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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
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<td>1.</td>
<td>KHU701/KHU702</td>
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<td>Department Elective –V</td>
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<td>5.</td>
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<td>Lab for Department Elective -</td>
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<td>6.</td>
<td>KEC-752</td>
<td>Mini Project or Internship Assessment**</td>
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</tbody>
</table>

**MOOCs (Essential for Hons. Degree)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEC-071</td>
<td>Digital Image Processing</td>
</tr>
<tr>
<td>KEC-072</td>
<td>VLSI Design</td>
</tr>
<tr>
<td>KEC-073</td>
<td>Optical Network</td>
</tr>
<tr>
<td>KEC-074</td>
<td>Microwave &amp; Radar Engineering</td>
</tr>
<tr>
<td>KEC-075</td>
<td>Information Theory &amp; Coding</td>
</tr>
<tr>
<td>KEC-076</td>
<td>Wireless &amp; Mobile Communication</td>
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<tr>
<td>KEC-077</td>
<td>Micro &amp; Smart Systems</td>
</tr>
<tr>
<td>KEC-078</td>
<td>Speech Processing</td>
</tr>
</tbody>
</table>

**Course Code**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEC751A</td>
<td>Digital Image Processing Lab</td>
</tr>
<tr>
<td>KEC751B</td>
<td>VLSI Design Lab</td>
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<tr>
<td>KEC751C</td>
<td>Optical System and Networking Lab</td>
</tr>
<tr>
<td>KEC751D</td>
<td>Microwave &amp; Radar Engineering Lab</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods</th>
<th>Evaluation Scheme</th>
<th>End Semeste</th>
<th>Total Credits</th>
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<td>Project II</td>
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MOOCs (Essential for Hons.

**Total**  

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</table>
B.Tech 4\textsuperscript{rd} Year
VII Semester
Syllabus
### KEC-071: Digital Image Processing

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Image Enhancement:</strong> 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. <strong>Image Restoration:</strong> 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 &amp; restoration, Image restoration techniques.</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td><strong>Image Transforms:</strong> Need for image transforms, Properties of Fourier transform, Discrete cosine transform, Discrete sine transform, Hadamard transform, Haar transform, Slant transform, SVD and KL transforms.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td><strong>Image Compression:</strong> Image compression model, type of redundancy, compression algorithms and its types, lossless compression algorithms, lossy compression algorithms, image and video compression standards.</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td><strong>Image Segmentation:</strong> Introduction, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, corner detection, Principle of thresholding, Principle of region - growing.</td>
<td>8</td>
</tr>
</tbody>
</table>

### Text Book:

### Reference Books:

### 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.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction</strong>: 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.</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td><strong>Interconnect Parameters</strong>: 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.</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td><strong>Dynamic CMOS design</strong>: 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.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td><strong>Semiconductor Memories</strong>: 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.</td>
<td>8</td>
</tr>
</tbody>
</table>

**Text Book:**

**Reference Books:**

**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.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>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</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Optical Switching, OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Deployment Considerations- SONET/SDH core Network</td>
<td>8</td>
</tr>
</tbody>
</table>

Text Books:

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.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Transmission Line:</td>
<td>Transmission line equations &amp; 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 Waveguide - Field Components and Parameters, TE, TM Modes, Dominant Mode, Circular Waveguides: TE, TM modes. Wave Velocities, Wave guide Cavities.</td>
<td>10</td>
</tr>
<tr>
<td>II Passive microwave devices:</td>
<td>Microwave Junctions and Couplers, Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components.</td>
<td>8</td>
</tr>
<tr>
<td>III Microwave tubes:</td>
<td>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.</td>
<td>7</td>
</tr>
<tr>
<td>IV Microwave Measurements:</td>
<td>Measurement of Insertion Loss, Frequency, Cavity Q, Dielectric Constant, Scattering Parameters, Noise Factors, Return Loss, Impedance; VSWR Metering and Measurement, High Power Measurement; Power Meters, Microwave Amplifiers.</td>
<td>7</td>
</tr>
<tr>
<td>V Introduction to RADAR systems:</td>
<td>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.</td>
<td>8</td>
</tr>
</tbody>
</table>

Text Books:

Reference Books:

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 waveguide 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

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Entropy:</strong> 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.</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td><strong>Asymptotic Equipartition Property:</strong> Asymptotic Equipartition Property Theorem. <strong>Consequences of the AEP:</strong> 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.</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td><strong>Channel Capacity:</strong> 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.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td><strong>Block Codes:</strong> 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. <strong>Linear Block codes:</strong> Definition of linear Block Codes, Generator matrices, Standard array, Parity-check matrices, Error detection and correction.</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td><strong>Convolution codes:</strong> 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.</td>
<td>8</td>
</tr>
</tbody>
</table>

### Text Books:

### Reference Books:

### 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.
<table>
<thead>
<tr>
<th>Unit</th>
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<tbody>
<tr>
<td>IV</td>
<td>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.</td>
<td>8</td>
</tr>
</tbody>
</table>
ELECTRONICS AND COMMUNICATION ENGINEERING

Text Books:

Reference Books:

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

<table>
<thead>
<tr>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Miniaturization:</strong> Introduction, Need of miniaturization, Microsystems versus MEMS, Need of micro fabrication, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems.</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td><strong>Micro sensors, actuators, systems and smart materials:</strong> 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.</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td><strong>Micromachining technologies:</strong> Silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td><strong>Modeling of solids in Microsystems:</strong> 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. <strong>Modeling of coupled electromechanical systems:</strong> Electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro-mechanics.</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td><strong>Integration of micro and smart systems:</strong> 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.</td>
<td>8</td>
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</tbody>
</table>

**Text Books:**

**E - Resources:** [https://nptel.ac.in/courses/112/108/112108092/](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 smart systems.
## KEC-078 Speech Processing

<table>
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<tr>
<th>Unit</th>
<th>Topics</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Digital models for speech signals</strong>: Mechanism of speech production &amp; acoustic phonetics, the acoustic theory of speech production, lossless tube models, and digital models for speech signals.</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td><strong>Time domain methods of speech sampling</strong>: Time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, discrimination between speech &amp; silence, pitch period estimation using parallel processing, short time autocorrelation function &amp; AMDF, pitch period estimation using autocorrelation function.</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td><strong>Short time Fourier analysis</strong>: 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.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td><strong>Homomorphic speech processing</strong>: Homomorphic system for convolution, complex cepstrum of speech, pitch detection using Homomorphic processing, formant estimation, Homomorphic vocoder.</td>
<td>6</td>
</tr>
<tr>
<td>V</td>
<td><strong>Linear predictive coding of speech</strong>: 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.</td>
<td>10</td>
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</tbody>
</table>

### Text Book:

### Reference Books:

### 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.
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.
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.
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 in a 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.
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.