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, DifficultyLevel, Sybil Attack, Energy utilization and alternate.

Unit IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Text Book

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July19, 2016).

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

B23-OEC-417	Neuro Fuzzy System						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3Hr
Course Outcomes							
CO1	Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues						
CO2	Understanding reasoning and fuzzy logic for artificial intelligence						
CO3	Students will be able to learn defuzzification and fuzzy measures						
CO4	Students will be able to learn the applications of fuzzy logic and hybrid soft computing techniques						

UNIT I – INTRODUCTION

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzysets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT II - NEURAL NETWORKS

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto- associative memory network, hetero-associative memory network, BAM, hop field networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

UNIT III - FUZZY LOGIC

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification:lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzymeasures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT IV - HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybridsystems – simplified fuzzy ARTMAP - Applications: A fusion approach of

multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

References:

- Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
- Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

Text book(s) and/or required material

1. T1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall , First Edition. Reference Books:
   1. Bart

Kosko, ―Neural network and Fuzzy System‖ - Prentice Hall-1994.

2. J.Klin and T.A.Folger, ―Fuzzy sets‖ University and information- Prentice Hall -1996.
3. J.M.Zurada, ―Introduction to artificial neural systems‖-Jaico Publication house,Delhi 1994.
4. VallusuRao and HayagvnaRao , ―C++ Neural network and fuzzy logic‖-BPB and Publication, NewDelhi,1996.
5. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

B23-OEC-419	Audio and Speech Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3**
Purpose	**To understand the concept of Audio Signal Processing.**						
Course Outcomes **At the end of this course, student will be able to**							
CO 1	Mathematically model the speech signal.						
CO 2	Analyse the quality and properties of speech signal.						
CO 3	Modify and enhance the speech and audio signals.						
CO 4	To understand various speech coding standards.						

Unit-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid; Requirements of speech codecs –quality, coding delays, robustness.

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Unit-II

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization – uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.
Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Text/Reference Books:

1. “Digital Speech” by A.M. Kondoz, Second Edition (Wiley Students Edition), 2004.
2. “Speech Coding Algorithms: Foundation and Evolution of Standardized Coders”, W.C. Chu, Wiley Inter science, 2003.

B23-OEC-421	Introduction to Digital Marketing						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3Hr
Course Outcomes							
CO1	Understand the concept of Digital Marketing and its environment						
CO2	Understanding significance of search engines in digital marketing						
CO3	Understand marketing strategies in digital marketing						
CO4	Students will be able to learn Digital Marketing Mechanisms.						

Unit-I

Introduction to Digital Marketing: Meaning and Characteristics, Difference between digital and traditional marketing, Scope of digital marketing, Tools used for digital marketing, Digital marketing environment analysis, Digital marketing and branding, ethical and legal issues in the field of digital marketing.

Unit-II

Introduction to SEO; Understanding search engines, basics of keyword search, On-page and Off page SEO. Search Engines marketing; Digital advertising, Social Media marketing, Facenbook marketing, LinkedIn marketing, Instagram and snapchat. Digital marketing strategy formulation and execution.

Unit-III

Understanding Digital consumer behavior, consumer characteristics and profiles, Information search behavior, Purchase decision process, post purchase behavior and management. Digital marketing mix decisions- product, Price, Distribution and Promotion, Digital market segmentation, targeting and positioning.

Unit-IV

Digital Marketing Mechanisms: Websites- company and Retail service providers, Video hosting and Entertainment- Youtube, Wimeo, Netflix etc. Mobile phones and applications, E-mails, Blogs, Web analytics: Key metrics, types of tracking codes, Mobile analytics.

Reference Books:

1. Puneet Bhatia, Fundamentals of Digital Marketing, Pearson Education 2017
2. Seema Gupta, Digital Marketing, McGraw Hill Education, New Delhi.
3. Philip Kotlar, Hermawan Kartajay, Iwan Setiawan-Marketing 4.0_ Moving from Traditional to Digital-Wiley publication 2016.

B23-ECP-423	Microcontroller Lab						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time (Hrs)**
0	**0**	**2**	**1.0**	**60**	**40**	**100**	**3**
Course Outcomes (CO): Learn about writing programs and interfacing devices with 8051 for designing real life application based embedded systems.							
CO1	*To familiarization with the 8051 microcontrollers.*						
CO2	*Ability to write an embedded C language and assembly language program for 8051 Microcontroller.*						
CO3	*Ability to interface the various Peripherals to the 8051 Microcontroller.*						
CO4	*Ability to design the embedded systems based on 8051 Microcontroller.*						

List of Experiments

Introduction to Universal microcontroller kit, Keil Software and hardware simulation software Proteus

1. Write an ALP to perform Arithmetic operations (i.e. Addition, Subtraction, Multiplication & Division) and Logical Operations (i.e. AND, OR, COMPLEMENT & XOR) using the 8051 Microcontroller.
2. Write an ALP to perform multi-byte Addition & Subtraction operations using the 8051 Microcontroller.
3. Write an ALP to transfer data from ROM memory having an initial memory address of 600h into RAM having an initial memory address of 60h.
4. Write an ALP for the 8051 Microcontrollers to count from 00h to 0Ah using a Counter.
5. Write an embedded C program using an 8051 Microcontroller to rotate the DC motor in clockwise and counterclockwise directions.
6. Write an embedded C program using an 8051 Microcontroller to rotate the stepper motor in clockwise and counterclockwise directions.
7. Write an embedded C program using an 8051 Microcontroller to display the message “WELCOME” on the LCD screen.
8. Write an embedded C program using an 8051 Microcontroller for interfacing the keypad to port P0. Whenever a key is pressed; it should be displayed on an LCD screen.
9. Write an embedded C program using an 8051 Microcontroller to display 0 to 9 on a 7-segment common anode display.
10. Write an embedded C program using an 8051 Microcontroller for interfacing 4 switches and 4 LEDs as long as the switch is pressed LEDs will glow.
11. Write an embedded C program using an 8051 Microcontroller to control the speed of the DC motor.
12. Write an embedded C program using an 8051 Microcontroller for interfacing the temperature sensorLM35 to display the current temperature on an LCD screen.
13. Write an embedded C program using an 8051 Microcontroller for interfacing the LEDs to glow them in different patterns.
14. Write an embedded C program using an 8051 Microcontroller for interfacing a switch and a buzzer at two different pins of a port such that the buzzer should sound as long as the switch is pressed.
15. Design a date display embedded system using the 8051 Microcontroller.
16. Design a fire alert embedded system using the 8051 Microcontroller.
17. Design a traffic light embedded system using the 8051 Microcontroller.

B23-ECP-425	Machine Learning Lab						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO) **At the end of the course, students will be able to**							
CO1	**Load and display datasets using Python.**						
CO2	**To implement various Supervised Machine learning Techniques.**						
CO3	**To implement various Unsupervised Machine learning Techniques.**						
CO4	**To normalise and Standardise the Data.**						

List of Experiments:

1. Loading different types of datasets in Python.
2. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in Python to get the result.
3. WAP to normalise and standardise the dataset.
4. Implement Dimensionality reduction using the Principle component Analysis method on a dataset iris.
5. Write a program to demonstrate the working of the decision tree-based ID3 algorithm by considering a dataset.
6. Consider a dataset, and use Random Forest to predict the output class.
7. Write a Python program to implement Simple Linear Regression and plot the graph.
8. Build a KNN Classification model for a given dataset.

9. Implement a Support Vector Machine for classification of the dataset.
10. Write a Python program to implement the K-Means clustering Algorithm.

B23-ECP-427	Biomedical Signal Processing Lab						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO) **At the end of the course, student will be able to**							
CO1	**Study of various biomedical signals.**						
CO2	**Acquisition of Biomedical signals.**						
CO3	**Preprocessing of Various Biomedical Signal.**						
CO4	**Analysis of various biomedical signals.**						

List of Experiments:

1. Familiarization of various biomedical signals.
2. To load and display Biomedical signals such as ECG, EEG, EMG, and PPG.
3. Consider ECG signal sampled at 200Hz, with a power line artifact. Design a notch filter to remove this artifact in MATLAB.
4. Remove high-frequency noise from ECG signals using moving averaging filters.
5. Filter noisy ECG signal sampled at 1000Hz using Butterworth Low pass filter.
6. Filter ECG signal having baseline wander noise sampled at 1000Hz with derivative based filters.
7. Filter noisy ECG signal sampled at 1000Hz using Butterworth High pass filter.
8. Design a Weiner filter to remove the artifacts in ECG Signal sampled at 1000Hz.
9. Implement Pan Tompkins methods for QRS detection.
10. To calculate parameters such as SNR, PSNR of biosignals.

B23-ECP-402	Fiber Optic Communications						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	**Students will be able to understand the structure of fiber and the mechanismof light travelling in the fiber.**						
CO2	**Students will be able to analyze various losses associated with fibers.**						
CO3	**Students will learn about the optical sources and optical detecters.**						
CO4	**Students will be able to understand the various components and devicesrequired in making optical networks**						

UNIT – I

INTRODUCTION: Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, acceptance angle, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

UNIT –II

LOSSES IN OPTICAL FIBER : Attenuation, Absorption Losses, Scattering Losses, Leaky modes, Modecoupling losses, Bending Losses, Combined Losses in the fiber.

DISPERSION EFFECT : Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion, Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

UNIT – III

LIGHT SOURCES : LEDS, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.

DETECTORS : P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

UNIT – IV

The fiber-optic Communication System: Design considerations of fiber optic systems: Analog and digitalmodulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, WDM: strategy, wavelength division multiplexer and demultiplexer, optical amplifier

OPTICAL NETWORKS: Elements and Architecture of Fiber-Optic Network, Optical link network-singlehop, multihop, hybrid and photonic networks.

Suggested Books:

John Power, An Introduction to Fiber optic systems, McGraw Hill International.John Gowar , Optical communication Systems.

R. Ramaswamy, Optical Networks, Narosa Publication

John M. Senior, Optical Fiber Communication

Gerd Keiser, Optical Fiber Communication

B23-ECP-404	EMBEDDED SYSTEMS						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Course Prerequisites	**Microprocessors and Microcontrollers**						
Course Objectives	*7. The course is designed to familiarize the students with the basic design concepts for Embedded Systems and design Embedded System solutions for real-life problems.* *8. To study the Architecture of Advanced Microcontrollers like PIC, AVR, ARM and SHARC.* **9.** *To study various network interfaces and concepts of RTOS.*						
Course Outcomes							
At the end of the course, students will be able to							
CO1	*Acquired knowledge about different types of Microcontrollers and various Embedded System design examples of real-life problems.*						
CO2	*Understand the PIC, AVR, ARM and SHARC architectures.*						
CO3	*Understand different types of I/O devices, Timer Devices and Communication Interfaces.*						
CO4	*Acquired knowledge about the design of RTOS and various operating systems.*						
SYLLABUS							

UNIT I

INTRODUCTION: Types of Microcontrollers: 4-bit, 8-bit, 16-bit, and 32-bit Microcontrollers, Processor Architectures: Harvard & Princeton, CISC & RISC, Microcontrollers Memory; Microcontrollers Features. Embedded System**:** Definition, Embedded Processors, Hardware Units, Devices and Software Tools in a System; Embedded system design, architecture and model, Classification and examples of embedded systems, Embedded systems on a chip, Complex systems design and processors, Design challenges, Design process and design examples.

UNIT II

PIC MICROCONTROLLER: Introduction to PIC16 Microcontroller Family, Features of PIC16C74, Architecture and pin diagram of PIC16C74, Pipelining, Program memory considerations, Register file structure, Addressing modes, Instruction sets; Advanced architectures**:** Only brief general architecture of AVR, ARM and SHARC.

UNIT III

COMMUNICATION INTERFACES: I/O devices types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Distributed networked embedded system architecture, Serial Bus communication protocols-I^2C, CAN, USB, Firewire and Advanced buses; Parallel bus device protocols- ISA, PCI, ARM and Advanced buses; Network protocols-HTTP, TCP, UDP, IP and Ethernet; Wireless and mobile system protocols- IrDA, Bluetooth, 802.11 and Zigbee.

UNIT IV

REAL-TIME OPERATING SYSTEMS: Architecture of Kernel, Processes, Threads, Task and Task scheduler: task states, context switching and scheduling algorithms; ISR, Semaphores, Mutex, Mailboxes, Message queue, Event Registers, Pipes, Signal, Timers, Memory Management, Priority Inversion Problem, Disabling and Enabling Functions, Introduction to RTOS, Basic Design using an RTOS, RTOS Task-Scheduling Model, Off-the-Shelf Operating System, Embedded Operating

Systems, Real-Time Operating Systems, and Handhold Operating Systems.

Text Books:

1. Raj Kamal, "Embedded systems architecture, programming and design", 3rd Ed., McGraw-Hill Companies.
2. John. B. Peatman, "Design with PIC Microcontroller", Pearson Education, 2003.
3. Dr. K.V.K.K. Prasad, "Embedded/Real-Time Systems: Concepts, design and programming", DreamTech Press.

References Books:

1. Myke Predko, "Programming and Customizing the 8051 Microcontroller", TMH.
2. M.A. Mazidi, R. D. McKinlay,Causey," The PIC microcontroller and Embedded Systems using assembly and C for PIC18", 2nd Ed., Pearson.
3. D.P. Kothari, Shriram K. Vasudevan, Sundaram R. M. D., Murali N., "Embedded System", New Age International (P) Limited, Publishers.
4. Shibu K V, "Introduction to Embedded Systems", 2nd Ed., McGraw Hill Education (India) Private Limited.

B23-ECP-406	Electronic Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3**
Course Outcomes **At the end of this course, student will be able to**							
CO 1	understand the relevant semiconductor materials for the Electronic Applications.						
CO 2	understand Dielectric Materials for Electronic Applications						
CO 3	understand Magnetic Materials for Electronic Applications						
CO 4	understand Photoemissive and photovoltaic Materials for Electronic Applications						

Unit-I

Semiconductor materials: Intrinsic, extrinsic, charge carriers, P type and N Type, applications, Electronic Materials and doping level for PN junction diode, Zener diode, PNP and NPN transistor, Construction, working principle and applications of LED.

Unit-II

Dielectric Materials: Types, Properties, Effect of dielectric on behaviour of capacitor, dielectric materials, dielectric losses, frequency dependence of permittivity, Ferroelectricity and piezoelectricity concept, materials and applications.

Unit-III

Magnetic Materials: Properties, classification: Permanent magnetic dipole, diamagnetism, paramagnetism, ferromagnetism. Magnetisation curve and Hysteresis loop. Magnetosteiction effect, materials used and applications.

Unit-IV

Photo emissive material: Impurities used to emit different colors of lights/wavelength, electroluminescence and Junction LASERS.

Photovoltaic materials: properties and applications, Solar Cell: Working Principle and Construction, Materials used in a Solar Panel, Terminologies used in energy storage system.

Reference Books:

1. Prof. Parasuraman S, “Fundamental of Electronic Material and Devices”, Metallurgy and Material Science, IIT Madras.
2. William D. Callister, “Material Science and Engineering”, WILLEY India 2nd edition.
3. S.P. Seth and PV Gupta, “A course in Electrical Engineering Materials”, Dhanpat Rai and Sons.

B23-ECP-408	Radar Engineering							
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End semester exam	Internal Assessment	Practical	Total	Time
3	-	-	3	70	30	-	100	3 Hrs.

Course Outcomes

At the end of this course students will demonstrate the ability to

CO1	To understand the concept of basics of radar, its equation and signals associated with radar.
CO2	To understand the concept of CW and MTI radar.
CO3	To familiarize with the concept of tracking radar.
CO4	To familiarize with the concept of radar receiver, mixers and duplexers.

Unit- I

Radar Block Diagram & operation, Applications of Radar
Radar Equation:
Simple form of Radar Equation, Detection of signals in noise, Signal to Noise ratio, Transmitter Power. Pulse repetition frequenc)' & range ambiguities, System losses, Propagation effects.
CW & Frequency Modulated Radar:

Unit- II

The Doppler effect, CW Radar, FM- CW Radar, Multiple Frequency CW Radar.

MTI & Pulse Doppler Radar:

Introduction, Delay Line Cancellors. Multiple or staggered Pulse repetition frequencies, .range-Gated Doppler Filters, Limitation of MTI performance, Non-coherent MTI, Pulse Doppler radar, MTI from a moving platform.

Unit-III

Tracking Radar: Tracking with Radar, Sequential Lobbing, Conical Scan, Mono-pulse Tracking Radar, Tracking in range, Acquisition, Low angle tracking.

Unit-IV

Receivers, Displays & Duplexers:
Radar Receivers, Noise Figure, Mixer: Low-noise Front ends. Displays, Duplexer, Receiver protectors.

Text Book:

I. Introduction to Radar Systems: Merrill!. Skolnik,; MGH

Reference Book:

Electronic Communication Systems: Kennedy; TMH.

B23-ECP – 410	Adaptive Signal Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester exam**	**Internal assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hr.**
CourseOutcomes							
CO1	To understand various stochastic processes and models in adaptive signal processing.						
CO2	To understand the analysis of wiener filters, the concept of the linear prediction andsteepest descent algorithms.						
CO3	To use Least-Mean-Square (LMS) & Recursive Least-Squares (RLS) algorithms for specific engineering problems.						
CO4	To apply the concept robustness and analysis the Finite-Precision effects on LMS and RLS algorithms.						

Unit -I

Stochastic Processes and Models: Partial Characterization of a Discrete-Time Stochastic Process, MeanErgodic Theorem, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule—Walker Equations. **Wiener Filters**: Linear Optimum Filtering: Statement of the Problem, Principle of Orthogonality, Minimum Mean-Square Error, Wiener-Hopf Equations, Error-Performance Surface, Multiple Linear Regression Model.

Unit -II

Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Levinson-Durbin Algorithm,Properties of Prediction-Error Filters, Schur-Cohn Test.

Method of Steepest Descent: Basic Idea of the Steepest-Descent Algorithm, The Steepest-Descent Algorithm Applied to the Wiener Filter, Stability of the Steepest-Descent Algorithm, Example, The Steepest-Descent Algorithm as a Deterministic Search Method, Virtue and Limitation of the Steepest-Descent Algorithm.

Unit -III

The Least-Mean-Square (LMS) Algorithm: Signal-Flow Graph, Optimality Considerations, Applications, Statistical Learning Theory, Transient Behavior and Convergence Considerations, Efficiency. **The Recursive Least-Squares (RLS) Algorithm:** Some Preliminaries, The Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm, Selection of the Regularization Parameter, Update Recursion for the Sum of Weighted Error Squares, Example: Single-Weight Adaptive Noise Canceller.

Unit -IV

Robustness: Robustness, Adaptation, and Disturbances, Robustness: Preliminary Considerations Rooted in$H\infty$ Optimization, Robustness of the LMS Algorithm, Robustness of the RLS Algorithm, Comparative Evaluations of the LMS and RLS Algorithms from the Perspective ofRobustness.

Finite-Precision Effects: Quantization Errors, Least-Mean-Square (LMS) Algorithm, Recursive Least-Squares (RLS) Algorithm, Summary and Discussion.

TEXT BOOKS:

1. S. Haykin, Adaptive filter theory,Pearson

REFERENCE BOOKS:

1. T. Adali and S. Haykin, Adaptive Signal Processing, WileyIndia
2. B. Widrow and S.D. Stearns, Adaptive signal processing, PrenticeHall.

B23-OEC-402	Renewable Energy Resources						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hour**
Course Outcomes							
CO 1	**To understand the energy demand of world, nation and available resources to fulfill the demand**						
CO 2	**To know about the conventional energy resources and their effective utilization**						
CO 3	**To acquire the knowledge of modern energy conversion technologies**						
CO 4	**To be able to understand and perform the various characterization techniques of fuels**						
CO5	**To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively.**						

Unit-I

Introduction: Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact offossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy– sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

Unit-II

Solar thermal systems: Solar radiation spectrum, Radiation measurement , Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing : Life cycle costing (LCC),Solar thermal system

Solar Photovoltaic systems ,Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series andparallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

Unit-III

Microhydel: Operating principle, Components of a microhydel power plant, Types and characteristics of turbines, Selection and modification, Load balancing, Costing: Life cycle costing –Microhydel Wind ; Wind patterns and wind data, Site selection, Types of wind mills , Characteristics of wind generators, Load matching, Life cycle costing - Wind system LCC.

Unit-IV

Biomass: Learning objectives, Operating principle, Combustion and fermentation, Anaerobic digester, Wood gassifier, Pyrolysis, Applications, Bio gas, Wood stoves, Bio diesel, Combustion engine, Life cycle costing - Biomass system LCC

Hybrid Systems, Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles

Suggested Books:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi,2003
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, NewDelhi, 2004
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi, 2004.

B23-OEC-404	SUPPLY CHAIN **MANAGEMENT**						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Tlme (Hrs.)
3	0	0	3	70	30	100	3
Purpose	The main objective of the course is to impart student with the knowledge of the performance, driver and metrics, network design, economies and uncertainties in Supply chain management.						
Course Outcomes							
C01	Student will be able to explain the basics of Supply chain management and its performance.						
C02	Student will be able to discuss supply chain metrics and the process of designing the supply chain networks.						
C03	Student will be able to explain various aspects arid functions of the supply chain network. Also, they will be able to explain the design process of Ihe Global supply chain network.						
C04	Student will be able to describe how to manage economies and uncertainties in the supply chain.						

Unit-I

Understanding the suppły chain: Introduction, definition, the objective of a supply chain, be importance of supply chain decisions, decision phases in a supply chain, process views of a supply chain, examples of supply Chains.

Supply chain performance: Achieving strategic fit and scope: Competitive and supply Chain strategies. achieving strategic fit, expanding strategic scope, challenges in achieving and maintaining strategic fit.

UNIT-II

Supply chain drivers and metrics: Financial measures of performance, drivers of supply chain performance, framework for structuring drivers, facilities, inventory, transportation, information, sourcing, pricing.

Designing the supply chain network: Designing distribution networks and applications to online sales: the role of distribution in the supply chain, factors influencing distribution network design, design options for a distribution network, online sales and the distribution network, distribution network in practice.

UNIT-III

Network design in the supply chain: The role of network design in the supply chain, factors influencing network design decisions, framework for network design decisions, models for facility location and capacity allocation, making network design decisions in practice.

Designing global supply chain networks: The impact of globalization on supply chain networks, the offshoring decision: total cost, risk management in global supply chains, discounted cash flows. evaluating network design decisions using decision trees, to onshore or offshore: evaluation of global supply chain design decisions under uncertainly, making global supply chain design decisions under uncertainty in practice.

Unit-IV

Managing economies of scale in a supply chain: Cycle inventory, Ihe role of cycle inventory in a supply chain, estimating cycle inventory—related costs in practice, economies of scale to exploit fixed costs, economies of scale to exploit quantity discounts, short-tern discounting: trade promotions, managing mull- echelon cycle inventory.

Managing uncertainty in a supply chain: Safely inventory, the role of safety inventory in a supply chain, determining the appropriate level of safety inventory, impact of supply uncertainty on safety inventory, impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, managing safety inventory in a multie-chelon supply chain, the role of IT in inventory management,

estimating and managing safety inventory in practice.

Text books:

Supply chain Management: Strategy, Ranning and Operations - Chopra, S., and Meindl, P., Fish Edition, Pearson Education (Singapore) Re. Ltd, 2004.

Designing & Managing Ihe Supply Chain: Concepts, Strategies & Case studies - Simchi-Levi, P., Kaminsky, Ravi Shankar, E., Third Edition, Tata McGraw-Hill Edition, 2003.

Reference books:

Purchasing and Supply Chain Management: Text and Cass - Doebler. D.W. and 8urt, D.N., McGraw•HiII Publishing Company Limited, New Delhi, 1996.

Supply Chain Management for Competitive Advantage - Rangaraj, TMH.

B23-OEC-406	Mobile App Development						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester exam**	**Internal Assessment**	**Total**	**Time**
3	0	0	3	70	30	100	3
Purpose	**To introduce the concepts of developing the mobile applications.**						
	Course Outcomes (CO)						
CO1	Be exposed to technology and Mobile apps development aspects.						
CO2	Be competent with the characterization and architecture of mobile applications.						
CO3	Appreciation of nuances such as native hardware play, location awareness, graphics, and multimedia.						
CO4	Perform testing, signing, packaging and distribution of mobile apps.						

Unit 1: Introduction to Mobility

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, challenges of Android app development, versions of Android, why develop apps for android, Setting up the Mobile App Development environment along with an Emulator.

Mobile Platforms: URIs for mobile apps, Compare and contrast native mobile platforms such as tightly controlled (IPhone), open (Android), and licensed (Windows Mobile), web as a mobile application platform.

Unit II: Building blocks of Mobile

Activities, Activity life cycle and interaction between activities, App User Interface Designing – User Interaction, user input controls, Mobile UI resources (Layout, UI elements, Drawable, Menu)screen navigation, Recycle view. App functionality beyond user interface - Threads, Async task, Services – States and Life Cycle, Notifications, Broadcast receivers, Content provider.

Unit III: Sprucing up Mobile Apps

Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, transferring data efficiently.Graphics and animation – Custom views, Canvas, Animation APIs, Multimedia – Audio/Video playback and record, Location awareness.

Native data handling –file I/O, Shared preferences, shared data through content provider, Mobile databases such as SQLite, and Enterprise data access (via Internet/Intranet).

Unit IV: Testing and Launching Mobile Apps

Debugging mobile apps, White box testing, Black box testing, and test automation of Mobile apps, JUnit for Android. Loading data using loaders, Permissions, Performance and Security, Firebase and AdMob and publish.

Suggested Books:

1. Barry Burd, *Android Application Development All in one for Dummies*, Wiley publications, 2nd Edition 2015.
2. Android Developer Fundamentals Course– Concepts (Learn to develop Androidapplications) Concepts Reference *Developed by Google Developer Training Team, 2016.*
3. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
4. Rick Boyer, Kyle Mew,Android Application Development Cookbook - SecondEdition,2016.
5. Carmen Delessio, Lauren Darcey, Teach Yourself Android Application Development In24 Hours , SAMS, 2013.

6. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009.
7. Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, 2010.

B23-OEC-408	ELECTRIC VEHICLES						
L	T	P	Credit	End Semester exam	Internal assessment	Total	Time
3	-	-	3	70	30	100	3h
Purpose	To familiarize the students with the Electric Vehicles basics and configuration.						
Course Outcomes							
CO1	To understand the basics of electric vehicle, history ,components & properties of batteries.						
CO 2	To understand the electrical machine properties and classifications.						
CO 3	To understand the properties of electric vehicle drive systems.						
CO 4	To understand the concepts of hybrid electric vehicles						

Unit 1

Introduction to Electric vehicles: Present scenario of electric vehicles, Need of Electric Vehicles, Economic and environmental impacts of using Electrical vehicles. Challenges faced by electric vehicles to replace ICE. Major requirements of electric vehicles. Types of electric vehicle , Pure Electric Vehicle (PEV): Battery Electric vehicle, Fuel Cell electric vehicle (FCEV), Hybrid Electric vehicle (HEV) . Challenges of Battery Electric vehicle.

Unit 2

Battery Electrical vehicle : Components of BEV drive train, The electric propulsion subsystem - Power converter , Driving wheels , Suspension system, Driveshaft, Mechanical transmission , Electric Motor, power electronics converters (DC-AC/DC-DC), The electronic control unit (ECU). The energy source subsystem - Battery pack with Battery Management System, On board charger, The auxiliary subsystem -Power steering unit, Common parts between ICE drive train and EV drive train.

Unit 3

Hybrid Electrical vehicle and Fuel cell electric vehicle: Hybrid Electric vehicle (HEV) -Basic architecture of hybrid drive trains, Components of HEV drive train system. Classification of HEVFuel efficiency in HEV. Fuel cell electric vehicle (FCEV) -Basic architecture of FCEV. Components of FCEV drive train system.

Unit 4

Energy Storage: Battery based energy storage, Overview of batteries, Battery Parameters, Battery Charging, regenerative braking, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, and flywheels.

List of Books:

1. Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018.
2. Electric & Hybrid Vehicles – Design Fundamentals – Iqbal Hussain, 2nd Edition, CRC Press.
3. Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals –Ehsani, CRC Press.
5. Electric Vehicle Battery Systems – Sandeep Dhameja, Newnes, 2000.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-OEC-410	Gender Equality at workplace						
Lecture (Hrs.)	**Tutorial (Hrs.)**	**Practical (Hrs.)**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To introduce basic concepts relating to gender and to provide logical understanding of gender roles.							
Course Outcomes (CO): At the end of the course, students will be able to							
CO1	Describe the social construction of gender and sexuality and their influence in social context. (Understand)						
CO2	Analyze how the concepts of gender equality are created, maintained, and/or challenged.						
CO3	Apply concepts of gender roles and equality in classroom, school, disciplinary or interdisciplinary creative, scholarly, and/or activist project.						

UNIT I

GENDER SENSITIZATION: Definition of gender, Perspectives-Gender sensitive approach- Gender and sex- Social construction of gender and gender roles- Socialization- institutions of socialization- changing content and context of gender-need for re-socialization. Gender Stereotyping and Gender Discrimination.

UNIT II

GENDER EQUALITY AND CONSTITUTION: Indian constitution related to equality - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation - cultural and educational rights - the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers- Internal Complaints Committee - Legal AID cells, Help line, State and National level Commission.

UNIT III

GENDER ROLES & EQUALITY: Gender & Morality – Structural and functionalist views of Gender- Gender in the Classroom- Beyond access for girls and boys- Gender equality in schools- Gender equality and adult basic educationDeveloping capacity to achieve gender equality in education- Individuality and removal of gender stereotypes- Respect for each other‟s-Promote equal opportunity.

REFERENCES: 1. Sheila Aikman and Elaine Unterhalter, “Practising Gender Equality in Education”, Oxfam GB, 2007.

2. Pasadena and Hackensack, “Gender roles and Equality”, Salem Press,2011.

B23-BSC-202	COMPLEX VARIABLES AND STATISTICS						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 h**
Purpose	To familiarize the prospective students with complex variables which is widely used in the field of Signal Processing and Electromagnetic, and the concept of probability& statistics to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.						
Course Outcomes							
CO1	To introduce the tools of differentiation and integration of functions of complex variable those are used in various techniques dealing engineering problems.						
CO 2	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.						
CO 3	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications..						
CO4	To make the students familiar about basic statistics including measures of central tendency, measures of dispersion, correlation, and regression.						

UNIT-I (08 Hrs)

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, findingharmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) andtheir properties;

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (withoutproof), Taylor's series,zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

UNIT-II (10 Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-III (10 hrs)

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV (12 hrs)

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8.Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECE-412	**Project-III**						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Time
-	-	24	12	200	200	400	3 Hrs.
Course Outcomes (CO) Upon completion of the course, students will be able to							
CO1	Identify a problem statement from a rigorous literature survey or the industry requirements analysis.						
CO2	Simulate and design a solution for the identified problem by applying acquired technical knowledge.						
CO3	Develop and test the prototype/algorithm to solve the complex engineering problem.						
CO4	Present project work orally and through a comprehensive report.						

Project-III Guidelines: After interactions with project guides/industry experts, based on a comprehensive literature survey/ Industry requirements analysis, the student shall identify the title and define the aim and objectives of a project. The student is expected to work on details specifications, methodology, resources required, critical issues in design and implementation, and submit the project proposal within the first two weeks of semester. The student is expected to work on the design, development, and testing of the proposed project work as per the schedule. The project report is to be submitted at the end of the semester. This report includes a summary of the literature survey, detailed objectives, project specifications, design, proof of concept, developed system/Algorithm, results, contributions, and innovations in project work.

Authorization to Approve Specialization for Students in Emerging Areas

In view of the introduction of new courses in emerging areas as part of the B.Tech. Honors with Specialization/Minor Degree scheme at UIET, Kurukshetra University, the Department of Electronics and Communication Engineering (ECE) seeks approval from the Board of Studies to authorize the department to approve new modified subjects in particular specialization. This is to accommodate the evolving academic landscape and ensure that students can pursue specializations in line with newly introduced courses each semester.

The ECE Department shall be authorized to approve this for specialization with amended subjects of students based on the courses modified in the curriculum each semester. The department shall have the flexibility to approve new or modified courses offered through SWAYAM or other recognized platforms, subject to the approval of the Board of Studies/Academic Council. Approval of this proposal will ensure that the department can promptly adapt to changes in the academic curriculum and provide students with relevant and updated specialization options.

Modified List of Swayam courses as per available on MOOC platform for the award of honors with specialization/Minor degree in ECE

1. 5G Wireless Standard Design
2. Analog Communication
3. An introduction to coding theory
4. Analog electronics circuits
5. Analog VLSI Designs
6. Analysis and Design Principles of Microwave Antennas
7. Applied Electromagnetics for Engineering
8. Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning
9. Arduino
10. Basics of Software Defined Radios and Practical Applications
11. Biomedical Ultrasound: Fundamentals of Imaging and Micromachined Transducers
12. Charging Infrastructure
13. Control Engineering
14. Control and Tuning Methods in Switched Mode Power Converters
15. Cryogenic Electronics for Quantum Computing
16. Digital circuits
17. Design of Photovoltic Circuits
18. Digital Image Processing
19. Digital speech Processing
20. Digital Switching
21. Distributed Optimization and Machine Learning
22. Design and Simulation of Power Conversion using Open Source Tools
23. ESim - EDA tool for circuit design, simulation, analysis and PCB design
24. Electrical Measurement and Electronic Instruments
25. Electromagnetic Theory
26. Electronic Modules for Industrial Applications using Op-Amps
27. Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software
28. Electronics System for Cancer diagnosis
29. Electronics & IoT design workshop
30. Enclosure Design of Electronics Equipment
31. Fibre Optic Communication Technology
32. Fabrication Techniques for MEMs-based Sensors: Clinical Perspective
33. Foundations of Virtual Reality
34. Fundamentals of Micro and Nanofabrication
35. Fundamentals of Nano and Quantum Photonics
36. Fundamentals of Wireless Communication (Hindi)
37. Introduction to Adaptive Signal Processing

38. Introduction to Large Language Models (LLMs)
39. Introduction to Microwave and Optical Metamaterials
40. Introduction to Photonics
41. Introduction to Semiconductor Devices
42. Introduction to Wireless and Cellular Communications
43. Low Voltage CMOS Circuit Operation
44. Machine Learning and Deep Learning - Fundamentals and Applications
45. Microelectronics: Devices to Circuits
46. Microsensors and Nanosensors
47. Microwave Engineering
48. Modern Digital Communication techniques
49. Nanobiophotonics: Touching Our Daily Life
50. Nanophotonics, Plasmonics, and Metamaterials
51. Neural Networks for Signal Processing
52. Optical Engineering
53. Optimization Theory and Algorithms
54. Passive Microwave Circuits, Devices, and Measurements
55. Pattern Recognition and application
56. Phase locked loop
57. Photonic Crystals: Fundamentals & Applications
58. Physical Modelling for Electronics Enclosures using Rapid prototyping
59. Power Electronics Applications in Power Systems
60. Power Electronics with Wide Band Gap Devices
61. Principles and Techniques of Modern Radar Systems
62. Principles of Digital Communication
63. Principles of Modern CDMA/ MIMO/ OFDM Wireless Communications
64. RFIC Design
65. Real Time Digital signal processing
66. Sensor Technologies: Physics, Fabrication, and Circuits
67. Signal Processing Algorithms and Architectures
68. Signal Processing for mm Wave Communication for 5G and Beyond
69. Simulation of Communication Systems using Matlab
70. Stochastic control and communication
71. System Design through Verilog
72. VLSI Design flow: RTL to GDS
73. VLSI Interconnects
74. Digital Switching