DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. FOURTH YEAR

ELECTRONICS ENGINEERING
ELECTRONICS AND COMMUNICATION ENGINEERING
ELECTRONICS AND TELECOMMUNICATION ENGINEERING

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

B.Tech. VII Semester
Electronics and Communication Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KHU701/KHU702	HSMC -1 #/HSMC-2 #	3	0	0	30	20	50		100		150	3
2.	KEC-071-074	Department Elective –IV	3	0	0	30	20	50		100		150	3
3.	KEC-075-076	Department Elective –V	3	0	0	30	20	50		100		150	3
4.		Open Elective-II	3	0	0	30	20	50		100		150	3
5.	KEC-751X	Lab for Department Elective -	0	0	2				25		25	50	1
6.	KEC-752	Mini Project or Internship Assessment**	0	0	2				50			50	1
7.	KEC-753	Project I	0	0	8				150			150	4
		MOOCs (Essential for Hons. Degree)											
		Total										**850**	**18**

Course Code	Course Title
	Department Elective-IV
KEC-071	Digital Image Processing
KEC-072	VLSI Design
KEC-073	Optical Network
KEC-074	Microwave & Radar Engineering
	Department Elective-V
KEC-075	Information Theory & Coding
KEC-076	Wireless & Mobile Communication
KEC-077	Micro & Smart Systems
KEC-078	Speech Processing

Course Code	***Elective Lab
KEC751A	Digital Image Processing Lab
KEC751B	VLSI Design Lab
KEC751C	Optical System and Networking Lab
KEC751D	Microwave & Radar Engineering Lab

***Students will opt one subject from the list of Department Elective-IV with its corresponding lab. i.e. if someone has opted Digital Image Processing (KEC071) from Department Elective-IV then it will be mandatory to opt the DIP Lab (KEC751A).

B.Tech. VIII Semester
Electronics and Communication Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semeste		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KHU801/KHU802	HSMC -1 #/HSMC-2 #	3	0	0	30	20	50		100		150	3
2.		Open Elective –III	3	0	0	30	20	50		100		150	3
3.		Open Elective –IV	3	0	0	30	20	50		100		150	3
4.	KEC-851	Project II	0	0	18				100		300	400	9
		MOOCs (Essential for Hons.											
		Total										**850**	**18**

B.Tech 4rd Year
VII Semester
Syllabus

KEC-071	Digital Image Processing	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction:** Overview of Image Processing, Application area of image processing, Digital Image Representation, Types of images, Digital Image Processing Operations, Fundamental steps in DIP, Overview of Digital Image Systems, Physical Aspect of Image Acquisition, biological Aspect of Image Acquisition, sampling & quantization, Digital Halftone Process, Image storage and File formats.	8
II	**Image Enhancement:** Need for image enhancement, Image enhancement operations, Image enhancement in spatial domain, histogram based techniques, Spatial Filtering concepts, Image smoothing and sharpening spatial and frequency domain filters, homomorphic filtering. **Image Restoration:** Introduction to degradation, types of Image degradations, image degradation models, noise modeling, estimation of degradation functions, Image restoration in presence of noise only, periodic noise and band pass and band reject filtering, difference between enhancement & restoration, Image restoration techniques.	8
III	**Image Transforms:** Need for image transforms, Properties of Fourier transform, Discrete cosine transform, Discrete sine transform, Hadamard transform, Haar transform, Slant transform, SVD and KL transforms.	8
IV	**Image Compression:** Image compression model, type of redundancy, compression algorithms and its types, lossless compression algorithms, lossy compression algorithms, image and video compression standards.	8
V	**Image Segmentation:** Introduction, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, corner detection, Principle of thresholding, Principle of region - growing.	8

Text Book:

1. Rafael C. Gonzalez Richard E woods Steven L. Eddins, ‘‘Digital Image Processing’’, Mc Graw Hill, 3rd Edition, 2008.
2. Anil K Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India Pvt. Ltd, 1989.

Reference Books:

1. Jayaraman, “Digital Image Processing”, Tata Mc Graw hill Education, India, 2009.
2. S. Sridhar, “Digital Image Processing”, OXFORD University Press, Second Edition, 2011.

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

1. Describe the concept and need for image processing.
2. Implement the various techniques for image enhancement and restoration both in spatial and frequency domains.
3. Interpret the various types of image transforms and their properties.
4. Distinguish between lossless and lossy image compression algorithms and examine their performances in spatial and frequency domains.
5. Examine the various image segmentation techniques.

KEC-072	VLSI Design	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction:** VLSI Design flow, general design methodologies; critical path and worst case timing analysis, overview of design hierarchy, layers of abstraction, integration density and Moore's law, VLSI design styles, packaging, CMOS Logic, Propagation Delay definitions, sheet resistance.	8
II	**Interconnect Parameters:** Resistance, Inductance, and Capacitance, skin effect and its influence , lumped RC Model, the distributed RC Model, transient Response, RC delay model, Linear Delay Model, Logical Effort of Paths, Scaling.	8
III	**Dynamic CMOS design:** steady-state behavior of dynamic gate circuits, noise considerations in dynamic design, charge sharing, cascading dynamic gates, domino logic, np-CMOS logic, problems in single-phase clocking, two-phase non-overlapping clocking scheme, Sequential CMOS Logic Circuits, Layout design.	8
IV	**Semiconductor Memories:** Dynamic Random Access Memories (DRAM), Static RAM, non-volatile memories, flash memories, Pipeline Architecture. Low – Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling,	8
V	**Introduction to Testing:** Faults in digital circuits. Modeling of faults, Functional Modeling at the Logic Level, Functional Modeling at the Register, Structural Model and Level of Modeling. Design for Testability, Ad Hoc Design for Testability Techniques, Controllability and Observability, Introduction to Built-in-self-test (BIST) Concept.	8

Text Book:

1. Sung-Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis & Design",Mcgraw Hill, 4th Edition.
2. Neil H.E.Weste, David Money Harris, "CMOS VLSI Design – A circuits and Systems Perspective" Pearson, 4th Edition.
3. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design: Systems and Circuits", PHI, 3rd Ed.,1994.

Reference Books:

1. R. J. Baker, H. W. Li, and D. E. Boyce , " CMOS circuit design, layout, and simulation", Wiley-IEEE Press,2007.
2. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design" , Jaico Publishing House.

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

1. Express the concept of VLSI design and CMOS circuits and delay study.
2. Analyze mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits.
3. Design and analyze various combinational & sequential circuits based on CMOS technology.
4. Examine power logic circuits and different semiconductor memories used in present day technology.
5. Interpret faults in digital circuits, Fault Models and various Testing Methodologies.

KEC-073	Optical Networks	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	Introduction to Optical Network:- Optical Networks: multiplexing techniques, second generation optical networks. The optical layer, optical packet switching. Transmission Basics: wavelength, frequencies and channel spacing, wavelength standards. Non linear Effects: Effective length and area, stimulated brillouin scattering, stimulated raman scattering, Propagation in a non linear medium, self phase modulation, cross phase modulation Four wave mixing	8
II	Components:-Couplers: Principles of operation, Conservation of energy, Isolators and circulators: Principles of operation Multiplexers and filters: Gratings, diffraction pattern, Bragg grating, Fiber gratings, Fabry-perot filters, multilayers dielectric thin – film filters, Mach-Zehnder interferometers, Arrayed waveguide grating, Acousto-optic tunable filter, High channel count multiplexer Architecture. Switching : large optical switches, Optical switch Technologies, large electronic switches wavelength converters: Optoelectronic Approch , optical grating, interferometric techniques wave mixing. Crosstalk: Intra-channel crosstalk, interchannel crosstalk, crosstalk in Networks, Bidirectional system crosstalk reduction.	8
III	Networks- SONET/SDH: Multiplexing, SONET/SDH layers, SONET Frame structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure. ATM: Function of ATM, Adaptation layers, Quality of service. IP: Routing and forwarding, QOS, WDM Network elements: Optical line terminals, Optical line amplifiers, Optical add/Drop multiplexers: Architecture, reconfigurable OADMS, Optical cross connects: All optical OXC configuration	8
IV	WDM Network Design Cost Trade-offs, Light path Topology Design, and Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks, Network Survivability, Basic Concepts, Protection in SONET/SDH, Protection in client layer, Optical Layer Protection, Different Schemes, Interworking between Layers, Access Networks, Network Architecture Overview, Enhanced HFC, FTTC, PON evolution	8
V	Optical Switching, OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Deployment Considerations- SONET/SDH core Network	8

Text Books:

1. R. Ramaswami, & K. N. Sivarajan, “Optical Networks a Practical perspective”,Morgan Kaufmann Publishers, 3rd Ed.
2. U. Black, “Optical Networks: Third Generation Transport Systems”/ PearsonEducations

Reference Books:

1. Biswanath Mukherjee “Optical WDM Networks” Springer Pub 2006

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

1. Express the multiplexing techniques, second generation optical networks, optical layer, and optical packet switching.
2. Explain the concept of Principles of operation, Conservation of energy, Isolators and Circulators: Principles of operation.
3. Classify the basics of Multiplexing, SONET/SDH layers, SONET Frame structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure.
4. Interpret the knowledge of Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks, Network Survivability.
5. Analyse the working of OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Deployment Considerations- SONET/SDH core Network.

KEC-074	Microwave & Radar Engineering	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Transmission Line:** Transmission line equations & solutions, reflection and transmission coefficient, standing wave, standing wave ratio, line impedance and admittance, Introduction to strip lines, Microstrip Transmission line (TL). **Wave Guide:** Rectangular Wave guide -Field Components and Parameters, TE, TM Modes, Dominant Mode, Circular Waveguides: TE, TM modes. Wave Velocities, Wave guide Cavities.	10
II	**Passive microwave devices:** Microwave Junctions and Couplers, Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circ ulators. S parameter analysis of all components.	8
III	**Microwave tubes :** Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications.	7
IV	**Microwave Measurements:** Measurement of Insertion Loss, Frequency, Cavity Q, Dielectric Constant, Scattering Parameters, Noise Factors, Return Loss, Impendence; VSWR Metering and Measurement, High Power Measurement; Power Meters, Microwave Amplifiers.	7
V	**Introduction to RADAR systems:** RADAR Block diagram, RADAR Range equation, Probability of detection of false alarm, Integration of RADAR pulses, RADAR cross section of targets, MTI RADAR, CW RADAR.	8

Text Books:

1. Liao, S.Y., " Microwave Devices & Circuits", 3rd Edition, Prentice Hall of India Publication, 1995.
2. Sushrut Das, "Microwave Engineering", 1st Edition, Oxford University Publication, 2015.
3. M.I. Skolnik, "Introduction to Radar Engineering ", 3rd Edition, Tata McGraw Hill Publication, 2001.

Reference Books:

1. A Das and S.K. Das, "Microwave Engineering", 1st Edition, Tata McGraw Hill Publication, 2000.

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

1. Analyze various parameters and characteristics of the transmission line and waveguide and also use of wave guide component as per applications.
2. Describe, analyze and design simple microwave circuits and devices e g couplers, Attenuators, Phase Shifter and Isolators. Student will also understand the microwave propagation in ferrites.
3. Analyze the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
4. Acquire knowledge about the handling and measurement of microwave equipment.
5. Differentiate different Radars, find applications and use of its supporting systems.

KEC-075	Information Theory & Coding	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Entropy**: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy and Mutual Information, Jensen's Inequality and Its Consequences, Log Sum Inequality and Its Applications, Data-Processing Inequality, Fano's Inequality.	8
II	**Asymptotic Equipartition Property**: Asymptotic Equipartition Property Theorem. **Consequences of the AEP:** Data Compression, High-Probability Sets and the Typical Set Data Compression: Examples of Codes, Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Optimality of Huffman Codes, Shannon–Fano–Elias Coding.	8
III	**Channel Capacity:** Channel Capacity for Various Binary Channels, Symmetric Channels, Properties of Channel Capacity, Preview of Channel Coding Theorem, Jointly Typical Sequences, Channel Coding Theorem, Channel capacity Theorem.	8
IV	**Block Codes:** Introduction to block codes, Single-parity check codes, Product codes, Repetition codes, Hamming codes, Minimum distance of block codes, Soft-decision decoding, Automatic-repeat-request schemes. **Linear Block codes:** Definition of linear Block Codes, Generator matrices, Standard array, Parity-check matrices, Error detection and correction.	8
V	**Convolution codes:** Encoding convolutional codes, Generator matrices for convolutional codes, Generator polynomials for convolutional codes, Graphical representation of convolutional codes, Viterbi Algorithm, Binary Cycle Codes, BCH codes. RS codes, Golay codes.	8

Text Books:

1. Bose, Information Theory, Coding and Cryptography, McGraw-Hill Education, 3rd Edition, (2016).
2. Joy A. Thomas, Thomas M. Cover, "Elements of information theory", Wiley-Interscience; 2nd edition (July 18, 2006).
3. S. Gravano, "Introduction to Error Control Codes" OUP Oxford (24 May 2001).
4. Robert B. Ash, "Information Theory", Dover Publications (November 1, 1990).
5. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms " Wiley, 2005.

Reference Books:

1. Simon Haykin, "Digital communication", John Wiley.
2. Ranjan Bose, "ITC and Cryptography", Tata McGraw-Hill.
3. Roberto Togneri, Christopher J.S deSilva, "Fundamentals of Information Theory and Coding Design", CRC Press.

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

1. Explain each block involved in digital communication thoroughly with applications.
2. Apply the knowledge of basic concepts of probability and entropies to analyze the behavior of a communication system.
3. Analyze the use of source coding and evaluating all the techniques of source coding.
4. Examine the significance of channel coding and evaluating all available techniques of channel coding and decoding with challenges.
5. Examine various error control coding techniques.

KEC-076	Wireless and Mobile Communication	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Wireless Communication Fundamentals:** Evolution of mobile radio communication fundamentals. General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing; Wireless Channel Modeling: AWGN Channel, Rayleigh Channel, Rician Fading Channel, Nakagami Fading Channel, Ocumura and Hata Path Loss Model; Channel Modeling: Stochastic, Flat Fading, Wideband Time-Dispersive Channel Modeling.	8
II	**Spread Spectrum and Diversity:** Theory of Vocoders, Types of Vocoders; Spread Spectrum Modulation, Pseudo-Noise Codes with Properties and Code Generation Mechanisms, DSSS and FHSS Systems, Time Hopping and Hybrid Spread Systems; Multicarrier Modulation Techniques, Zero Inter Symbol Interference Communication Techniques, Detection Strategies, Diversity Combining Techniques: Selection Combining, Threshold Combining, Equal Gain Combining, Maximum Ratio Combining; Spatial Diversity and Multiplexing in MIMO Systems, Channel Estimation.	8
III	**Equalization and Multiple Access:** Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms; Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, SC- FDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.	8
IV	**Cellular Networks:** GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA Based Standards: IS 95 to CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication.	8
V	**Other Wireless Networks:** Introduction to Mobile Adhoc Networks, Bluetooth, Wi-Fi Standards, WiMax Standards, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 4G & 5G and concept of NGN.	8

Text Books:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson Publications, Second Edition.
2. Upena Dalal, "Wireless Communication and Networks", Oxford Press Publications, first edition.
3. T L Singal, "Wireless Communications", McGraw Hill Publications, 2010.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.

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

1. Express the basic knowledge of mobile radio & cellular communication fundamentals and their application to propagation mechanisms, path loss models and multi-path phenomenon.
2. Analyze the performance of various voice coding and diversity techniques.
3. Apply the knowledge of wireless transmission basics to understand the concepts of equalization and multiple access techniques.
4. Examine the performance of cellular systems being employed such as GSM, CDMA and LTE using various theoretical and mathematical aspects.
5. Express basic knowledge of Mobile Adhoc networks and the existing & upcoming data communication networks in wireless and mobile communication domain.

KEC-077	Micro and Smart Systems	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Miniaturization:** Introduction, Need of miniaturization, Microsystems versus MEMS, Need of micro fabrication, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems.	8
II	**Micro sensors, actuators, systems and smart materials:** Silicon capacitive accelerometer, piezo-resistive pressure sensor, conductometric gas sensor, an electrostatic combo -drive, a magnetic micro-relay, portable blood analyzer, piezoelectric inkjet print head, micro-mirror array for video projection, smart materials and systems.	8
III	**Micromachining technologies:** Silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.	8
IV	**Modeling of solids in Microsystems:** Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses. **Modeling of coupled electromechanical systems:** Electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro-mechanics.	8
V	**Integration of micro and smart systems:** Integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.	8

Text Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Aatre, "Micro and smart systems", Wiley India, 2010.
2. S Nihtianov, A. Luque "Smart Sensors and MEMS", Woodhead publishing limited 2014.

E - Resources: https://nptel.ac.in/courses/112/108/112108092/

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

1. Interpret the need of Microsystems and Miniaturization.
2. Design the smart materials, actuators and Micro sensors.
3. Interpret the Micromachining Technologies.
4. Analyze the modeling of solids in Microsystems.
5. Evaluate the case studies of mart systems.

KEC-078	Speech Processing	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Digital models for speech signals**: Mechanism of speech production & acoustic phonetics, the acoustic theory of speech production, lossless tube models, and digital models for speech signals.	6
II	**Time domain methods of speech sampling**: Time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, discrimination between speech & silence, pitch period estimation using parallel processing, short time autocorrelation function & AMDF, pitch period estimation using autocorrelation function.	10
III	**Short time Fourier analysis**: Definition and properties, design of filter banks, implementation of filter bank summation method using FFT, spectrographic displays, pitch detection, analysis by synthesis phase, vocoder and channel vocoder.	8
IV	**Homomorphic speech processing**: Homomorphic system for convolution, complex cepstrum of speech, pitch detection using Homomorphic processing, formant estimation, Homomorphic vocoder.	6
V	**Linear predictive coding of speech**: Basic principles of linear predictive analysis, the autocorrelation method, computation of the gain for the model, solution of LPC equations for auto correlation method, prediction error and normalized mean square error, frequency domain interpretation of mean squared prediction error relation of linear predictive analysis to lossless tube models, relation between various speech parameters, synthesis of speech from linear predictive parameters, application of LPC parameters.	10

Text Book:

1. R. L. Rabiner & R.W. Schafer, "Digital Processing of speech signals", Pearson Education, 2004.
2. B. Gold and Nelson Morgon, "Speech and audio signal processing", Wiley India Edition, 2006.

Reference Books:

1. D O Shaughnessy, "Speech Communication: Human and Machine" May 29, 2012.
2. J L Flanagan, "Speech Analysis, Synthesis and Perception" October 11, 2012.
3. John Coleman, "Digital Speech Processing: Synthesis, and Recognition" by Sadaoki Furui, "Introducing Speech and Language Processing" 2nd edition, November 17, 2000.

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

1. Describe the mechanism of speech production & acoustic phonetics, the acoustic theory of speech production, lossless tube models.
2. Explain time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate.
3. Design filter banks, implement filter banks and perform summation method using FFT.
4. Evaluate homomorphic system for convolution, complex cepstrum of speech, pitch detection using Homomorphic processing.
5. Interpret the basic principles of linear predictive analysis, the autocorrelation method, computation of the gain for the model, solution of LPC equations.

KEC-751A	Digital Image Processing Lab	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Introduction to MATLAB Image Processing Toolbox.
2. Write a MATLAB program to learn the basic image processing operations.
3. Write a MATLAB program for geometric transformation.
4. Write a MATLAB program for image enhancement using Histogram equalization.
5. Write a MATLAB program to perform smoothing or averaging filter in spatial domain.
6. Write a MATLAB program to perform smoothing or averaging filter in frequency domain.
7. Write a MATLAB program for image restoration.
8. Write a MATLAB program of sharpening of image using gradient mask.
9. Write a MATLAB program for performing morphological operations on the image.
10. Write a MATLAB program to fill the region of interest of the image.
11. Write a MATLAB program for edge detection of an image.
12. Write a MATLAB program for DCT based image compression.
13. Write a MATLAB program to remove high frequency components in the image using frequency domain approach.

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

1. Explain image processing operations using MATLAB tool.
2. Evaluate the appropriate methods for image enhancement and image restoration.
3. Formulate spatial and frequency domain filters to obtain better quality image.
4. Select various attributes of image such as texture and edges from the image.
5. Design and develop the applications of transforms such as DCT and wavelet.

KEC-751B	VLSI Design Lab	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Design and analysis of basic of logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR.
2. Design and implementation of Half adder and Full adder using CMOS logic.
3. To simulate the schematic of the common drain amplifier.
4. To simulate the schematic of the differential amplifier.
5. To simulate the schematic of the operational amplifier.
6. Design of 3-8 decoder using MOS technology.
7. Design a 4:1 Multiplexer.
8. Design and implementation of Flip flop circuit.
9. Layout design of PMOS, NMOS transistors.
10. Layout design of CMOS inverter and its analysis.

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

1. Designing of logic gates.
2. Implementation of combinational and sequential circuits using CMOS logic.
3. Analyze amplifier circuits.
4. Design sequential circuits such as flip flop.
5. Do the layout designing for physical analysis of the MOS transistor and MOS based circuits.

KEC-751C	Optical System & Networking Lab	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

Part - A

1. Familiarisation of different types of cables and different commands.
   a) Identify Cat5 cable , RJ 45 Connector , Crimping Tool , Wire Stripper
   b) Use Wire Stripper for Cutting wire shield and Understanding of Internal Structure of Cat5 Cable
   c) Finding Pin No-1 on RJ 45 Connector and Inserting Wires in connector
   d) Crimping of RJ45 connector using Crimping tool
   e) Preparation of Straight cable (used for Dissimilar devices such as PC to Switch , PC to router) and Cross cables (used for similar devices such as PC to PC , Router to Router, Switch to Switch)
   f) Understand different commands like ping, teacart, if config, dig etc..
2. Making a subnet and configuring router
   a) Understand the working of a router & method to access the router via console or using telnet, different types of cables used for connectivity.
   b) Different types of show commands & their purpose.
   c) Assignment of IP address and enabling layer 3 connectivity.
   d) Implement sub netting
3. Configuring web and DHCP servers
   a) Understand Internet Information Services tool and its installation.
   b) To configure web services using IIS tool.
   c) Configure DHCP
4. Configuring VLAN
   a) Understand the configuration of Vlan in a switch
   b) How to make the port of a switch as an access port & a trunk port, purpose of the Vlan ina network
   c) Different types of show commands & their purpose.
5. To implement a simple file transfer protocol (FTP) using connection oriented and connectionless sockets.
6. To develop a concurrent file server that spawns several threads, one for each client requesting specific file.
7. To develop a simple chatting application using (i) Connection oriented and (ii)Connectionless sockets

Part – B

1. To setting up fiber optic analog link.
2. Study and measurement of losses in optical fiber.
3. Study and measurement of numerical aperture of optical fiber.
4. Study and perform time division multiplexing (digital).
5. Study of framing in time division multiplexing.
6. Study of Manchester coding and decoding.
7. Study of voice coding and codec chip.
8. Study and measure characteristics of fiber optic LED’s and photo detector.

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

1. Define the concept of Optical Systems and Networking.
2. Indentify the various types of cables, connectors, routers and switches.
3. Design the various networking protocols.
4. Create various fiber optic link.
5. Interpret the basic knowledge of multiplexing and coding-decoding.

KEC-751D	Microwave & Radar Engineering Lab	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. To study microwave test bench.
2. To study the characteristics of reflex klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working on TE01 mode.
4. To study measurement of reflection coefficient and standing wave ratio using double minima method.
5. a) To study isolation and coupling coefficient of a magic Tee.
   b) To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
6. To study V-I characteristic of Gunn diode.
7. To measure an unknown impedance with Smith chart.
8. a) To measure attenuation and insertion loss of a fixed and variable attenuator.
   b) To measure isolation and insertion loss of a three port Circulators/Isolator.
9. Study of Attenuator (Fixed and Variable type).
10. To Study working of Doppler radar, and measure the velocity of the object moving in the Radar range.

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

1. Describe working on microwave testing bench.
2. Practically demonstrate the Characteristics of Reflex klystron using Microwave bench setup.
3. Demonstrate the performance of the Gunn diode using Microwave bench setup.
4. Perform measurement of Frequency, attenuation, VSWR, Impedance of microwave passive device using Klystron Bench Setup.
5. Interpret the basics of Smith chart for solution of transmission line problems and impedance matching.