



**Shirpur Education Society's**  
**R. C. Patel Institute of Technology,**  
**Shirpur**

*An Autonomous Institute*

Affiliated to DBATU, Lonere (M.S.),

Approved by AICTE, New Delhi and Govt. of Maharashtra

(DTE: EN - 5172)

Accredited by NAAC 'A' Grade, Bangalore.

**Course Curriculum Structure**  
**Electronics & Telecommunication Engineering**

**Final Year B. Tech**

**Batch: 2021-2025**

*With Effect from Academic Year 2024-25*




Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405


[www.rcpit.ac.in](http://www.rcpit.ac.in)

**Semester-VII (w.e.f. Academic Year 2024-25)**

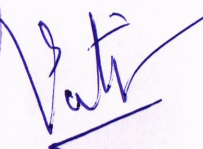
| Sr. No       | Course Category | Course Code | Course Title                           | Teaching Scheme |           |           | Evaluation Scheme          |           |           |           | Total      | Credit     |                      |
|--------------|-----------------|-------------|--|-----------------|-----------|-----------|----------------------------|-----------|-----------|-----------|------------|------------|----------------------|
|              |                 |             |  | L               | T         | P         | Continuous Assessment (CA) |           |           | ESE       |            |            |                      |
|              |                 |             |  |                 |           |           | TA                         | TT1       | TT2       |           |            |            | Average of TT1 & TT2 |
| A            | B               | C           | A+B+C                                  |                 |           |           |                            |           |           |           |            |            |                      |
| 1            | PC              | PCET7010T   | Mobile Communication System            | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 2            | PC              | PCET7010L   | Mobile Communication System Laboratory | --              | --        | 2         | 25                         | --        | --        | --        | 25         | 50         | 1                    |
| 3            | PC              | PCET7020T   | Microwave Engineering                  | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 4            | PC              | PCET7020L   | Microwave Engineering Laboratory       | --              | --        | 2         | 25                         | --        | --        | --        | 25         | 50         | 1                    |
| 5            | PE              | PEET703-T   | Professional Elective                  | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 6            | PE              | PEET703-L   | Professional Elective Laboratory       | --              | --        | 2         | 25                         | --        | --        | --        | 25         | 50         | 1                    |
| 7            | OE              | OEET704-T   | Open Elective                          | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 8            | PC              | PCET7050L   | IoT and Sensor Network Laboratory      | --              | --        | 2         | 25                         | --        | --        | --        | 25         | 50         | 1                    |
| 9            | PC              | PCET7060L   | Industrial Automation Laboratory       | --              | --        | 2         | 25                         | --        | --        | --        | 25         | 50         | 1                    |
| 10           | PJ              | PJET7070L   | Project Stage-II                       | --              | --        | 8         | 25                         | --        | --        | --        | 25         | 50         | 4                    |
| <b>Total</b> |                 |             |  | <b>12</b>       | <b>--</b> | <b>18</b> | <b>250</b>                 | <b>--</b> | <b>--</b> | <b>40</b> | <b>410</b> | <b>700</b> | <b>21</b>            |

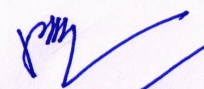
PC: Program Core, PE: Program Elective, OE: Open Elective, PJ: Project, TA: Teachers Assessment, TT1: Term Test-1, TT2: Term Test-2


  
Prepared By  
Bhushan V. Patil

  
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Dr. Prashant G Patil



  
BOS Chairman  
Prof. Dr. Vijay S. Patil

  
Dean Academics  
Prof. Dr. Pramod J. Deore  
Dean, Academics

  
COE  
Prof. S.P. Shukla  
Controller of Examination


  
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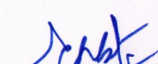
**Semester-VIII (w.e.f. Academic Year 2024-25)**

| Sr. No       | Course Category | Course Code | Course Title            | Teaching Scheme |           |           | Evaluation Scheme          |           |           |           | Total      | Credit     |                      |
|--------------|-----------------|-------------|-------------------------|-----------------|-----------|-----------|----------------------------|-----------|-----------|-----------|------------|------------|----------------------|
|              |                 |             |                         | L               | T         | P         | Continuous Assessment (CA) |           |           | ESE       |            |            |                      |
|              |                 |             |                         |                 |           |           | TA                         | TT1       | TT2       |           |            |            | Average of TT1 & TT2 |
|              |                 |             |                         |                 |           |           |                            |           |           |           |            |            | A                    |
| 1            | PE              | PEET801-T   | Professional Elective-1 | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 2            | PE              | PEET802-T   | Professional Elective-2 | 3               | --        | --        | 25                         | 10        | 10        | 10        | 65         | 100        | 3                    |
| 3            | INT             | INTET8030L  | Internship              | --              | --        | 20        | 150                        | --        | --        | --        | 150        | 300        | 10                   |
| <b>Total</b> |                 |             |                         | <b>6</b>        | <b>--</b> | <b>20</b> | <b>200</b>                 | <b>--</b> | <b>--</b> | <b>20</b> | <b>280</b> | <b>500</b> | <b>16</b>            |

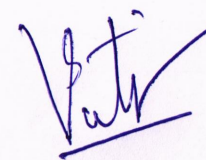
**PE:** Program Elective, **PJ:** Project, **TA:** Teachers Assessment, **TT1:** Term Test-1, **TT2:** Term Test-2

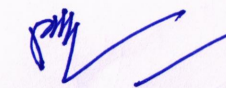
- \* Professional Elective Courses offered for the students doing Internship at institute level.
- # Professional Elective Courses offered for the students doing Internship at Industry. These courses are to be studied in self-study mode using NPTEL/Swayam platform.
- Students doing internship at industry shall submit certificate of NPTEL examination OR they have to appear examinations conducted by institute like TT1, TT2 and ESE.
- List of NPTEL courses will be declared by concerned BOS at the beginning of semester.

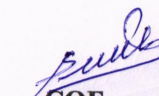
  
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| <b>Semester-VII - Professional Elective</b> |                    |   |
|---|--------------------|---|
| <b>Sr. No.</b>                              | <b>Course Code</b> | <b>Course Title</b>                         |
| 1   | PEET7031           | Radar Engineering                           |
| 2   | PEET7032           | Big Data Analytics                          |
| 3   | PEET7033           | Embedded Systems                            |
| 4   | PEET7034           | Fundamentals of Speech and Audio Processing |
| 5   | PEET7035           | Computer Vision                             |
| 6   | PEET7036           | SAS   |

| <b>Semester-VII- Open Electives</b> |                    |   |
|-------------------------------------|--------------------|---|
| <b>Sr. No.</b>                      | <b>Course Code</b> | <b>Course Title</b>                         |
| 1                                   | OEET7041           | Product Lifecycle Management                |
| 2                                   | OEET7042           | Big Management Information System           |
| 3                                   | OEET7043           | Operations Research                         |
| 4                                   | OEET7044           | Cyber Security and Laws                     |
| 5                                   | OEET7045           | Personal Finance Management                 |
| 6                                   | OEET7046           | Energy Audit and Management                 |
| 7                                   | OEET7047           | Disaster Management and Mitigation Measures |
| 8                                   | OEET7048           | Science of Well-being                       |
| 9                                   | OEET7049           | Research Methodology                        |
| 10                                  | OEET70410          | Public Systems and Policies                 |

| <b>Semester-VIII - Professional Elective-1</b> |                    |                                     |
|--|--------------------|-------------------------------------|
| <b>Sr. No.</b>                                 | <b>Course Code</b> | <b>Course Title</b>                 |
| 1  | PEET8011           | Wireless Network *                  |
| 2  | PEET8012           | Satellite Communication*            |
| 3  | PEET8013           | Advanced Digital Signal Processing* |
| 4  | PEET8014           | Microwave Integrated Circuits *     |
| 5  | PEET8015           | NPTEL/Swayam Course #               |

| <b>Semester-VIII - Professional Elective-2</b> |                    |  |
|--|--------------------|--|
| <b>Sr. No.</b>                                 | <b>Course Code</b> | <b>Course Title</b>                      |
| 1  | PEET8021           | Optical Communication*                   |
| 2  | PEET8022           | 5G Technology*                           |
| 3  | PEET8023           | Internet Engineering & Network Security* |
| 4  | PEET8024           | Machine Learning for Signal Processing*  |
| 5  | PEET8025           | NPTEL/Swayam Course #                    |

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Mobile Communication System (PCET7010T)</b>                    |                           |
| <b>Mobile Communication System Laboratory (PCET7010L)</b>         |                           |

**Pre-requisite:**

- Analog & Digital Communication
- Signals and Systems
- Computer Networks

**Course Objectives:**

- To understand the cellular fundamentals and different types of radio propagation models.
- To study the system architecture of 2G, 2.5 G and 3G.
- To develop the concepts of emerging technologies for 4 G standards and beyond.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Classify different types of propagation models.   | L2           | Understand         |
| CO2 | Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems. | L3           | Apply              |
| CO3 | Illustrate the fundamentals and system architecture of GSM, 2.5G, IS-95 and UMTS.             | L2           | Understand         |
| CO4 | Elaborate on the concepts and principles 4G network deployment and optimization.              | L3           | Apply              |
| CO5 | Identify the emerging technologies for upcoming mobile communication systems.                 | L4           | Analyze            |



**Unit-VI****Road map towards 5G****4 Hrs.**

Introduction 5G enabling technologies, Introduction to Femtocell, Femtocell Attributes, Femtocell Standards, Concept of Femtocells, Types of Femtocells Applications of Femtocells.

## **Mobile Communication System Laboratory (PCET7010L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Study of frequency reuse using Matlab/Scilab.
2. To study performance evaluation of handover for absolute signal strength measurement.
3. Tutorial based on fundamentals of frequency reuse and capacity of cellular communication system.
4. Implementation of adaptive modulation for wireless environment.
5. Study of Rayleigh and Ricean fading distribution using Simulink and computation of link budget using Okumura model.
6. Tutorial based on emerging technologies of 4G.
7. Tutorial based on 3GPP LTE.
8. Scilab Based GSM, CDMA Implementations.
9. Verify use of Orthogonal Walsh codes in CDMA environment.
10. Tutorial based on Propagation Models.

### **Text Books**

1. Theodore S. Rappaport, Wireless communications - principles and practice, 2nd Edn, Pearson.
2. T L Singal, Wireless communications, 2010, Mc Graw Hill Education.
3. Andreas F. Molisch, Wireless communications, 2nd Edn, Wiley India Pvt. Ltd.

### **Reference Books**

1. Upena Dalal, Wireless and Mobile Communications, 2009, Oxford University Press.
2. Vijay K.Garg, Wireless Communications and Networking, 2007, Morgan–Kaufmann series in Networking-Elsevier.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Microwave Engineering (PCET7020T)</b>                          |                           |
| <b>Microwave Engineering Laboratory (PCET7020L)</b>               |                           |

**Pre-requisite:**

- Electromagnetic wave and Propagation
- Electrical Network Analysis and Synthesis

**Course Objectives:**

- To understand basics of Microwave Communication Systems.
- To understand various Microwave Devices and Measuring Techniques.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Analyze propagation through guiding media using Wave equation and design various Impedance Matching Techniques. | L4           | Analyze            |
| CO2 | Analyze functioning of different Microwave components.  | L4           | Analyze            |
| CO3 | Analyze Microwave Tubes and derive expressions of necessary performance parameters for them.                    | L4           | Analyze            |
| CO4 | Implement communication systems using microwave communication bench set-up and software tool.                   | L3           | Apply              |
| CO5 | Measure various circuit parameters at microwave frequency and carry out experimental verification for the same. | L3           | Apply              |

## Microwave Engineering (PCET7020T)

### COURSE CONTENTS

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**Unit-I**                      **Basics of Microwave Communication Systems**                      **2 Hrs.**

Microwave Frequency Bands in Radio Spectrum, Characteristics, Advantages and Applications of Microwaves. Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnections of Two port networks. High Frequency parameters, Formulation of S- parameters, Properties of S- parameters.

**Unit-II**                      **Waveguides and Impedance matching Network and Passive**                      **10 Hrs.**  
**Devices**

Rectangular waveguides: Construction, Working and Mode analysis and Applications. Circular and Ridge Waveguide: Construction and Applications. Design of Impedance matching network using distributed parameters.

**Unit-III**                      **Passive and Semiconductor Microwave Devices**                      **12 Hrs.**

Tees, Hybrid ring, Directional couplers, Phase shifters, Terminations, Attenuators and Ferrite devices such as Isolators, Gyrotors, and Circulators. Diodes: Varactor, PIN, Tunnel, Point Contact, Schottky Barrier, Gunn, IMPATT. Transistors: BJT, Hetro junction BJT, MESFET and HEMT (construction, working, equivalent circuit and performance characteristics).

**Unit-IV**                      **Microwave Generation and Amplification**                      **10 Hrs.**

Two Cavity Klystron, Multi-Cavity Klystron and Reflex Klystron. Helix Travelling Wave Tube and Cross Field Amplifier. Backward Wave Oscillator, Cylindrical Magnetron and Gyrotron.

**Unit-V**                      **Microwave Measurements**                      **4 Hrs.**

VSWR, Frequency, Power, Impedance, Attenuation, Dielectric Constant.

**Unit-VI**                      **Microwave Application and Modern Trends in Microwave**                      **4 Hrs.**  
**Engineering**

Effects of Microwave radiation on human body, Microwave hazards. Medical (Microwave Imaging, Microwave Diathermy) and Civil applications (Microwave heating, Instrumentation landing Systems, Radar Navigation Systems) of microwaves.

## **Microwave Engineering Laboratory (PCET7020L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Study of Microwave Components.
2. Measurement of Microwave frequency using Microwave Bench Setup.
3. Measurement of Attenuation using Microwave Bench Set-up.
4. Study of Various Modes of Reflex Klystron.
5. Compare Analytical and Graphical Method of Impedance Matching for Single Stub.
6. Study of Microwave Hazards.
7. Measurement of Wavelength, VSWR and Unknown load using Microwave Bench Set-up.
8. Measurement of S-parameters for various microwave components.
9. Design and Simulation of Branch line coupler.

### **Text Books**

1. Samuel Liao, Microwave Devices and Circuits, 3rd Edn, Prentice Hall.
2. M. Kulkarni, Microwave and Radar Engineering, 3rd Edn, Umesh Publication.

### **Reference Books**

1. D. M. Pozar, Microwave Engineering, 4th Edn, Wiley Publications. Education.
2. Annapurna Das, Sisir K. Das, Microwave engineering, 3rd Edn, Tata McGraw Hill Publication.
3. Peter A. Rizzi, Microwave Engineering: Passive Circuits, 1st Edn, Prentice Hall.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Radar Engineering (PEET7031T)</b>                              |                           |
| <b>Radar Engineering Laboratory (PEET7031L)</b>                   |                           |

**Pre-requisite:**

- Electromagnetic Field Theory
- Analog & Digital Communication
- Antenna and Wave Propagation

**Course Objectives:**

- To interpret Radar range equations.
- To explain different types of Radar.
- To design Radar transmitters and receivers for given conditions.

| COs | Course Outcomes  | Blooms Level | Blooms Description |
|-----|--|--------------|--------------------|
| CO1 | Explain the concept of Radar and its applications.   | L2           | Understand         |
| CO2 | Analyze Radar range equation for various condition.  | L4           | Analyze            |
| CO3 | Identify different types of Radar for specific application.  | L3           | Apply              |
| CO4 | Evaluate the design constraints for transmitter and receiver.  | L5           | Evaluate           |
| CO5 | Gain ability to work in teams to solve complex problems and communicate effectively with technical reports / writeups. | L3           | Apply              |



## **Radar Engineering Laboratory (PEET7031L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. To study basic Radar and range equation.
2. To Study CW Radar and find the relative speed of the object.
3. Derive Radar range equation with noise figure and find the distance.
4. To study MTI Radar and find the blind speed.
5. Calculate pulse repetition frequency and velocity of the moving object.
6. To study various displays used in Radar systems.
7. To study clutters and its effects on Radar range equation.
8. To study delay line canceller.
9. Find the speed of the fan using Doppler Radar.
10. To study duplexer and mixer.
11. To study tracking Radar.

### **Text Books**

1. Merrill Skolnik, Introduction to Radar Systems, 2nd Edn, Tata McGra Hill.
2. G S N Raju, Radar Engineering, 1st Edn, Wiley Publication.
3. Bassem R. Mahafza, Radar Signal Analysis, 1st Edn, CRC press.

### **Reference Books**

1. E. David Jansing, Introduction to Synthetic Aperture Radar, 2nd Edn, Tata Mc-Gra Hill.
2. William L Melvin, James A Scheer, Principles of Modern Radar, 2nd Edn, Institution of Engineering and Technology.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Big Data Analytics (PEET7032T)</b>                             |                           |
| <b>Big Data Analytics Laboratory (PEET7032L)</b>                  |                           |

**Course Objectives:**

- To Provide an Overview of an exciting growing field of Big Data Analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, Spark.
- To teach the fundamental techniques in achieving big data analytics with scalability and streaming capability.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Understand the key issues in big data management and its associated applications for business decisions and strategy.                               | L2           | Understand         |
| CO2 | Understand and Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop and NoSQL in big data analytics. | L3           | Apply              |
| CO3 | Evaluate Big Data processing by using Map Reduce.   | L5           | Evaluate           |
| CO4 | Interpret business models and scientific computing paradigms and apply software tools for big data analytics.                                       | L3           | Apply              |
| CO5 | Exploring the capabilities of big data using Apache Spark.  | L4           | Analyze            |

# Big Data Analytics (PEET7032T)

## COURSE CONTENTS

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**Unit-I Introduction to Big Data Analytics Hadoop 6 Hrs.**

Introduction to Big Data, Big Data characteristics, Types of Big Data, Traditional vs. Big Data business approach. Technologies available for Big Data, Infrastructure for Big Data, Big Data challenges. Case Study of Big Data solutions. Introduction to Hadoop, Core Hadoop components, Hadoop Ecosystem, Physical architecture, Hadoop limitations.

**Unit-II NoSQL 8 Hrs.**

Introduction to NoSQL, NoSQL business drivers, NoSQL case studies. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Big table) stores, Document stores, Variations of NoSQL architectural patterns, analysing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer Introduction to MongoDB, MongoDB commands.

**Unit-III MapReduce 8 Hrs.**

MapReduce and The New Software Stack: Distributed File Systems, Physical organization of compute Nodes, Large scale file-system organization. MapReduce: The Map tasks, grouping by key, The Reduce tasks, Combiners, Details of MapReduce execution, Coping with node failures. Matrix vector multiplication using MapReduce, Case studies on MapReduce using Java/Python.

**Unit-IV Techniques in Big Data Analytics 12 Hrs.**

Finding Similar Item: Nearest Neighbour Search, Similarity of Documents. Mining Data Streams: Data Stream Management Systems, Data Stream Model, Examples of Data Stream Applications: Sensor Networks, Network Traffic Analysis. Link Analysis: PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine.

Frequent Item set Mining: Market Basket Model- Applications, Association Rule-Confidence, Interest, Support, Apriori Algorithm - Pass1, Pass2, Recommendation Systems: Introduction, Collaborative-Filtering System, Content based recommendation system.

**Unit-V Big Data Analytics using Apache Spark 8 Hrs.**

Introduction to Spark: Features, Spark built on Hadoop, Components of Spark Resilient Distributed Datasets: Data sharing using Spark RDD, Iterative operations on Spark RDD, Interactive operations on Spark RDD, Spark installation, Core programming, RDD transformations, Execution of word count transformation.

## **Big Data Analytics Laboratory (PEET7032L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Start-up scripts, Configuration files.
2. Hadoop Implementation of file management tasks.
3. Installation of MongoDB, and execution of CREATE, INSERT, DELETE and UPDATE operations.
4. Querying in MongoDB using FIND command, aggregate functions etc.
5. Execution of PIG SCRIPTING language.
6. Execution of HIVE SCRIPTING language.
7. Execution of Matrix Multiplication Using MapReduce.
8. Execution of Word Count using MapReduce.
9. Execution of Word Count using Apache Spark.
10. Case Study on Recommendation Systems.

### **Text Books**

1. Radha Shankarmani and M Vijayalakshmi, Big Data Analytics, 2nd Edn, Wiley Publication.
2. Alex Holmes, Hadoop in Practice, 2012, Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly, Making Sense of NoSQL – A guide for managers and the rest of us, 2013, Manning Press.
4. Andy Konwinski, Matei Zaharia, Holden Karau, Learning Spark, 2015, O'Reilly Media, Inc.

### **Reference Books**

1. Bill Franks, Taming, The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics, 2012, Wiley Publication.
2. Chuck Lam, Hadoop in Action, 2010, Dreamtech Press.
3. Bill Chambers, Matei Zaharia, Spark: The Definitive Guide, 2018, O'Reilly Media, Inc.

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Embedded Systems (PEET7033T)</b>                               |                           |
| <b>Embedded Systems Laboratory (PEET7033L)</b>                    |                           |

**Pre-requisite:**

- Microprocessors & Microcontrollers
- Digital Electronics

**Course Objectives:**

- To develop background knowledge of Embedded Systems.
- To understand Embedded Systems communication techniques.
- To write programs for Embedded Systems and Real Time Operating Systems.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Describe the Embedded System characteristics, design metrics and development life cycle.                                | L2                  | Explain                   |
| CO2        | Discuss different processor design techniques and architectures with example.   | L3                  | Apply                     |
| CO3        | Identify different communication types and buses with different protocols.  | L2                  | Classify                  |
| CO4        | Describe concepts and components of Real Time Operating system.   | L2                  | Explain                   |
| CO5        | Gain ability to work in teams to solve complex problems and communicate effectively with technical reports / write ups. | L3                  | Apply                     |



## **Embedded Systems Laboratory (PEET7033L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Interfacing of I2C, CAN, SPI, ZigBee etc. with ARM.
2. Speed Control of DC Motor using ARM.
3. Simulation of multitasking using RTOS.
4. Simulation of mutex using RTOS.
5. Simulation of mailboxes using RTOS.
6. Inter process communication using semaphore in RTOS.
7. Simulation of message queues using RTOS.
8. Simulate the scheduling algorithms.
9. Mini Project.

### **Text Books**

1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, 3rd Edn, Wiley Publication.
2. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edn, Tata McGraw- Hill Publication.
3. Sriram Iyer and Pankaj Gupta, Embedded Real-time Systems Programming, 1st Edn, Tata McGraw-Hill Publication.

### **Reference Books**

1. David Simon, An Embedded Software Primer, 1st Edn, Pearson Publication.
2. K.V. Shibu, Introduction to Embedded Systems, 2nd Edn, McGraw Hill.
3. K.V.K. Prasad, Embedded Systems / Real-Time Systems: Concepts, Design Programming, 1st Edn, Dreamtech Press.

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b>         | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Fundamentals of Speech and Audio Processing (PEET7034T)</b>            |                           |
| <b>Fundamentals of Speech and Audio Processing Laboratory (PEET7034L)</b> |                           |

**Pre-requisite:**

- Signals and Systems
- Digital Signal Processing
- Engineering Mathematics

**Course Objectives:**

- To understand basic concepts and methodologies for the analysis and modelling of speech signal.
- To characterize the speech signal as generated by a speech production model.
- To understand the mechanism of speech and audio perception.
- To understand the digital representation of the speech waveform.
- To perform the analysis of speech signal using STFT.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Demonstrate advanced Knowledge in Digital model representation of speech signal.  | L3                  | Apply                     |
| CO2        | Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing. | L6                  | Create                    |
| CO3        | Analyse speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).                                    | L4                  | Analyze                   |
| CO4        | Formulate and design a system for speech recognition and speaker recognition.   | L6                  | Create                    |
| CO5        | Acquired knowledge about audio and speech signal estimation and detection.  | L2                  | Understand                |



## **Fundamentals of Speech and Audio Processing Laboratory (PEET7034L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. To record the name of student in Praat and plot its spectrogram.
2. Plot a vowel file 'a' and its Welch power spectral density estimate.
3. To calculate positive and negative ZCR for a voiced and unvoiced speech segment.
4. A program to find pitch period using method of autocorrelation.
5. A MATLAB program to find pitch frequency using spectrum method for unvoiced segment.
6. Program for finding cepstrum of speech segment.
7. To find formants using power spectrum estimate using Welch method and method of period grams for voiced segment of speech.
8. A program to use Homomorphic processing and extract the impulse response of the vocal tract.
9. Program to convert frequency to Mel scale.
10. To find LPC and reflection coefficients using Levinson Durbin algorithm.

### **Text Books**

1. Rabiner and Schafer, Digital Processing of Speech Signals, Pearson Education, 2004
2. Shaila D. Apte, Speech and Audio Processing, Wiley India, 2012.
3. Douglas O'Shaughnessy, Speech Communications: Human Machine, 2nd Edn, Universities Press.
4. Thomas F. Quatieri, Discrete-Time Speech Signal Processing: Principles and Practice, 2001, Prentice Hall.
5. J. L. Flanagan, Speech Analysis Synthesis and Perception, 2nd Edn, Springer Verlag.

### **Reference Books**

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, Wiley India (P) Ltd, 2006.
2. L. R. Rabiner, B. H. Juang, B. Yegnanarayana, Fundamentals of speech Recognition, Pearson Education, 1993.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Computer Vision (PEET7035T)</b>                                |                           |
| <b>Computer Vision Laboratory (PEET7035L)</b>                     |                           |

**Pre-requisite:**

- Digital Signal Processing
- Engineering Mathematics

**Course Objectives:**

- Exemplify fundamental concepts related to multidimensional signal processing, feature extraction, pattern analysis and clustering.
- Obtain and process image data and relate it to 3D scene structures.
- Familiarize with the necessary tools of Computer Vision such as OpenCV, Matlab, and Python etc.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Apply computer vision algorithms to edge detection, motion and object recognition.                        | L2                  | Apply                     |
| CO2        | Recognize geometrical relationships between 2D and 3D world.  | L3                  | Apply                     |
| CO3        | Design and develop practical and innovative Image Processing and Computer Vision applications or systems. | L6                  | Create                    |



## Computer Vision Laboratory (PEET7035L)

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### List of Laboratory Experiments: (Any Eight)

1. Implementation of Viola Jones Algorithm for face recognition.
2. Segmentation of Images using Canny Edge Detector.
3. Segmentation of Image using k-means algorithm.
4. Optical Flow with Lucas-Kanade method.
5. Image Compression using Principal Component Analysis.
6. Corner Detection using the Harris Corner Detector.
7. Implementation of ALEXNET or RESNET architectures for any desired application.
8. Segmentation based on Image Texture.
9. Tensor Flow: Introduction (any one application).
10. Transformer: Introduction (any one application).

### Text Books

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education 2003.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley 1992.

### Reference Books

1. O. Marques, Practical Image and Video Processing using Matlab, IEEE Press, Wiley, 2011.
2. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Edn, Academic Press, Morgan Kaufmann.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Statistical Analysis System (PEET7036T)</b>                    |                           |
| <b>Statistical Analysis System Laboratory (PEET7036L)</b>         |                           |

**Pre-requisite:**

- Probability & Statistics
- Engineering Mathematics
- Data Structures

**Course Objectives:**

- Business Analytics refers to skills, practices and techniques used in converting data into information and knowledge that aid business decision making.
- Statistical learning including quantitative, qualitative analysis techniques
- The use of the above analysis and visualization to aid decision making.

| <b>COs</b> | <b>Course Outcomes</b>                              | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Able to familiar with Base SAS programming.         | L2                  | Understand                |
| CO2        | Demonstrate visual analytics.                       | L3                  | Apply                     |
| CO3        | Design the report using reporter.                   | L6                  | Create                    |
| CO4        | View various reports using different media devices. | L2                  | Understand                |



## **Statistical Analysis System Laboratory (PEET7036L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Importing data in SAS from Excel and CSV file.
2. Creating summary statistical data.
3. Exporting results to Excel and PDF.
4. Manipulating data with functions.
5. Using data with formats like charts and graphs.
6. Creating data by applying filters and performing data analysis on it.
7. Working with graph level display rules.
8. Analyzing a Text data source.

### **Text Books**

1. SAS programming 1 – Essentials.
2. SAS Visual Analytics – Fast Track.
3. SAS Support

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Product Life Cycle Management (OEEE7041T)</b>                  |                           |

**Prerequisite:**

- Knowledge of basic concepts of Management.

**Course Objectives**

- To familiarize the students with the need, benefits and components of PLM.
- To acquaint students with Product Data Management and PLM strategies.
- To give insights into new product development program and guidelines for designing and developing a product.
- To familiarize the students with Virtual Product Development.

| COs | Course Outcomes  | Blooms Level | Blooms Description |
|-----|--|--------------|--------------------|
| CO1 | Describe the phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.               | L2           | Understand         |
| CO2 | Illustrate various approaches and techniques for designing and developing products.  | L3           | Apply              |
| CO3 | Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc. | L3           | Apply              |
| CO4 | Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant.         | L3           | Apply              |

# **Product Life Cycle Management (OEEE7041T)**

## **COURSE CONTENTS**

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### **Unit-I Introduction to Product Lifecycle Management (PLM) 9 Hrs.**

Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance and Benefits of PLM, Widespread Impact of PLM, Focus and Application.

A PLM Project, Starting the PLM Initiative, PLM Applications. PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM.

### **Unit-II Product Design 9 Hrs.**

Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process

Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process.

### **Unit-III Product Data Management (PDM) 9 Hrs.**

Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

### **Unit-IV Integration of Environmental Aspects in Product Design 8 Hrs.**

Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.

### **Unit-V Life Cycle Assessment and Life Cycle Cost Analysis 7 Hrs.**

Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards,

Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.

**Text Books:**

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realization", Springer-Verlag, 2004, ISBN: 1852338105.
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor and Francis, 2006.

**Reference Books:**

1. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, 2009, ISBN: 3540257314.
2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265.
3. François Villeneuve, Luc Mathieu, Max Giordano, "Product Life-Cycle Management: Geometric Variations", Wiley, 2010.

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Management Information System (OEEE7042T)</b>                  |                           |

**Prerequisite:**

- Knowledge of basic concepts of Management.

**Course Objectives**

- The course is blend of Management and Technical field.
- To discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
- To define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
- To identify the basic steps in systems development.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Explain how information systems Transform Business.   | L2                  | Understand                |
| CO2        | Use information systems concepts to assess their effects on organizational operations.  | L3                  | Apply                     |
| CO3        | Describe IT infrastructure and its components and its current trends.   | L2                  | Understand                |
| CO4        | Explain principal tools and technologies for accessing in-formation from databases to improve business performance and decision making. | L2                  | Understand                |
| CO5        | Use enterprise-wide knowledge management systems to show their benefits for business operations.  | L3                  | Apply                     |



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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Operations Research (OEET7043T)</b>                            |                           |

**Prerequisite:**

- Basic Knowledge of Algebra, Probability and Statistics

**Course Objectives**

- To formulate a real-world decision problem as a mathematical programming model.
- To learn the mathematical tools that are employed to solve mathematical programming models.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Analyze a real-world problem by formulating it as a Linear Programming Problem and interpreting the solution obtained using the Simplex method or other                           | L4           | Analyze            |
| CO2 | Determine real-world problems as Transportation Problem and Assignment Problem and solve the decision problem by choosing appropriate algorithm.                                  | L3           | Apply              |
| CO3 | Determine the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.   | L3           | Apply              |
| CO4 | Explain reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.    | L2           | Understand         |
| CO5 | Explain the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.   | L2           | Understand         |
| CO6 | Explain the concept of simulation and replacement policy, apply Monte Carlo Simulation technique to systems such as inventory and queuing, and determine optimal replacement age. | L2           | Understand         |

# Operations Research (OEEE7043T)

## COURSE CONTENTS

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### **Unit-I** **10 Hrs.**

Introduction to Operations Research: Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization. Linear Programming Problem: Mathematical Formulation.

Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.

### **Unit-II** **8 Hrs.**

Assignment Problems: Mathematical Formulation, finding optimal solution - Hungarian Method Transportation problem: Mathematical Formulation, finding initial basic feasible solution- Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Improving the solution.

### **Unit-III** **6 Hrs.**

Dynamic Programming: Bellman's Principle of optimality - Applications of dynamic Programming-Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem.

### **Unit-IV** **10 Hrs.**

Queuing Models: Characteristics of queuing models. Single Channel – Single and multiphase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel- Single phase server - Poisson arrivals, exponential service time with infinite population.

Game Theory: Introduction, Minimax and Maximin Criterion and optimal strategy, Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle.

Approximate methods, Iterative method, m x 2 and 2 x n Games-Graphical method and method of sub-games. Expressing game as LPP.

### **Unit-V** **8 Hrs.**

Simulation: Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages. Replacement Models: Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy.

**Text Books:**

1. Sharma J. K., “Operations Research”, Trinity Press.
2. Gupta P. K., Hira D. S., “Operations Research”, S. Chand Limited.

**Reference Books:**

1. Taha, H. A., “Operations Research - An Introduction”, Pearson Education, 2022.
2. Ravindran A., Phillips D. T., and Solberg J. J., “Operations Research: Principles and Practice”, John Willey and Sons, 2009.
3. Hiller F. S., and Liebermann G. J., “Introduction to Operations Research”, Tata McGraw Hill, 2010.
4. Pradeep Prabhakar Pai, “Operations Research Principles and Practice”, Oxford University Press, 2012.
5. R. Panneerselvam, “Operations Research”, PHI Publications, 2nd Edition, 2016.
6. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, “Operations Research”, Pearson Education, 2nd Edition, 2014.
7. Kanti Swarup, P. K. Gupta and Man Mohan, “Operations Research”, Sultan Chand and Sons, 2010.

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Cyber Security and Laws (OEEE7044T)</b>                        |                           |

**Prerequisite:**

- Knowledge of basic concepts of security.

**Course Objectives**

- To understand and identify different types cybercrime and cyber offences.
- To recognized Indian IT Act 2008 and its latest amendments.
- To learn various types of security standards compliances.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Explain the different types of cybercrime and security issues E Business.   | L2                  | Understand                |
| CO2        | Analyze different types of cyber threats and techniques for security management.  | L4                  | Analyze                   |
| CO3        | Analyze the legal requirements and standards for cyber security in various countries to regulate cyberspace.            | L4                  | Analyze                   |
| CO4        | Explain the Information Technology Act and the legal framework of right to privacy, data security, and data protection. | L2                  | Understand                |

# Cyber Security and Laws (OEEE7044T)

## COURSE CONTENTS

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**Unit-I Introduction to Cybercrime 10 Hrs.**

Introduction to Cybercrime: Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus and Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling.

Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and D DoS attacks, SQL Injection, Buffer Over Flow,, Phishing Identity Theft (ID Theft) ,How criminal plan the attacks, Social Engineering, Cyber stalking.

**Unit-II Cyber Threats Analysis 7 Hrs.**

Cyber Threats Analysis: Knowledge of Dynamic and Deliberate Targeting, Knowledge of Indications and Warning, Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions, Knowledge of Key Cyber Threat Actors and their Equities Knowledge of Specific Target Identifiers and Their Usage.

**Unit-III Electronic Business and legal issues 8 Hrs.**

Electronic Business and legal issues: Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic. Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E- Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats and Protections, Security for E-Commerce.

**Unit-IV Indian IT Act 8 Hrs.**

Indian IT Act: Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in cyber-Law: The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law.

**Unit-V Security Industries Standard Compliances 9 Hrs.**

Security Industries Standard Compliances: IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Centre for Internet Security Controls)

**Reference Books:**

1. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley India, 2011.
2. Suresh T. Vishwanathan, “The Indian Cyber Law”, 3rd Edition, Bharat Law House, 2022.
3. “The Information Technology Act, 2000”, Bare Act- Professional Book Publishers, New Delhi, 2022.
4. Anup K. Ghosh, “E-Commerce Security and Privacy”, Springer Science and Business Media, 2012.
5. Izzat Alsmadi, “The NICE Cyber Security Framework Cyber Security Intelligence and Analytics”, 1st Edition, Springer, 2019.
6. Advocate Prashant Mali, “Cyber Law and Cyber Crimes”, 2nd Edition, Snow White Publications, 2015.
7. Nina Godbole, “Information Systems Security”, 2nd Edition, Wiley India, 2017.
8. Kenneth J. Knapp, “Cyber Security and Global Information Assurance”, Information Science Publishing, 2009.
9. William Stallings, “Cryptography and Network Security”, 8th Edition, Pearson Publication, 2023.

**Web Resources:**

1. The Information Technology ACT, 2008- TIFR: <https://www.tifrh.res.in>
2. A Compliance Primer for IT professional: <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Personal Finance Management (OEEE7045T)</b>                    |                           |

**Prerequisite:**

- Basic Knowledge of Algebra, Probability and Statistics.

**Course Objectives**

- To create awareness and educate consumers on access to financial services.
- To make the students understand the basic concepts, definitions and terms related to direct taxation.
- To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
- To familiarise the students with microfinance for accelerating the expansion of local microbusinesses.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Use a framework for financial planning to understand the overall role finances play in his/her                    | L3                  | Apply                     |
| CO2        | Calculate income from salaries, house property, business/profession, capital gains and income from other sources. | L3                  | Apply                     |
| CO3        | Calculate the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.              | L3                  | Apply                     |
| CO4        | Describe how Microfinance can help in financial inclusion.  | L2                  | Understand                |

# **Personal Finance Management (OEEE7045T)**

## **COURSE CONTENTS**

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|               |  |               |
|---------------|--|---------------|
| <b>Unit-I</b> | <b>Overview of Indian Financial System</b> | <b>7 Hrs.</b> |
|---------------|--|---------------|

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.

Introduction to Personal Finance: Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.

|                |                                      |               |
|----------------|--------------------------------------|---------------|
| <b>Unit-II</b> | <b>Personal Financial Management</b> | <b>8 Hrs.</b> |
|----------------|--------------------------------------|---------------|

Personal Financial Management: Loans: Home, Car, Education, Personal, Loan against property and Jewel loan.

Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. Investment: Investing Basics and Evaluating Bonds, investing in Stocks and Investing in Mutual Funds, Planning for the Future.

|                 |                              |               |
|-----------------|------------------------------|---------------|
| <b>Unit-III</b> | <b>Income Tax Act Basics</b> | <b>9 Hrs.</b> |
|-----------------|------------------------------|---------------|

Income Tax Act Basics: Introduction to Income Tax Act, 1961. Heads of Income and Computation of Total Income and Tax Liability: Income and Computation of Total Income under various heads, Clubbing Provisions, set off and carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. Tax Management, Administrative Procedures and ICDS: TDS, TCS and Advance Tax Administrative Procedures, ICDS.

|                |                               |               |
|----------------|-------------------------------|---------------|
| <b>Unit-IV</b> | <b>Goods and Services Tax</b> | <b>9 Hrs.</b> |
|----------------|-------------------------------|---------------|

Goods and Services Tax: GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union and State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST and IGST); GST Council, GST Network, State Compensation Mechanism, Registration.

Levy and Collection of GST: Taxable event - “Supply” of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST - Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services.

|               |                                     |               |
|---------------|-------------------------------------|---------------|
| <b>Unit-V</b> | <b>Introduction to Microfinance</b> | <b>9 Hrs.</b> |
|---------------|-------------------------------------|---------------|

Introduction to Microfinance: Micro-Finance: Definitions, Scope and Assumptions, Types of Micro-finance, Customers of Microfinance, Credit Delivery Methodologies, SHG concept, origin, Formation and Operation of Self-Help Groups (SHGs).

Models in Microfinance: Joint Liability Groups (JLG), SHG Bank Linkage Model and

GRAMEEN Model: Achievements and Challenges.

Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs), Constraints and Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand and Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs.

**Reference Books:**

1. Asha Singh, M.S. Gupta, "Banking and Financial Sector Reforms in India", Serials Publication, 2010.
2. M. S. Gupta and J. B. Singh, "Indian Banking Sector: Essays and Issues", 1st Edition, Serials Publication, 2016.
3. K.M. Bhattacharya O.P. Agarwal, "Basics of Banking and Finance", Himalaya Publishing House, 2018.
4. S. Subba Reddy, P. Raghu Ram, "Agricultural Finance and Management", Oxford and IBH Publishing, 2018.
5. Dr. Vasant Desai, "The Indian Financial System and Development", 4th Edition, Himalaya Publishing House, 2011.
6. Sanjay Kumar Satapathy, "Income Tax Management Simple Way of Tax Management, Tax Planning and Tax Saving", 2018.
7. Dr. R. K. Jain, "Direct Tax System Income Tax", SBPD Publications, 2020.
8. S K Mishra, "Simplified Approach to GST Goods and Services Tax", Educreation Publishing, 2018.
9. Todd A Watkins, "Introduction to Microfinance", World Scientific Publishing Company, 2020.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Energy Audit and Management (OEET7046)</b>                     |                           |

**Prerequisite:**

- Basic Knowledge of Social science and Current affairs.

**Course Objectives**

- To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
- To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
- To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
- To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|--|---------------------|---------------------------|
| CO1        | Identify and describe the present state of energy security and its importance.   | L2                  | Understand                |
| CO2        | Identify and describe the basic principles and methodologies adopted in the energy audit of a utility.                       | L2                  | Understand                |
| CO3        | Describe the energy performance evaluation of some common electrical installations and identify energy-saving opportunities. | L2                  | Understand                |
| CO4        | Describe the energy performance evaluation of some common thermal installations and identify energy-saving opportunities.    | L2                  | Understand                |
| CO5        | Analyze the data collected during performance evaluation and recommend energy-saving measures.                               | L4                  | Analyze                   |

## **Energy Audit and Management (OEET7046)**

### **COURSE CONTENTS**

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**Unit-I** **5 Hrs.**

Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act- 2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.

**Unit-II** **10 Hrs.**

Energy Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring and targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).

**Unit-III** **10 Hrs.**

Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipment's and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.

**Unit-IV** **10 Hrs.**

**Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.

**Unit-V** **7 Hrs.**

Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.

**Reference Books:**

1. Geofry Stokes, "Handbook of Electrical Installation Practice", Blackwell Science, 2003.
2. Anil Valia, "Designing with light: Lighting Handbook", Lighting System.
3. W. C. Turner, "Energy Management Handbook", Fairmont Press, 5th Edition, 2004.
4. A. K. Tyagi, "Handbook on Energy Audits and Management", Tata Energy Research Institute, 2000.
5. C. B. Smith, "Energy Management Principles", Elsevier Science Publishing, 2nd Edition, 2015.
6. Dale R. Patrick, S. Fardo, Ray E. Richardson, "Energy Conservation Guidebook", Fairmont Press, 2nd Edition, 2007.
7. Albert Thumann, W. J. Younger, T. Niehus, "Handbook of Energy Audits", Fairmont Press, 6th Edition, 2010.

**Web Resources:**

1. [www.energymanagertraining.com](http://www.energymanagertraining.com)
2. [www.bee-india.nic.in](http://www.bee-india.nic.in)

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Disaster Management and Mitigation Measures (OEET7047)</b>     |                           |

### Course Objectives

- To provide basic understanding hazards, disaster and various types and categories of disaster occurring around the world.
- To identify extent and damaging capacity of a disaster.
- To study and understand the means of losses and methods to overcome /minimize it.
- To understand roles and responsibilities of individual and various organization during and after disaster.
- To appreciate the significance of GIS, GPS in the field of disaster management.
- To understand the emergency government response structures before, during and after disaster.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Describe natural as well as man-made disasters, their extent, and possible effects on the economy.  | L2           | Understand         |
| CO2 | Describe the institutional framework and organizational structure in India for disaster management and explain government policies, acts, and various emergency laws. | L2           | Understand         |
| CO3 | Describe the simple dos and don'ts during extreme events and explain the skills required to respond accordingly   | L2           | Understand         |
| CO4 | Explain the importance of disaster prevention and various mitigation measures with exposure to disaster hotspots across the globe.                                    | L2           | Understand         |

## **Disaster Management and Mitigation Measures (OEET7047)**

### **COURSE CONTENTS**

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#### **Unit-I** **9 Hrs.**

General Information about Disaster: Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development.

Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc.

Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

#### **Unit-II** **8 Hrs.**

Disaster Management: Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc. Prior, During and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public aware-ness, Research, Reconstruction of essential services and livelihood restoration

#### **Unit-III** **8 Hrs.**

Institutional framework and Mechanism for disaster management in India: Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster.

NGO's involved in disasters and their task, Jobs carried out by armed forces. Financial Relief During disaster (State, National and International Disaster Assistance)

#### **Unit-IV** **8 Hrs.**

Disaster risk reduction and Mitigation Measures: Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.

Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc. Use of information

management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.

### **Unit-V**

**9 Hrs.**

Case studies on disaster (National /International): Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on.(Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken)

### **Reference Books:**

1. H. K. Gupta, “Disaster Management”, Universities Press, 2003.
2. O. S. Dagur, “Disaster Management: An Appraisal of Institutional Mechanisms in India”, Centre for Land Warfare Studies, 2011.
3. D. Copolla, “Introduction to International Disaster Management”, Butterworth-Heinemann, Elsevier, 2015.
4. J. Pinkowski, “Disaster Management Handbook”, CRC Press, Taylor and Francis, 2008.
5. R. Dasgupta, “Disaster Management and Rehabilitation”, Mittal Publications, 2007.
6. R. B. Singh, “Natural Hazards and Disaster Management, Vulnerability and Mitigation”, Rawat Publications, 2006.
7. C. P. Lo and A. K. W. Yonng, “Concepts and Techniques of GIS”, Prentice Hall (India), 2006.
8. C. G. F. Gonzales, “Risk Management of Natural Disasters”, KIT Scientific Publishing, 2010.
9. W. N. Carter, “Disaster Management – A Disaster Manager’s Handbook”, Asian Development Bank, 2008.
10. R. K. Srivastava, “Disaster Management in India”, Ministry of Home Affairs, Government of India, New Delhi, 2011.
11. W. Mara, “The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy”, Marshall Cavendish Corporation, 2011.
12. R. Eisler, “The Fukushima 2011 Disaster”, Taylor and Francis, 2013. (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Science of Well-being (OEET7048)</b>                           |                           |

### Course Objectives

- To create consciousness about importance of holistic health and physical as well as mental well-being.
- To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
- To introduce the learners to the means of mental and physical well-being, ill effects of mal- practices like alcoholism, smoking etc.
- To equip the learners to manage and cope up with stress in their daily living.

| COs | Course Outcomes  | Blooms Level | Blooms Description |
|-----|--|--------------|--------------------|
| CO1 | Describe concepts of holistic health and well-being, differentiate between its true meaning and                                | L2           | Understand         |
| CO2 | Describe the meaning of happiness, practice gratitude and self-compassion, and analyze incidents from one's own life           | L4           | Analyze            |
| CO3 | Explain the causes and effects of stress, identify reasons for stress in one's own surroundings and self.                      | L2           | Understand         |
| CO4 | Describe the importance of physical health and fitness, assess one's lifestyle, and justify its limitations or effective-ness. | L5           | Evaluate           |
| CO5 | Analyze one's own coping mechanisms, assess their effectiveness, develop and strategize for betterment, and execute them.      | L4           | Analyze            |

## Science of Well-being (OEET7048)

### COURSE CONTENTS

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**Unit-I** **Health and Well-being** **9 Hrs.**

The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being. Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.

**Unit-II** **Concepts of Happiness** **8 Hrs.**

Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Nar-row vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.

**Unit-III** **Stress and Mental Health / Well-being** **9 Hrs.**

Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress. Sources of stress and how does stress cause illness, various sources of stress, delineate between sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.

**Unit-IV** **Physical Well-being / Health Management** **8 Hrs.**

Concept of health behaviours, dimensions of health behaviours. Health enhancing behaviours: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviours and illness management: concept of illness management, effectiveness of illness management. Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition, Health compromising behaviours: Alcoholism, Smoking and its effects on health.

**Unit-V** **Dealing with Difficult Times / Coping mechanisms** **8 Hrs.**

The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience - concept, pathways and models, Meditation and Self-introspection.

**Text Books:**

1. Felicia Huppert, Nick Baylis, Barry Keverne, "The Science of well-being", Oxford University Press, 2005.
2. S. Ojha, U. Rani Srivastava, Shobhna Joshi, "Health and Well-Being: Emerging Trends", Global Vision Publishing House, 2010.
3. Charles Richard Snyder, Shane, J. Lopez, Jennifer Teramoto Pedrotti, "Positive Psychology: The scientific and Practical Explorations of Human Strengths", 2nd Edition, Sage Publications, 2011.

**Reference Books:**

1. Kitayama S. and Markus H. R., "The Pursuit of Happiness and the Realization of Sympathy: Cultural Patterns of Self, Social Relations, and Well-being", Culture and subjective well-being, The MIT Press, 2000.
2. Dubos R., "Man Adapting New Haven", Yale University Press, 1980.
3. McMahon D. M., "Happiness a history", Atlantic Monthly Press, 2006.
4. D. Kahneman, E. Diener and N. Schwarz, "Well-being: The Foundations of Hedonic Psychology", Russell Sage Foundation, 1999.
5. Selye H., "The Stress of Life", McGraw-Hill, 1984.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Research Methodology (OEET7049)</b>                            |                           |

**Prerequisite:**

- Basic Knowledge of Probability and Statistics.

**Course Objectives**

- To understand Research and Research Process.
- To acquaint learners with identifying problems for research and develop research strategies.
- To familiarize learners with the techniques of data collection, analysis of data and interpretation.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Apply preliminary research design concepts for projects in their subject matter areas.    | L3                  | Apply                     |
| CO2        | Analyze and report research data using appropriate statistical and analytical techniques. | L4                  | Analyze                   |
| CO3        | Explain complex data or situations clearly.   | L2                  | Understand                |
| CO4        | Analyze the research findings.  | L4                  | Analyze                   |
| CO5        | Summarize a structured research report based on research findings.                        | L2                  | Understand                |

## **Research Methodology (OEET7049)**

### **COURSE CONTENTS**

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**Unit-I** **7 Hrs.**

Basic Research Concepts: Meaning of research, Objectives of research, Types of research, Significance of research process.

**Unit-II** **10 Hrs.**

Research Methodology: Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.

**Unit-III** **10 Hrs.**

Research and Sample Design: Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs.

**Unit-IV** **10 Hrs.**

Data Collection and Data Analysis: Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data.

**Unit-V** **5 Hrs.**

Interpretation and Report Writing: Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues.

**Reference Books:**

1. Dawson, Catherine, "Practical Research Methods", 1st Edition, UBS Publishers Distributors, 2002.
2. Kothari C. R., "Research Methodology- Methods and Techniques", 2nd Edition, Wiley Eastern Limited, 2004.
3. Kumar, Ranjit, "Research Methodology- A Step-by-Step Guide for Beginners", 3rd Edition, Pearson Education, 2010.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Public Systems and Policies (OEET70410)</b>                    |                           |

**Prerequisite:**

- Basic Knowledge of Social science and Current affairs.

**Course Objectives**

- To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
- To understand public systems in a fast-changing environment in the global context.
- To provide an indepth understanding of the ills prevailing in the society and aids to identify the solutions for them.
- To explain public policy and its operations with special focus on policy relating to Government finance.
- To analyze and evaluate the impact of the public policy on firms and economy at large.

| COs | Course Outcomes  | Blooms Level | Blooms Description |
|-----|--|--------------|--------------------|
| CO1 | Explain the importance of public systems in a fast-changing environment in the global context.                           | L4           | Analyze            |
| CO2 | Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field. | L2           | Understand         |
| CO3 | Explain public policy and its operations with special focus on policy relating to Government finance.                    | L4           | Analyze            |
| CO4 | Analyze the impact of public policy on firms and the economy at large and work under various fields as policymakers.     | L3           | Apply              |
| CO5 | Apply analytical skills through Expenditure Policy in public services case studies.                                      | L5           | Evaluate           |

## **Public Systems and Policies (OEET70410)**

### **COURSE CONTENTS**

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#### **Unit-I** **9 Hrs.**

Introduction and Overview of Public Systems: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.

#### **Unit-II** **6 Hrs.**

Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.

#### **Unit-III** **7 Hrs.**

Public Choice and Fiscal Politics: Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.

#### **Unit-IV** **11 Hrs.**

Introduction and Overview of Public Policy: Markets and Government; Social goods and Market failure, public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal and Budgetary Policy, Fiscal Federalism in India.

#### **Unit-V** **9 Hrs.**

Case Studies in Expenditure Policy: Public Services: A) National Defence B) Highways C) Outdoor Recreation D) Education.

#### **Reference Books:**

1. Charles Wheelan, "Introduction to Public Policy", W. W. Norton and Company, 2011.
2. Thomas R. Dye, "Understanding Public Policy", Prentice Hall, 2008.
3. Anderson J.E., "Public Policy-Making: An Introduction", Boston, 2011.
4. Avasthi and Maheshwari, "Public Administration", Lakshmi Narain Agarwal, 2008.
5. Mohit Bhattacharya, "New Horizons of Public Administration", Jawahar Publishers, New Delhi, 2011.
6. Nicholas Henry, "Public Administration and Public Affairs", Prentice Hall of India, 2017.
7. Harvey S Rosen and Ted Gayer, "Public Finance", 10th Edition, McGraw-Hill Education, 2013.
8. Richard A. Musgrave and Peggy B. Musgrave, "Public Finance in Theory and Practice", 5th Edition, McGraw Hill, 2017.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>IoT and Sensor Network Laboratory (PCET7050L)</b>              |                           |

**Course Objectives:**

- To learn IoT and Sensor Network systems.
- To learn IoT and Sensor Network techniques.
- To Analyze IoT in terms of a suggested IoT conceptual framework.
- To learn initiatives of international organizations for design standardization of IoT/M2M architectural layers and domains.
- To provide working experience in various Hardware / Software programming techniques.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Identify different components of an IoT and Sensor network system.    | L3                  | Apply                     |
| CO2        | Designing and affordability of IoT devices.                           | L6                  | Create                    |
| CO3        | Explore the Industrial IoT, Industry 4.0, Connected Car applications. | L4                  | Analyze                   |
| CO4        | Use Internet of Things for real time applications.                    | L3                  | Apply                     |

## **IoT and Sensor Network Laboratory (PCET7050L)**

### **COURSE CONTENTS**

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**Unit-I Introduction 6 Hrs.**

Internet of Things an overview, IoT Conceptual framework, IoT architectural View, Technology behind IoT, Sources of IoT, M2M Communication, and Examples of IoT.

**Unit-II Design Principles for Connected Devices 4 Hrs.**

IoT/M2M systems Designs Standardization, Communication Technologies, Data Enrichment, Data Consolidation, and device management, Designing and affordability, Energy efficiency in IoT.

**Unit-III Design Principles for Web Connectivity 4 Hrs.**

Introduction, Web communication protocol for connected devices, Message communication protocols for connected devices, Internet based communication, IP addressing in the IoT.

**Unit-IV Data Acquiring, Organizing, Processing and Analytics 8 Hrs.**

Data acquiring and storage, Organizing the data, Transactions, Integration and Enterprise systems, Acquiring, Managing and storing processes.

**Unit-V Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks 6 Hrs.**

Sensor technology, Industrial IoT and Automotive IoT, Actuator, Sensor data communication protocols, Wireless sensor networks technology, Embedded Computing Basics, Embedded Platforms for prototyping.

## **IoT and Sensor Network Laboratory (PCET7050L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. LED Blink and Pattern.
2. 7 Segment Display.
3. Push Button.
4. LED Pattern with Push Button Control.
5. Push Button Counter.
6. LM35 Temperature Sensor.
7. Analog Inputs.
8. Analog Input Digital Output
9. IR Sensor Analog Input.
10. LCD 16X2 Display.
11. IR Sensor Based Security System.
12. Night Light Controlled Monitoring System.
13. Analog Input Analog Output.
14. LM35 Temperature Sensor with Fire Alarm.

### **Text Books**

1. Raj Kamal, Internet of Things Architecture and Design Principles, Tata McGraw Hill, 2017.
2. Colin Dow, Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python, 2018, Packt Publishing.
3. Constandinos X. Mavromoustakis, George Mastorakis, Jordi Mongay Batalla, Internet of Things (IoT) in 5G Mobile Technologies, 2016, Springer International Publication.

### **Reference Books**

1. Fadi Al-Turjman, Artificial Intelligence in IoT, 1st Edn, Springer International Publishing.
2. Shampa Sen, Leonid Datta, Sayak Mitra, Machine Learning and IoT: A Biological Perspective, 2019 CRC Press.
3. Anand Tamboli, Build Your Own IoT Platform: Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours, 2019 Apress.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Industrial Automation Laboratory (PCET7060L)</b>               |                           |

**Course Objectives:**

- To learn Industrial automation and various systems.
- To learn Industrial automation techniques.
- To identify the differences between PLCs, SCADA, DCS.
- To provide the skills to install and trouble shoot Automation systems.
- To provide working experience in various programming techniques.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Identify various components and status indications of automation systems and PLCs used in industrial and daily life applications. | L2                  | Understand                |
| CO2        | Simulate input/output devices with appropriate PLC modules using ladder diagrams.   | L4                  | Analyze                   |
| CO3        | Develop and test ladder programs for a variety of automation applications using PLC simulation software.                          | L3                  | Apply                     |
| CO4        | Design simple SCADA mimic diagram for basic industrial process monitoring.  | L6                  | Create                    |



## **Industrial Automation Laboratory (PCET7060L)**

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### **List of Laboratory Experiments: (Any Eight)**

1. Develop/Execute ladder diagram using timer, counter, logical and arithmetic instructions.
2. Use PLC to control the devices, lamp, motor switches, sensors
3. Measure Temperature of the given liquid using RTD or Thermocouple and PLC.
4. Design ladder diagram for Blink LEDs
5. Design ladder diagram for sequential control of DC motor.
6. Develop and test ladder program for pulse counting using switch/ proximity sensor.
7. Use various functions of SCADA simulation editors to develop simple project.
8. Develop SCADA mimic diagram for water tank level control.
9. Industrial PC based control system.
10. Identify various automation systems available in different appliances/devices/machines in day- to-day use.
11. Identify various parts and front panel status indications of the given PLC.

### **Text Books**

1. Petruzella F. D, Programmable Logic Controller, 4th Edn, Tata McGraw Hill.
2. Mitra Madhuchandra, Sengupta, Programmable logic controller and industrial automation, 5th Edn, Penram International Publication.
3. Bhojar S A, Supervisory control Data acquisition, 4th Edn, ISA Publication.
4. Stenerson John, Industrial Automation Process Control, 1st Edn, Pearson Publication.

### **Reference Books**

1. S.K. Singh, Industrial Instrumentation and Control, 2nd Edn, Tata McGraw Hill.
2. Richard L. Shell, Handbook of Industrial Automation, 1st Edn, CRC Press.
3. Bailey, David, Practical SCADA for Industry, 1st Edn, New nes international Publication.

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| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VII</b>            |
| <b>Project Stage - II (PJET7070L)</b>                             |                           |

**Course Objectives:**

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method. | L2                  | Analyze                   |
| CO2        | Demonstrate project-based learning that allows students to transfer existing ideas into new applications.   | L3                  | Apply                     |
| CO3        | Develop an ability to work in teams and manage the conduct of the research study.   | L3                  | Apply                     |
| CO4        | Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.                             | L2                  | Apply                     |
| .CO5       | Present the research in the form of technical writing, understand what constitutes to plagiarism and how to   | L2                  | Apply                     |

## **Project Stage - II (PJET7070L)**

### **COURSE CONTENTS**

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#### **Syllabus:**

- Project-I work done in VI semester shall be continued as Project-II in semester VII.
- Students should complete remaining implementation of ideas given in synopsis/Abstract of semester VII.
- Students / group must plan their execution of project, so that project work should be completed before end of semester.
- Project-II involves fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing, possible results and report writing.
- Each project group is required to maintain log book for documenting various activities of Project- II and submit group project report at the end of Semester-VII in the form of Hard bound.

Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:

Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and big data, Communication, Web and Application development, Robotics, AI and Machine learning. The above areas can be updated based on the technological innovations and development needed for specific project.

#### **Guidelines:**

The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

- Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
- In the first review of this semester, each group is expected to complete 30 % of project.
- In the second review of this semester, each group is expected to complete 50 % of project.
- Interaction with alumni mentor will also be appreciated for the improvement of project.

#### **Assessment Criteria:**

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project stage I (at the end of the semester) will be done by the departmental

committee (including project guide).

- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

**Prescribed project report guidelines:**

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project stage I Outcomes
- Conclusion
- References

**Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:**

**Table 1: Log Book Format**

| Sr. No | Week (Start Date: End Date) | Work Done | Sign of Guide | Sign of Coordinator |
|--------|-----------------------------|-----------|---------------|---------------------|
| 1      |                             |           |               |                     |
| 2      |                             |           |               |                     |

**Table 2: Continuous Assessment Sheet**

| Sr No | Exam Seat No | Name of Student | Student Attendance | Log Book Maintain | Literature Review | Depth of Understanding | Report | Total |
|-------|--------------|-----------------|--------------------|-------------------|-------------------|------------------------|--------|-------|
|       |              |                 | 5                  | 5                 | 5                 | 5                      | 5      | 25    |

**Assessment criteria for the departmental committee (including project guide) for End Semester Exam:**

**Table 3: Evaluation Sheet**

| Sr No | Exam Seat No | Name of Student | Project Selection | Design/ Simulation/ Logic | PCB/ hardware/ programming | Result Verification | Presentation | Total |
|-------|--------------|-----------------|-------------------|---------------------------|----------------------------|---------------------|--------------|-------|
|       |              |                 | 5                 | 5                         | 5                          | 5                   | 5            | 25    |

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

- Project progress
- Documentation/Technical paper writing
- Key findings

- Validation of results

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be considered for final grading. The final certification and acceptance of TA ensures the satisfactory performance on the above aspects.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Wireless Network (PEET8011T)</b>                               |                           |

**Pre-requisite:**

- Computer Networks
- Digital Communication
- Mobile Communication

**Course Objectives:**

- To understand architecture concept of wireless transmission and spectrum requirement.
- To understand the concepts of WPAN, WLAN and WSN.
- To understand type 1 and type 2 applications of WSN.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms<br/>Level</b> | <b>Blooms<br/>Description</b> |
|------------|--|-------------------------|-------------------------------|
| CO1        | Explain the fundamentals, architecture, design issues and standards and spectrum of various wireless network and compare them. | L2                      | Understand                    |
| CO2        | Compute different parameters of wireless networks.   | L3                      | Apply                         |
| CO3        | Evaluate various wireless systems and deduce some conclusion.  | L5                      | Evaluate                      |
| CO4        | Simulate various wireless systems using different simulation softwares.  | L4                      | Analyze                       |



2. Kazem Sohraby, Daniel Minoli, and Taieb Znati, Wireless Sensor Networks: Technology, Proto- cols, and Applications, 2007, John Wiley Sons.
3. Sunil Kumar, S. Manvi, and Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks Concepts and Protocol, 2010, Wiley Publication.
4. Raj Kamal, Internet of Things Architecture Design Principles, 2017, McGraw Hill.

#### **Reference Books**

1. Upena Dalal, Wireless and Mobile Communications, 2016, Oxford University Press.
2. Theodore S. Rappaport, Wireless communications principles and practice, 2nd Edn, Pearson Publication.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Satellite Communication (PEET8012)</b>                         |                           |

**Pre-requisite:**

- Analog Communication
- Digital Communication

**Course Objectives:**

- To understand the basics of satellite communications and different satellite communication or bits.
- Provide an in-depth understanding of satellite communication system operation, launching techniques, satellite link design and earth station technology.
- To explain the tools necessary for the calculation of basic parameters in a satellite communication system.
- Review the state of the art in new research areas such as satellite networking, satellite personal. Communications, mobile satellite communication, Laser satellite.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Explain the fundamentals of satellite communication systems, orbital mechanics, wave propagation, and launching techniques.                     | L2           | Understand         |
| CO2 | Apply the concepts of satellite subsystems and stabilization techniques in the space segment.   | L3           | Apply              |
| CO3 | Apply design considerations and working principles of earth station components including antenna, tracking system, LNA, and HPA.                | L3           | Apply              |
| CO4 | Analyze satellite link parameters including link budget, noise, C/N ratio, uplink and downlink performance under various losses and conditions. | L4           | Analyze            |
| CO5 | Apply multiple access techniques and satellite applications such as VSAT, TDMA, FDMA, CDMA, and optical satellite communication systems.        | L3           | Apply              |

# Satellite Communication (PEET8012)

## COURSE CONTENTS

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**Unit-I Overview of Satellite Systems, Orbits and Launching 8 Hrs.**

Frequency allocation for satellite communication, Polar orbiting satellites, Kepler 's Laws, orbital parameters, orbital perturbations, effects of a non-spherical earth, atmospheric drag. Wave Propagation Polarization, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Antenna Polarization, Polarization of Satellite signals. Sub-satellite Point, predicting satellite position, antenna look angels, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage. Selection of launching site, launch window, launch vehicles; satellite launch vehicle (SLV), augmented satellite launch vehicle (ASLV), polar SLV, geostationary satellite launch vehicle (GSLV).

**Unit-II Space Segment 8 Hrs.**

Satellite subsystems: Transponder sub-system, Antenna subsystem, AOC Sub-system, TTC Sub- system, power sub-system, Thermal sub-system, reliability and quality Assurance. Satellite stabilization, stabilization techniques.

**Unit-III Earth station 8 Hrs.**

Design consideration, General configuration- Block diagram, receive only type earth, transmit-receive type earth station. Antenna system, Feed system, Tracking system, LNA, HPA.

**Unit-IV Satellite Link 10 Hrs.**

Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed atmospheric and ionospheric losses, link power budget. System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio. Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output. Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, inter-modulation noise.

**Unit-V The Space Segment Access and Utilization 8 Hrs.**

Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system. Code Division Multiple Access: Direct-sequence spread spectrum– acquisition and tracking TDMA: Reference Burst; Preamble and Post amble, carrier recovery, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA. Satellite Applications: VSAT systems: Advantages, configurations, frequency bands, Television broadcast systems, DAB, Laser Satellite Communication: Link analysis, optical satellite link

transmitter, optical satellite link receiver, satellite beam acquisition, tracking positioning, deep space optical communication link.

### **Text Books**

1. Dennis Roddy, "Satellite Communications", Mc. Graw-Hill International, 4th Edition, 2019.
2. M. Richharia, "Satellite Communication Systems Design Principles", Macmillan Press Ltd, 2nd Edition, 2003.
3. R. N. Mutangi, "Satellite Communication", Oxford university press, 1st, Edition, 2016.
4. Gerard Maral and Michel Bousquet, "Satellite Communication Systems", Wiley Publication, 4th, Edition, 2018.

### **Reference Books**

1. Gerard Maral, "VSAT Networks", John Willy Sons, 2nd Edition, 2004.
2. Timothy Pratt, Charles Bostian, and Jeremy Allmuti, Satellite Communications, 1st Edn, John Willy Sons.
3. Wilbur L. Pritchard, Henri G. Suyderehoud, and Robert A. Nelson, Satellite Communication Systems Engineering, 2nd Edn, Pearson Publication.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Advanced Digital Signal Processing (PEET8013T)</b>             |                           |

**Pre-requisite:**

- Signals and Systems
- Digital Signal Processing
- Engineering Mathematics

**Course Objectives:**

- Understand Multirate Signal Processing, Power Spectrum Estimation, Adaptive Filtering and Wavelet Transform.
- Apply signal processing to real world problems.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|--|---------------------|---------------------------|
| CO1        | Demonstrate an understanding of Multirate sampling and its mechanism.                          | L2                  | Understand                |
| CO2        | Apply the techniques of power spectrum estimation and wavelet theory for various applications. | L3                  | Apply                     |
| CO3        | Implement adaptive filters for given applications.   | L3                  | Apply                     |
| CO4        | Apply Wavelet Transform to Signal/Image Processing.  | L4                  | Apply                     |



|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Microwave Integrated Circuits (PEET8014T)</b>                  |                           |

**Pre-requisite:**

- Microwave Engineering
- Electromagnetic Wave and Propagation
- Electronic Devices & Circuits

**Course Objectives:**

- To understand the integration of microwave devices in the form of IC.
- To understand the basic principles of micro strip line and coplanar waveguide.
- To design amplifier and oscillator for various applications.

| <b>COs</b> | <b>Course Outcomes</b>  | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|---|---------------------|---------------------------|
| CO1        | Differentiate between HMIC and MMIC.                          | L4                  | Analyze                   |
| CO2        | Analyze the transmission lines used at microwave frequencies. | L4                  | Analyze                   |
| CO3        | Design the microwave amplifier for the given specifications.  | L6                  | Create                    |
| CO4        | Design the microwave oscillator.                              | L6                  | Create                    |



**Text Books**

1. D. M. Pozar, Microwave Engineering, John Wiley & Sons Publication, 2013.
2. M. M. Radmanesh, Radio Frequency and Microwave Electronics, Pearson Education, 2007
3. D. H. Schraeder, Microstrip Circuit Analysis, Prentice Hall PTR, New Jersey.

**Reference Books**

1. K. C. Gupta, R. Garg and I. J. Bahl, Microstrip Lines and Slot Lines, Artech House.
2. D. Vendelin, A. M. Pavio, and U. L. Rohde, Microwave Circuit Design, John Wiley & Sons Publication.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Optical Communication (PEET8021T)</b>                          |                           |

**Pre-requisite:**

- Analog Communication
- Digital Communication
- Electromagnetic Wave and Propagation

**Course Objectives:**

- To understand and analyse Optical fibre structures wave guide, fabrication and signal degradation in fiber.
- To understand and analyse the characteristics of optical sources and detectors.
- To design optimal optical links by using Link budget and rise time budget and understand basic concepts of optical networks.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|--|---------------------|---------------------------|
| CO1        | Analyze propagation of light in optical fiber in different fiber types using the ray theory and electromagnetic mode theory.   | L4                  | Analyze                   |
| CO2        | Analyze transmission characteristics (attenuation / dispersion/Nonlinearity) of an optical fiber using different techniques.   | L4                  | Analyze                   |
| CO3        | Compare and contrast working principle of different optical sources, detectors and analyze performance of different receiver structures.                                 | L4                  | Analyze                   |
| CO4        | Summarize different fiber optic components and demonstrate the use of them in optical link.  | L3                  | Apply                     |
| CO5        | Design optical fiber communication links by evaluating different system considerations and understand basic concepts of optical networks and scope of free space optics. | L6                  | Create                    |

# Optical Communication (PEET8021T)

## COURSE CONTENTS

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|               |                                   |                |
|---------------|-----------------------------------|----------------|
| <b>Unit-I</b> | <b>Optical Fiber Fundamentals</b> | <b>10 Hrs.</b> |
|---------------|-----------------------------------|----------------|

Motivations for light wave communications, General Optical system block diagram, advantages, dis- advantages and applications of optical fiber communication, Loss and bandwidth window optical fiber waveguides, Ray theory, Electromagnetic waves, Modes in a planar waveguide, Phase and group velocity, Types and classification of optical fibers

|                |  |                |
|----------------|--|----------------|
| <b>Unit-II</b> | <b>Transmission Characteristics of Optical Fiber</b> | <b>10 Hrs.</b> |
|----------------|--|----------------|

Attenuation, absorption, linear and nonlinear scattering losses, bending losses, dispersion, Chromatic dispersion, Intermodal dispersion, over all dispersion in single mode and multimode fibers, dispersion shifted and dispersion flattened fibers, OTDR. Non-linear effects, scattering effects, Kerr effects, soliton.

|                 |                                      |               |
|-----------------|--------------------------------------|---------------|
| <b>Unit-III</b> | <b>Optical Sources and Detectors</b> | <b>8 Hrs.</b> |
|-----------------|--------------------------------------|---------------|

Working principle and characteristics of sources (LED, LASER), Tuneable lasers, Quantum well lasers, Charge capture in Quantum well lasers, Multi Quantum well Laser diodes, Surface Emitting Lasers: Vertical cavity Surface Emitting Lasers. Working principle and characteristics of detectors (PIN, APD), Material requirement for RCEPD, Resonant cavity enhancement (RCE) Photo Detector, receiver structure, bit error rate of optical receivers and receiver performance

|                |   |               |
|----------------|---|---------------|
| <b>Unit-IV</b> | <b>Optical Communication Components</b> | <b>6 Hrs.</b> |
|----------------|---|---------------|

Fiber joints, fiber connectors, splices Couplers, Isolators, multiplexers, filters, fiber gratings, Fabry Perot filters, switches and wavelength converters, Optical amplifiers, basic applications and types (EDFA and SOA).

|               |   |               |
|---------------|---|---------------|
| <b>Unit-V</b> | <b>Optical Networks and Free Space Optics</b> | <b>8 Hrs.</b> |
|---------------|---|---------------|

Point-to-Point links, system considerations, Link Power budget, Rise time budget, SONET/SDH optical networks, WDM and DWDM optical networks. Introduction to FSO, Applications, Comparison with microwave systems, coherent optical space communication, Drawback and problems of realization, system description and design.

### Text Books

1. John M. Senior, Optical Fiber Communications, 3rd Edn, Pearson Education.
2. JH Franz, VK Jain, Optical Communications Components and systems, 2013, Narosa.
3. Gerd Keiser, Optical Fiber Communication, 4th Edn, MGH.

## **Reference Books**

1. Harold Kolimberis, Fiber optics communications, 2007, Pearson Education
2. Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, 3rd Edn, Elsevier India Pvt. Ltd.
3. Ghatak and K. Thyagrajan, An introduction to fiber optics, 2010, Cambridge Univ Press.
4. Joseph C Palais, Fiber Optic Communication, 4th Edn, Pearson Education.

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>5G Technology (PEET8022T)</b>                                  |                           |

**Pre-requisite:**

- Mobile Communication
- Digital Communication

**Course Objectives:**

- To learn the Basics of 5G and Beyond Wireless communication
- To provide a basic understanding of the key technologies and modulation techniques of 5G
- To study architecture of 5G.
- To develop the concepts of spectrum requirements, MIMO, antennas for 5G.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|--|---------------------|---------------------------|
| CO1        | Understand the basics of 5G and beyond communication.                                    | L2                  | Understand                |
| CO2        | Characterize and analyze various modulation and multiplexing techniques used in 5G.      | L4                  | Analyze                   |
| CO3        | Elaborate system architecture of 5G technology.  | L2                  | Understand                |
| CO4        | Illustrate spectrum requirement, antenna design and radio propagation for 5G technology. | L2                  | Understand                |
| CO5        | Design security architecture of 5G.  | L6                  | Create                    |

# 5G Technology (PEET8022T)

## COURSE CONTENTS

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|               |                     |               |
|---------------|---------------------|---------------|
| <b>Unit-I</b> | <b>Introduction</b> | <b>6 Hrs.</b> |
|---------------|---------------------|---------------|

Introduction – Historical trend of wireless communication – Evolution of LTE Technology to Beyond 4G. THE 5G INTERNET – Internet of Things and context – Awareness – Network Reconfiguration and Virtualization support – Mobility – quality of Service Control – Emerging approach for resource over provisioning the 5G radio-access technologies-OFDMA, NOMA, SCMA, IDMA

|                |   |               |
|----------------|---|---------------|
| <b>Unit-II</b> | <b>Architecture of the Core Network</b> | <b>8 Hrs.</b> |
|----------------|---|---------------|

The Evolved Packet Core - Release 8 Architecture. Control and User Plane Separation The 5G Core Network- Representation Using Reference Points, Representation Using Service-based Interfaces, Data Transport, Roaming Architectures, Data Storage Architectures, Non-3GPP Access to the 5G Core. Network Areas, Slices and Identities-Signaling Protocol, Signaling Protocol Architecture

|                 |   |               |
|-----------------|---|---------------|
| <b>Unit-III</b> | <b>Architecture of the Radio Access Network</b> | <b>8 Hrs.</b> |
|-----------------|---|---------------|

The Evolved UMTS Terrestrial Radio Access Network – 3GPP Architecture, Carrier Aggregation, Dual Connectivity the Next-generation Node B - High Level Architecture, Internal Architecture and Deployment Options. Network Areas and Identities - Tracking Areas, RAN Areas, Cell Identities. Signalling Protocols - Signalling Protocol Architecture, Signalling Radio Bearers

|                |   |               |
|----------------|---|---------------|
| <b>Unit-IV</b> | <b>MIMO systems and Communication Devices</b> | <b>6 Hrs.</b> |
|----------------|---|---------------|

Introduction, MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Fundamentals of baseband and RF implementations in massive MIMO.

Device To Device D2D Communication – D2D: from 4G to 5G – Radio resource management for mobile brand D2D – Multihop D2D communications for proximity and emergency services – Multi-operator D2D communications.

|               |   |               |
|---------------|---|---------------|
| <b>Unit-V</b> | <b>Spectrum, Antennas and Radio Propagation</b> | <b>8 Hrs.</b> |
|---------------|---|---------------|

Spectrum - Spectrum landscape and requirements, Spectrum Allocations for 5G, Bandwidth requirements, Spectrum access modes and sharing scenarios, Spectrum technologies-Spectrum toolbox, Main technology component.

Antennas - Antennas and Propagation, Antenna Gain Radio Propagation - Radio Propagation Issues for Millimetre Waves, Diffraction and Reflection, Penetration Losses, Foliage Losses, Atmospheric Losses, Multipath, Fading and Coherence, Introduction, Angular Spread and Coherence Distance, Doppler Spread and Coherence Time.

**Unit-V****Security and Applications of 5G****6 Hrs.**

Security Issues and Challenges in 5G Communications Systems. Mobile Malware Attacks Targeting UE. Access Networks, User Equipment and External IP Networks - Attacks on 5G Access Network. HeNB Femtocell Attack. Mobile Operator's Core Network. 5G Applications and Future Scope.

**Text Books**

1. Christopher Cox, Chris Cox, An Introduction to 5G: The New Radio, 5G Network and Beyond, 1st Edn, John Wiley & Sons Ltd.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch 5G Mobile and Wireless Communications Technology, 1st Edn, Cambridge University Press.

**Reference Books**

1. Raj Kamal, Internet of Things Architecture and Design Principles, 2017, McGraw Hill Education (India) Private Limited.
2. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, 2015, Wiley publication.

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|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Internet Engineering &amp; Network Security (PEET8023T)</b>    |                           |

**Pre-requisite:**

- Computer Networks

**Course Objectives:**

- To understand on Internet protocol, standards, services and administration.
- To discuss voice over IP as a real-time interactive audio/video service.
- To introduce various techniques to implement security mechanisms for network and cyber security.
- To discuss security implications on Organizations with the help of Risk Management and Incident preparation.

| COs | Course Outcomes   | Blooms Level | Blooms Description |
|-----|---|--------------|--------------------|
| CO1 | Configure various application layer protocols.  | L3           | Apply              |
| CO2 | Analyze services of network layer provided by advanced protocols.   | L4           | Analyze            |
| CO3 | Compare and analyze various audio and video digitization and compression mechanism and explain voice over IP in the context of real-time interactive audio/video service. | L4           | Analyze            |
| CO4 | Describe security threats and apply security techniques using cryptosystems.  | L3           | Apply              |
| CO5 | Describe different network security mechanisms.   | L2           | Understand         |
| CO6 | Analyze different types of firewalls, IDS and system security mechanisms.   | L4           | Analyze            |

**Internet Engineering & Network Security (PEET8023T)**

**COURSE CONTENTS**

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|               |   |               |
|---------------|---|---------------|
| <b>Unit-I</b> | <b>Introduction to Internet and Application layer protocols</b> | <b>8 Hrs.</b> |
|---------------|---|---------------|

What is the Internet, Evolution of the Internet, Review of TCP IP layer functions Application Layer protocols: HTTP, DHCP, DNS, FTP, TFTP, SMTP, MIME, IMAP, POP3, TELNET, SSH

**Unit-II** **Network Layer** **4 Hrs.**

IPv6, Packet format, Transition from IPv4 to IPv6, ICMP (v4 and v6) Review of IP addresses, Special addresses, NAT, CIDR: Address aggregation

**Unit-III** **Multimedia Communication** **8 Hrs.**

Digitizing audio and video, Audio Compression, video compression, streaming stored audio / video Characteristics of real time interactive audio/video, RTP, RTP Packet format, UDP Port, RTCP, RTCP messages VOIP: SIP, H.323 Flow characteristics, Flow classes, techniques to improve QoS, resource reservation, admission control

**Unit-IV** **Security in Networks** **10 Hrs.**

Introduction to Information Security, Network Security Domains, Attacks and Their classification, Security services and mechanisms Network security basics, Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange. Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET).

**Unit-V** **Firewalls IDS and system security** **6 Hrs.**

Designing and Configuring Firewall Systems, Firewall Components Firewalls – Types, Comparison of Firewall Types, Firewall Configurations. Installing and Configuring FW, Proxy Server, Honey pot, Digital Immune System.

**Unit-VI** **System security and case study** **6 Hrs.**

Signature verification, Finger print recognition, Voice recognition, Iris Recognition system. Security Operations Centre (SOC), Network Operations Centre (NOC), Network Security Audit Cloud Security. Wi-Fi Security, Mobile and Cellular Security.

**Text Books**

1. B. Forouzan, TCP/IP Protocol Suite, 4th Edn, McGraw Hill Publication.
2. B. Forouzan, Cryptography and Network Security, McGraw Hill Publications, 2010.
3. Nina Godbole, Cyber Security by John Wiley Publications, 2011.

**Reference Books**

1. Leon Garcia, Communication Networks by, 2nd Edn, McGraw-Hill Publication.
2. Kurose and Ross, Computer Networking by, 5th Edn, Pearson Publication.

3. P.fleeger and P.fleeger, Security in Computing, 5th Edn, Pearson Publications.
4. M. Whitman, Management of Information Security, 4th Edn, Cengage Publications
5. B. Menezes, Network Security and Cryptography, 1st Edn, Cengage Learning India

|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Machine Learning for Signal Processing (PEET8024T)</b>         |                           |

**Pre-requisite:**

- Signals and Systems
- Digital Signal Processing

**Course Objectives:**

- Introduce students to the fundamentals of machine learning (ML) techniques useful for various signal processing applications.
- To discuss various mathematical methods and algorithms involved in ML for Signal Processing.

| COs | Course Outcomes  | Blooms Level | Blooms Description |
|-----|--|--------------|--------------------|
| CO1 | Explain the fundamental concepts of linear algebra, probability theory, and digital signal processing relevant to machine learning.              | L2           | Understand         |
| CO2 | Apply linear regression techniques such as least squares, maximum likelihood estimation, and regularization to solve signal processing problems. | L3           | Apply              |
| CO3 | Analyze and implement linear classification models including least squares classification and perceptron algorithms for signal processing tasks. | L4           | Analyze            |
| CO4 | Design and develop non-linear models using neural networks with optimization and regularization techniques.                                      | L6           | Create             |
| CO5 | Analyze probabilistic models such as k-means clustering and Gaussian Mixture Models using Expectation-Maximization algorithms.                   | L4           | Analyze            |
| CO6 | Design and develop machine learning models for real-world applications including audio classification, speech recognition, and image processing. | L6           | Create             |



|   |                           |
|---|---------------------------|
| <b>Program: Electronics and Telecommunication<br/>Engineering</b> | <b>Final Year B. Tech</b> |
|   | <b>Sem-VIII</b>           |
| <b>Internship (INTET8030L)</b>                                    |                           |

**Course Objectives:**

- To get exposure of industrial ecosystem.
- To enhance student's knowledge in the particular technology.
- To nurture student's leadership ability and responsibility to perform or execute the given task individually or in team.

| <b>COs</b> | <b>Course Outcomes</b>   | <b>Blooms Level</b> | <b>Blooms Description</b> |
|------------|--|---------------------|---------------------------|
| CO1        | Apply theoretical knowledge to real-world engineering problems through hands-on experience in industry or field settings.      | L3                  | Apply                     |
| CO2        | Apply technical knowledge and problem-solving approaches to address complex engineering problems in an industrial environment. | L3                  | Apply                     |
| CO3        | Analyze organizational structures, workflows, and technologies to understand industry practices and operational challenges.    | L4                  | Analyze                   |
| CO4        | Develop technical documentation, reports, and presentations reflecting experiential learning and problem-solving approaches.   | L6                  | Create                    |
| CO5        | Discuss career goals and identify areas for personal and professional development based on internship exposure.                | L2                  | Understand                |

## **GUIDELINES**

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Internships offer valuable educational and career development opportunities by providing students with practical experience in their field of study. In Semester – VIII, students have two options for their internship: Industry Internship and In-house Internship.

### **A. Industry Internship**

**Objectives:** The industry internship aims to achieve the following objectives

1. Expose technical students to the industrial environment, allowing them to gain real-world experience and develop into competent professionals.
2. Provide opportunities to learn and enhance the practical technical skills required for professional roles.
3. Familiarize students with current technological developments relevant to their field of study.
4. Encourage the application of technical knowledge in real industrial situations.
5. Develop skills in writing technical reports and projects.
6. Introduce students to the responsibilities and ethics of the engineering profession.
7. Familiarize students with various materials, processes, products, and quality control practices.
8. Promote academic, professional, and personal growth.
9. Facilitate connections between students and potential future employers.
10. Foster an understanding of the social, economic, and administrative factors influencing industrial organizations and their working environments.
11. Develop an understanding of worker psychology, habits, attitudes, and problem-solving approaches.

### **Industry Internship Guidelines:**

The Training and Placement (T&P) cell of the institute will arrange internships for students in industries/organizations after the seventh semester.

Students are expected to accept internship offers regardless of the company, job profile, location, or stipend offered.

Alternatively, students can individually apply by submitting “Student Internship Program Application” (available on Institute Website) for industry internships, adhering to the prescribed guidelines as follows:

1. Only T&P department granted internship will be considered.
2. The internship duration should be of minimum 12 Weeks.
3. Each student needs to take prior permission from T&P department before proceeding for any internship opportunity on his/her own.

4. Each student will be monitored twice (virtually/through online meetings) during the internship period in the presence of an industry mentor and the departmental faculty mentor and the concerned TPC.
5. If any student wants to withdraw from the Internship, he/she can only be allowed within two weeks of joining the same. Such students will have to continue the semester VIII academic activities regularly along with In-house internship.

### **Expected Activity in Industry Internship**

Students may choose either to work on innovation or entrepreneurial activities resulting in start-ups or undergo internship with Industry/NGO/ Government organizations/Micro/ Small/ Medium enterprises to make themselves ready for the industry.

Every student is required to prepare a file containing documentary proofs of the activities done by him / her. The evaluation of these activities will be done twice (virtually/through online meetings) during the internship period by the committee constituted by the Head of the Department which shall include an industry mentor, faculty mentor and Department TP Coordinator (TPC). The assessment criteria for continuous assessment are as per Table 1.

**Table 1:** Continuous Assessment for Industry Internship

| Internship Objectives and Goals | Internship Experience Skills Gained/Enhanced | Professional Development and Growth | Internship Report | Presentation |
|---------------------------------|--|-------------------------------------|-------------------|--------------|
| (30 Marks)                      | (30 Marks)                                   | (30 Marks)                          | (30 Marks)        | (30 Marks)   |

The ESE will be jointly evaluated by an industry mentor, faculty member and department T&P coordinator (TPC). The evaluation criteria are as per Table 2.

**Table 2:** Evaluation Criteria of Industry Internship

| Internship Objectives and Goals | Internship Experience Skills Gained/Enhanced | Professional Development and Growth | Internship Report | Presentation |
|---------------------------------|--|-------------------------------------|-------------------|--------------|
| (30 Marks)                      | (30 Marks)                                   | (30 Marks)                          | (30 Marks)        | (30 Marks)   |

### **Industry Internship Report:**

Upon completion of the internship, students should prepare a comprehensive report that reflects their observations and learnings during the training period. Students can consult their Industrial Supervisor, Faculty Mentor, or T & P Officer for guidance on selecting special topics and problems for the report.

The internship report will be evaluated based on the following criteria:

- I. Adequacy and purposeful write-up.

- II. Variety and relevance of learning experiences.
- III. Practical applications and connections with the fundamental theories and concepts covered in the course (semester I to VII).

**B. In-house Internship:**

The in-house internship provides students with research-oriented opportunities to cultivate a research mindset. It serves as an extension of the project completed in VI and VII semesters (Project Stage-I & II) or offers new objectives provided by the department or research guide.

1. The in-house internship can be pursued individually or as a group activity.
2. If extending a project from Stage II, at least one student in the group must have participated in Stage I & II.
3. If working on the topic offered by the department or in-house mentor, a group of fresh students can form a team.
4. The maximum group size is limited to four students.
5. In case of extension of project stage II, the outcomes should be in the form of product development/technology transfer along with patent and copyright / one research publication (UGC care listed journal/conference). Students can work jointly with any government funding agency or industry. In such cases, a detailed project report shall be submitted after verification by the in-house mentor and industry/funding agency mentor/authority. In case of standalone/non- sponsored activity, i.e. without any funding agency/industry collaboration, the detailed project report shall be submitted after verification by the in-house mentor.
6. If pursuing a Topic offered by the department or in-house mentor, the outcome of the in-house internship should include the publication of a journal paper, preferably in an SCI/Scopus/UGC care listed/indexed conference. The detailed project report must be submitted and verified by the in-house mentor.
7. All the designated work shall be submitted to the department in the form of a report in hard- bound as well as soft copy.
8. Evaluation Scheme:

**Continuous Assessment (A):**

- A logbook (as per Table 3) of the work done must be maintained by each group.
- Each in-house internship activity will be reviewed twice in the semester. In the first review (as per Table 4), at least 40% work shall be completed including the topic identification / introduction/ scope of the work, literature survey, problem definition and objectives. The remaining 60% of work shall be completed in the second review

(as per Table 5) including implementations, key findings, publications & /patenting & /copyright & / product development etc.

**End Semester Examination:**

End semester examination (as per Table 6) will be jointly evaluated by the faculty mentor and an external examiner appointed by the HOD in consultation with the COE.

**Assessment Formats:**

**Table 3:** Log Book Format

| Sr. No | Week (Start Date: End Date) | Work Done | Sign of In- house mentor | Sign of Coordinator |
|--------|-----------------------------|-----------|--------------------------|---------------------|
|        |                             |           |                          |                     |

**Table 4:** First Review

| Sr. No | Topic Identification & Validation | Literature Survey | Problem Definition | Objectives |
|--------|-----------------------------------|-------------------|--------------------|------------|
|        | 20 Marks                          | 20 Marks          | 20 Marks           | 15 Marks   |
|        |                                   |                   |                    |            |

**Table 5:** Second Review

| Sr. No | Implementation | Publications | Report   | Presentation |
|--------|----------------|--------------|----------|--------------|
|        | 20 Marks       | 20 Marks     | 20 Marks | 15 Marks     |
|        |                |              |          |              |

**Table 6:** End Semester Examination

| Sr. No | Topic Identification & Validation | Literature Survey & Problem Definition | Objectives & Implementation/ Product Development | Presentation | Report, Publications/Patent /IPR documents |
|--------|-----------------------------------|--|--|--------------|--|
|        | 30 Marks                          | 30 Marks                               | 30 Marks   | 30 Marks     | 30 Marks                                   |
|        |                                   |  |  |              |  |