Shri Vile Parle Kelavani Mandal's

# Dwarkadas J. Sanghvi College of Engineering

*(Autonomous College Affiliated to the University of Mumbai)*

Scheme and detailed syllabus (DJ19)

## Second Year B.Tech.

in

## Electronics & Telecommunication Engineering

(Semester VIII)

*Revision: 1 (2019)*
*With effect from the Academic Year: 2022-2023*

*1st July, 2022*

# SEMESTER VIII

Shri Vile Parle Kelavani Mandal's
**DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING**
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

**Scheme for Fourth Year Undergraduate Program in Electronics & Telecommunication Engineering : Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

**Sem VIII**

| Sr | Course Code | Course | Teaching Scheme | | | | Semester End Examination (A) | | | | | | Continuous Assessment (B) | | | | | Aggregate (A+B) | Credits earned | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory (hrs.) | Practical (hrs.) | Tutorial (hrs.) | Credits | Duration (hrs) | Theory | Oral | Pract | Oral & Pract | SEE Total (A) | Term Test 1 (TT1) | Term Test 2 (TT2) | Avg (TT1 & TT2) | Term Work Total | CA Total (B) | | | |
| 1 | DJ19ECC801 | Wireless Network | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | 4 |
| | DJ19ECL801 | Wireless Network - Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| 2 | DJ19ECC802 | Optical Communication | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | 4 |
| | DJ19ECL802 | Optical Communication - Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| 3@ | DJ19ECEC8011 | Microwave Integrated Circuits | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | 4 |
| | DJ19ECEL8011 | Microwave Integrated Circuits - Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| | DJ19ECEC8012 | Internet Engineering & Network Security | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ECEL8012 | Internet Engineering & Network Security - Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| | DJ19ECEC8013 | Advanced Digital Signal Processing | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ECEL8013 | Advanced Digital Signal Processing- Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| | DJ19ECEC8014 | 5G Technology | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ECEL8014 | 5G Technology -Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| | DJ19ECEC8015 | Satellite Communication | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ECEL8015 | Satellite Communication- Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| | DJ19ECEC8016 | Machine Learning for Signal Processing | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ECEL8016 | Machine Learning for Signal Processing- Laboratory | -- | 2 | -- | 1 | -- | -- | 25 | -- | -- | 25 | -- | -- | -- | 25 | 25 | 50 | 1 | |
| 4# | DJ19ILO8021 | Project Management | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | 3 |
| | DJ19ILO8022 | Entrepreneurship Development and Management | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8023 | Corporate Social Responsibility | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8024 | Human Resource Management | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8025 | Corporate Finance Management | **3** | -- | -- | **3** | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8026 | Logistics and Supply Chain Management | **3** | -- | -- | **3** | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8027 | IPR and Patenting | **3** | -- | -- | **3** | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8028 | Digital Marketing Management | **3** | -- | -- | **3** | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8029 | Environmental Management | **3** | -- | -- | **3** | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| | DJ19ILO8030 | Labour and Corporate Law | 3 | -- | -- | 3 | 3 | 75 | -- | -- | -- | 75 | 25 | 25 | 25 | -- | 25 | 100 | 3 | |
| 5 | DJ19ECP801 | Project Stage - II | -- | 10 | -- | 5 | -- | -- | -- | -- | 100 | 100 | -- | -- | -- | 100 | 100 | 200 | **5** | **5** |
| | | Total | **12** | **16** | **--** | **20** | **12** | **300** | **75** | **--** | 100 | **475** | **100** | **100** | **100** | **175** | **275** | **750** | **20** | |

@ Any 1 Elective Course

# Any 1 Institute Professional Elective

Prepared by | Checked by | **Head of the Department** | **Vice Principal** | **Principal**

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

<table>
<tr><td colspan="9">Program: Fourth Year Electronics and Telecommunication Engineering</td><td>Semester: VIII</td></tr>
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**Pre-requisite:**

1. Analog Communication
2. Digital Communication
3. Computer Networks
4. Mobile Communication

**Objectives:**

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

**Outcomes: On completion of the course, learner will be able to:**

1. Understand wireless network standards and frequency bands used for various wireless technologies
2. Compare various personal area networks and understand their applications
3. Compare IEEE 802.11 standards and understand their features
4. Understand category 1 and category 2 applications of WSN and the required middleware

| **Detailed Syllabus: (unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Basics of Wireless Networks:**<br>Introduction to Wireless Network, Classifications of wireless networks, Wireless Standards, Spectrum requirement for various wireless systems. | **04** |
| 2 | **Wireless Personal Area Networks:**<br>WPAN: Bluetooth (802.15.1): Radio Specifications, Protocol Stack, Link Types, Security, Topologies, Zigbee (802.15.4): Radio Specifications, Components, Topologies, Protocol Stack, Applications. RFID: Radio Specifications, Architecture & Types, Near Field Communication & UWB (802.15.3 a): Introduction and working. | **10** |
| 3 | **Wireless Local Area Network and Wireless Metropolitan and Wide Area Networks:**<br>Introduction and features of IEEE802.11a, b, I, g and n Equipment, Topologies, Technologies, Applications, IEEE802.11 WLAN Joining an existing Basic Service Set, Security and Power Management, Radio Link and Coverage Planning for IEEE 802.11 WLAN<br>**Case Study:** Campus Wi-Fi installation. | **08** |
| 4 | **Wireless Sensor Network:**<br>Background of sensor network technology, sensor network architectural elements, historical survey of sensor networks, Technologies for wireless sensor network, sensor node technology, hardware and software, sensor taxonomy, operating environment, wireless network trends, transmission technology | 08 |
| 5 | **Applications of Wireless Sensor Network:**<br>Applications of wireless sensor network, range of applications, examples of category 1 and 2<br>**Case Study:** Any one application of sensor network<br>Wireless Body Area Network: Properties, Network Architecture, Network Components, | **06** |
| | Applications. | |
| 6 | **Middleware for Wireless Sensor Networks:**<br>Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware | 04 |

**List of Laboratory Experiments: (minimum eight)**

1. Tutorial based on introduction to Wireless Networks.
2. Study, discussion and installation of network simulation tool such as NS2/ NS3.
3. To design a Wireless nodes using TCL Script/ Packet tracer/ Contiki Cooja.
4. To create energy nodes and observe energy dissipation using TCL Script/ Packet tracer/ Contiki Cooja.
5. To deploy sensor nodes with reference to their communication range using NS2/NS3.
6. Analysis of Wi-Fi network.
7. Implementation of data transfer using Bluetooth.
8. Implementation of data transfer using Zigbee.
9. Implementation of data transfer using RFID.
10. Case study home automation system using IoT.

Any other experiment based on open-source tools may be included, which would help the learner to understand topic/concept.

**Books Recommended:**

Text Books:


1. Vijay K. Garg, *Wireless Communication and Networking*, Morgan, 2010, Kaufmann Series in Networking, Elsevier.
2. Kazem Sohraby, Daniel Minoli, and Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, 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.

**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

1 .Term work shall consist of minimum 7 experiments, 1 Power Point Presentation/case study and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Final year Electronics & Telecommunication Engineering** | **Semester : VIII** |
|---|---|
| **Course: Optical Communication** | **Course Code: DJ19ECC802** |
| **Course: Optical Communication - Laboratory** | **Course Code: DJ19ECL802** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | **50** |
| **3** | **2** | **--** | **3+1=4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Applied Physics
2. Electromagnetic Wave Theory
3. Analog Communication

**Objectives:**

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

**Outcomes:** On completion of the course, learner will be able to:

1. Analyze propagation of light in optical fiber in different fiber types using the ray theory and electromagnetic mode theory.

2. Analyze transmission characteristics (attenuation /dispersion/Nonlinearity) of an optical fiber using different techniques.
3. Compare and contrast working principle of different optical sources, detectors and analyze performance of different receiver structures.
4. Summarize different fiber optic components and demonstrate the use of them in optical link.
5. Design optical fiber communication links by evaluating different system considerations and understand basic concepts of optical networks and scope of free space optics.

| **Detailed Syllabus: (unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Optical Fiber Fundamentals:**<br>Motivations for light wave communications, General Optical system block diagram, advantages, disadvantages 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 | **10** |
| **2** | **Transmission Characteristics of Optical Fiber:**<br>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.<br>Non-linear effects, scattering effects, Kerr effects, soliton | **10** |
| **3** | **Optical Sources and Detectors:**<br>Working principle and characteristics of sources (LED, LASER), Tunable lasers, Quantum well lasers , Charge capture in Quantum well lasers, Multi Quantum well Laser diodes, Surface Emitting Lasers: Vertical cavity Surface Emitting Lasers.<br>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 | **08** |
| **4** | **Optical Communication Components:**<br>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). | **06** |

| | | |
|---|---|---|
| 5 | **Optical Networks and Free Space Optics:**<br>Point-to-Point links, system considerations, Link Power budget, Rise time budget, SONET/SDH optical networks, WDM and DWDM optical networks.<br>Introduction to FSO, Applications, Comparison with microwave systems, coherent optical space communication, Drawback and problems of realization, system description and design. | **08** |

**List of Laboratory Experiments: (minimum eight)**

1. Calculation of Numerical aperture
2. Calculation of dispersion for given fiber
3. Calculation of link Loss for given link
4. Performance analysis of Single mode fiber.
5. Analog communication link.
6. Digital communication link.
7. Performance Analysis of Optical Link with Different Sources
8. Performance Analysis of Optical Link with Different Detectors
9. Performance Analysis of Optical Amplifier
10. Calculation of link Loss for given link with nonlinearities.
11. Experiments using MATLAB.
12. Calculation of bit error rate.
13. Study of Eye pattern.

**Books Recommended:**

*Text books:*


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


*Reference Books:*


1. Harold Kolimbiris, 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.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

1. Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Fourth Year Electronics and Telecommunication Engineering** | **Semester: VIII** |
|---|---|
| **Course: Microwave Integrated Circuits** | **Course Code: DJ19ECEC8011** |
| **Course: Microwave Integrated Circuits - Laboratory** | **Course Code: DJ19ECEL8011** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | **50** |
| **3** | **2** | **--** | **3+1=4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Electromagnetics and Wave Propagation
2. Radio Frequency Circuit Design
3. Microwave Engineering

**Objectives:**

1. To understand the integration of microwave devices in the form of IC.
2. To understand the basic principles of microstrip line and coplanar waveguide.
3. To design amplifier and oscillator for various applications.

**Outcomes:** On completion of the course, learner will be able to:

1. Differentiate between HMIC and MMIC
2. Analyze the transmission lines used at microwave frequencies
3. Design the microwave amplifier for the given specifications
4. Design the microwave oscillator

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Hybrid MICs and Monolithic MICs:**<br>Definition, characteristics, comparison with conventional circuits, field of application and limitations and criteria for the choice of substrate material in HMICS and MMICS.<br>Thin film hybrid circuits, thick film hybrid circuits, art work, masking, photolithography, resistor stabilization, sawing, brazing process, wire bonding.<br>Monolithic MICs: Doping by ion implantation, Ohmic contacts, metal resistive layers, gate metal, dielectric and air-bridge vias, wafer process steps. | **08** |
| **2** | **Microstrip Lines:**<br>Planar wave guides, non-TEM propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters.<br>Microstrip open circuits and gaps, micro strip corners, step change in width.<br>Dispersion analysis, micro strip characteristic impedance, symmetric-T junction, Green's functions, millimeter wave modelling of micro strip lines. | **08** |
| **3** | **Coupled Line Propagation:**<br>Coupled line propagation: wave equations for coupled lines, propagation models, coupled line parameters, coupled line parameter variations with frequency, directional couplings, Lange coupler, coupled line pair operated as a four port.<br>Coplanar wave guides: design considerations and coplanar line circuits. | **10** |
| **4** | **Microwave Amplifier Design:**<br>Introduction, Definitions of Two-Port Power gains, derivation of power gains, stability circles, Test for unconditional stability.<br>Single-stage Transistor amplifier design: Maximum gain (Conjugate Matching), constant-gain circles and design for specified gains, Low noise amplifier design.<br>Broadband transistor amplifier design: Balanced amplifier, Distributed amplifiers, differential amplifiers.<br>Power amplifiers, amplifier linearization methods, design of class A power amplifiers. | **12** |
| **5** | **Microwave Oscillator Design:**<br>Introduction, compressed smith chart, resonators, single and two-port oscillator design, negative resistance from transistor model. | **08** |

| | | |
|---|---|---|
| | Noise in oscillators: linear approach, analytical approach to optimum oscillator design using s parameters, nonlinear active models for oscillators. | |

**List of Laboratory Experiments: (minimum Eight)**

1. Parametric analysis of Microstrip Line
2. Parametric analysis of Coplanar Waveguide
3. Parametric study of microstrip corners, step change width of microstrip line
4. Design and simulation of single stage maximum gain amplifier design
5. Design and simulation of specified gain amplifier design
6. Design and simulation of low noise amplifier design
7. Design and simulation of one port oscillator design
8. Case study on Hybrid MICs
9. Case study on Monolithic MICs

**Books Recommended:**

*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. Schrader, *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.


**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

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*Laboratory: (Term work)*

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

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i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Final year Electronics & Telecommunication Engineering** | **Semester: VII** |
|---|---|
| **Course: Internet Engineering & Network Security** | **Course Code: DJ19ECEC8012** |
| **Course: Internet Engineering & Network Security - Laboratory** | **Course Code: DJ19ECEL8012** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | **50** |
| **3** | **2** | **--** | **3+1=4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Computer Networks

**Objectives:**

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

**Outcomes:** On completion of the course, learner will be able to:

1. Configure various application layer protocols.
2. Analyze services of network layer provided by advanced protocols.

3. 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.
4. Describe security threats and apply security techniques using cryptosystems.
5. Describe different network security mechanisms
6. Analyze different types of firewalls, IDS and system security mechanisms

| **Detailed Syllabus: (unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Introduction to Internet and Application layer protocols:**<br>What is the Internet, ,Evolution of the Internet **,** Review of TCP IP layer functions<br>Application Layer protocols: HTTP, DHCP,DNS, FTP,TFTP,SMTP,MIME, IMAP,POP3,TELNET,SSH | **08** |
| **2** | **Network Layer:**<br>IPv6,Packet format, Transition from IPv4 to IPv6,ICMP(v4 and v6)<br>Review of IP addresses, Special addresses, NAT,CIDR: Address aggregation | **04** |
| **3** | **Multimedia Communication:**<br>Digitizing audio and video, Audio Compression ,video compression, streaming stored audio / video<br>Characteristics of real time interactive audio/video, RTP,RTP Packet format, UDP Port, RTCP,RTCP messages<br>VOIP:SIP,H.323<br>Flow characteristics, Flow classes, techniques to improve QoS, resource reservation, admission control | **08** |
| **4** | **Security in Networks:**<br>Introduction to Information Security, Network Security Domains, Attacks and Their classification, Security services and mechanisms<br>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.<br>Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET). | **10** |
| **5** | **Firewalls IDS and system security:** | **06** |

| | | |
|---|---|---|
| | 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. | |
| **6** | **System security and case study:** 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. | **06** |

**List of Laboratory Experiments: (minimum eight)**

1. Configure DNS Server using open source tool.
2. Configure DHCP Server using open source tool.
3. Configure services of TFTP server using Cisco Packet tracer.
4. Configuration of VOIP using Cisco packet tracer.
5. Explore and analyze network vulnerabilities using open source tools.
6. Understanding various networking commands like ARP, RARP, ping, tracert, telnet, nslookup.
7. Study of packet sniffer tools : Wireshark, :
    1. Download and install Wireshark and capture ICMP, TCP, and http packets in promiscuous mode.
    2. Explore how the packets can be traced based on different filters.
8. Detect ARP spoofing using nmap and/or open source tool ARPWATCH and Wireshark. Use Arping tool to generate gratuitous arps and monitor using Wireshark.

**Books Recommended:**

*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. Pfleeger and Pfleeger, *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

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments. The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Fourth Year Electronics and Telecommunication Engineering** | **Semester: VIII** |
|---|---|
| **Course: Advanced Digital Signal Processing** | **Course Code: DJ19ECEC8013** |
| **Course: Advanced Digital Signal Processing - Laboratory** | **Course Code: DJ19ECEL8013** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | |
| **3** | **2** | **--** | **3+1=4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | **50** |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Signals and Systems
2. Digital Signal Processing

**Objectives:**

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

**Outcomes:** On completion of the course, learner will be able to:

1. Demonstrate an understanding of multirate sampling and its mechanism.
2. Apply the techniques of power spectrum estimation and wavelet theory for various applications.
3. Implement adaptive filters for given applications.
4. Apply Wavelet Transform to Signal/Image Processing.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Multirate Digital Signal Processing:**<br>Advantages of Multirate Signal Processing, Interpolation and Decimation, Sampling Rate Conversion by Non Integer Factor. | **06** |
| **2** | **Power Spectrum Estimation:**<br>**Non Parametric Method of Power Spectrum Estimation:**<br>Periodogram, Modified Periodogram, Barlett Method, Welch's Method, Blackman-Tukey Approach<br>**Parametric Methods of Power Spectrum Estimation:**<br>Regressive Spectrum Estimation, Model Parameters-Yule-Walker Equation, Least Square Method and Linear Prediction, Moving Average Spectrum Estimation, Autoregressive Moving Average Spectrum Estimation. | **10** |
| **3** | **Linear Prediction and Optimum Linear Filters:**<br>Representation of Stationary Random Process, Forward and Backward Linear Prediction, Solution of Normal Equation(Levinson-Durbin and Schur Algorithm),<br>AR Lattice and ARMA Lattice Ladder Filters, Weiner Filters for Filtering and Prediction. | **10** |
| **4** | **Adaptive Filters:**<br>**Applications of Adaptive Filters:** System Identification, Adaptive Channel Equalization, Echo Cancellation, Adaptive Noise Cancellation,<br>**Adaptive Algorithms:** LMS Algorithm, RLS Algorithm | **06** |
| **5** | **Wavelet Transform:**<br>Introduction to Time Frequency Analysis, Short Time Fourier Transform, Continuous Wavelet Transform, Discrete Wavelet Transform, Multiresolution Analysis. Applications. | **10** |

**List of Laboratory Experiments: (minimum eight)**

1. Implementation of decimation and of interpolation of a signal.
2. Implementation of adaptive filter using Least Mean Squares (LMS) algorithm.
3. Implementation of adaptive filter using Normalized Mean square algorithm.
4. Periodogram of a signal using the Non Parametric method.

5. Implementation of the Levinson Durbin algorithm.
6. Implementation of AR, MA and ARMA PROCES.S
7. Prediction of signal using the LPC coefficient.
8. Implementation of Schur Algorithm for prediction.
9. Application of wavelets to image processing.
10. Implementation of Adaptive channel equalization.

**Books Recommended:**

*Text Books:*


1. John G. Proakis, and Dimitris G. Monolakis, *Digital Signal Processing*, 2007, Prentice Hall India.
2. Emmanuel C. Ifeachor, and Barrie W. Jervis, *Digital Signal Processing A Practical Approach*, 2008, Pearson Education.


*Reference Books:*


1. Simon Haykin, *Adaptive Filter Theory*, 2013, Pearson Education.
2. Tarun Kumar Rawat, *Digital Signal Processing*, 3rd Edn, Oxford University Press.
3. Raghuveer M. Rao and Ajit S. Bopardikar, 2000, *Wavelet Transforms, Introduction to Theory and Applications*, Pearson Education Asia.


**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including the practical performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Term work shall consist of minimum 8 experiments, and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Fourth Year Electronics and Telecommunication Engineering** | **Semester: VIII** |
|---|---|
| **Course: 5G Technology** | **Course Code: DJ19ECEC8014** |
| **Course: 5G Technology - Laboratory** | **Course Code: DJ19ECEL8014** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | **50** |
| **3** | **2** | **--** | **3+1=4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Analog Communication
2. Digital Communication
3. Computer Networks
4. Mobile Communication

**Objectives:**

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

**Outcomes:** On completion of the course, learner will be able to:

1. Understand the basics of 5G and beyond communication.
2. Characterize and analyze various modulation and multiplexing techniques used in 5G

3. Elaborate system architecture of 5G technology.
4. Illustrate spectrum requirement, antenna design and radio propagation for 5G technology.
5. Design security architecture of 5G

| Unit | Detailed Syllabus: (unit wise) | Duration |
|---|---|---|
| 1 | **Introduction:**<br>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. | **09** |
| 2 | **Architecture of the Core Network:**<br>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-Signalling Protocol, Signalling Protocol Architecture | **10** |
| 3 | **Architecture of the Radio Access Network:**<br>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 | **09** |
| 4 | **MIMO systems and Communication Devices:**<br>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. | **06** |
| 5 | **Spectrum, Antennas and Radio Propagation:**<br>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, | **08** |

| | | |
|---|---|---|
| | Penetration Losses , Foliage Losses , Atmospheric Losses , Multipath, Fading and Coherence , Introduction , Angular Spread and Coherence Distance , Doppler Spread and Coherence Time. | |
| **6** | **Security and Applications of 5G:**<br>Security Issues and Challenges in 5G Communications Systems. Mobile Malware Attacks Targeting UE. Access Networks User Equipment and External IP Networks - Attacks on 4G Access Network, HeNB Femtocell Attack , Mobile Operator's Core Network 5G Applications and Future Scope | **06** |

**List of Laboratory Experiments: (minimum eight)**

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

1. To find Antenna diversity in 5G
2. MIMO
3. SU Massive MIMO
4. Spatial Diversity, Spatial Multiplexing
5. Beam Forming in 5G
6. Channel Estimation
7. Signal Detection
8. Simulate 5G New Radio PHY in MATLAB
9. Waveform Generation, Simulation, Measurement and Over-the-Air Testing within MATLAB
10. Write program in MATLAB for 5G New Radio Polar Coding
11. Write program in MATLAB for LDPC Processing for DL-SCH and UL-SCH
12. Write program in MATLAB for NR Cell Search and MIB and SIB1 Recovery
13. Write program in MATLAB for Transmission over MIMO Channel Model with Delay Profile TDL
14. Modelling Downlink Control Information
15. NR Intercell Interference Modelling

**Books Recommended:**

*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


**Evaluation Scheme:**

**Semester End Examination (A):**

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

***Theory:***

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

1. Term work shall consist of minimum 7 experiments, 1 Power Point Presentation/case study and minimum assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

| **Program: Fourth Year Electronics and Telecommunication Engineering** | **Semester: VIII** |
|---|---|
| **Course: Satellite Communication** | **Course Code:DJ19ECEC8015** |
| **Course: Satellite Communication - Laboratory** | **Course Code:DJ19ECEL8015** |

| **Teaching Scheme (Hours / week)** | | | | **Evaluation Scheme** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Semester End Examination Marks (A)** | | | **Continuous Assessment Marks (B)** | | | **Total marks (A+ B)** |
| **Lectures** | **Practical** | **Tutorial** | **Total Credits** | **Theory** | | | **Term Test 1** | **Term Test 2** | **Avg.** | |
| | | | | **75** | | | **25** | **25** | **25** | **100** |
| | | | | **Laboratory Examination** | | | **Term work** | | **Total Term work** | **50** |
| **3** | **2** | **--** | **3+1= 4** | **Oral** | **Practical** | **Oral & Practical** | **Laboratory Work** | **Tutorial / Mini project / presentation/ Journal** | | |
| | | | | **25** | **--** | **--** | **15** | **10** | **25** | |

**Pre-requisite:**

1. Basic Electronics.
2. Analog Communication
3. Digital Communication
4. Electromagnetic Engineering
5. Radiating Systems

**Objectives:**

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

**Outcomes: On completion of the course, learner will be able to:**

1. Explain basics of satellite communication, space segment and earth segment.
2. Understand different satellite orbits and orbital parameters.
3. Design and analyze link budget of satellite signal for proper communication.
4. Understand various applications of satellite communications.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Overview of Satellite Systems, Orbits and Launching:**<br>Frequency allocation for satellite communication, Polar orbiting satellites, Kepler's Laws, orbital parameters, orbital perturbations, effects of a non-spherical earth, atmospheric drag.<br>Wave Propagation & Polarization, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Antenna Polarization, Polarization of Satellite signals.<br>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.<br>Selection of launching site, launch window, launch vehicles; satellite launch vehicle (SLV), augmented satellite launch vehicle (ASLV), polar SLV, geostationary satellite launch vehicle (GSLV). | 08 |
| 2 | **Space Segment:**<br>Satellite subsystems: Transponder sub-system, Antenna subsystem, AOC Sub-system, TT&C Sub-system, power sub-system, Thermal sub-system, reliability and quality Assurance.<br>Satellite stabilization, stabilization techniques. | 08 |
| 3 | **Earth station:**<br>Design consideration, General configuration- Block diagram, Receive only type earth, transmit-receive type earth station.<br>Antenna system, Feed system, Tracking system, LNA, HPA. | 06 |
| 4 | **Satellite Link:**<br>Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed atmospheric and ionospheric losses, link power budget.<br>System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise | 10 |

| | | |
|---|---|---|
| | temperature of absorptive networks, overall system noise temperature, carrier to noise ratio.<br>Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output.<br>Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, inter-modulation noise. | |
| **5** | **The Space Segment Access and Utilization:**<br>Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system.<br>Code Division Multiple Access: Direct-sequence spread spectrum– acquisition and tracking<br>TDMA: Reference Burst; Preamble and Post amble, carrier recovery, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA.<br>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. | **08** |

**List of Laboratory Experiments: (minimum eight)**

1. To study Active and Passive satellite.
2. To study transmission and reception of 1 KHz tone signal through satellite link.
3. To study transmission of video and audio signal over satellite link.
4. To design link budget for satellite system.
5. To find look angles and limits of visibility for the satellite.
6. To design satellite antennas and measure the gain of the antennas.
7. To find satellite system temperature and measure the light intensity for solar panel.
8. To find the power and efficiency of the solar panel used in satellite.
9. To find the time delay for transmission and reception of satellite data between earth stations.
10. To study effect of multipath fading, path loss and propagation delay on satellite signal.

**Books Recommended:**

*Text Books:*


1. Dennis Roddy, *Satellite Communications*, 4th Edn, McGraw-Hill International.
2. M. Richharia, *Satellite Communication Systems Design Principles*‖, 2nd Edn, Macmillan Press Ltd.
3. Gerard Maral and Michel Bousquet, *Satellite Communication Systems*, 4th Edn, Wiley Publication.


*Reference Books:*

1. Gerard Maral, *VSAT Networks*, 2nd Edn, John Willy & Sons.
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.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

1. Term work shall consist of minimum 8 experiments, and a case study based on any one topic is compulsory.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Assignments, Case study): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

<table>
<tr><td colspan="8">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VIII</td></tr>
<tr><td colspan="8">Course: Machine Learning for Signal Processing</td><td colspan="3">Course Code: DJ19ECEC8016</td></tr>
<tr><td colspan="8">Course: Machine Learning for Signal Processing - Laboratory</td><td colspan="3">Course Code: DJ19ECEL8016</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A + B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
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<tr><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">3+1=4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

**Pre-requisite:**

1. Engineering Mathematics IV
2. Digital Signal Processing

**Objectives:**

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

**Outcomes:** On completion of the course, learner will be able to:

1. Recognize fundamentals of machine learning (ML) techniques useful for various signal processing applications.
2. Understand various mathematical methods involved in ML for Signal Processing.
3. Design their own models for Speech Recognition and Audio Classification.
4. Design efficient models for Image Processing.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Refresher Topics:**<br>Linear Algebra:<br>Vectors, Matrices and Tensors, Linear Dependence and Span, Norms, Eigen decomposition, Singular Value Decomposition.<br>Probability Theory:<br>The Chain Rule of Conditional Probabilities, Independence and Conditional Independence, Expectation, Variance and Covariance, Bayes' Rule.<br>Digital Signal Processing:<br>Audio Acquisition, Representation and Storage, Image and Video Acquisition, Representation and Storage. | 05 |
| **2** | **Linear Models for Regression:**<br>Polynomial Curve fitting, Maximum likelihood and least squares, Geometry of least squares, Sequential learning, Regularized least squares, Multiple outputs. | 05 |
| **3** | **Linear Models for Classification:**<br>Two class Classification, Multiclass Classification, Least Squares for Classification, Problems with Least Squares Loss, Perceptron Algorithm. | 05 |
| **4** | **Non Linear Models-Neural Networks:**<br>Non Linear Regression, Parameter Optimization, Gradient descent Optimization, Evaluation of error-function derivatives, A simple example, Efficiency of backpropagation.<br>Regularisation for Neural Networks:<br>Data set Augmentation, Early Stopping, Bagging, Dropout. | 08 |
| **5** | **Probabilistic models and Expectation Maximisation Algorithm:**<br>k- means clustering, Gaussian Mixture Model, Maximum likelihood for Gaussian Mixtures, EM for Gaussian Mixtures. | 08 |
| **6** | **Machine Learning for Audio Classification:**<br>Time Series Analysis, LSTMs and CNNs.<br>**Machine Learning for Speech Recognition:**<br>Hidden Markov Models, Finite State Transducers and Dynamic Programming.<br>**Machine Learning for Image Processing:**<br>Transfer Learning, Attention models, Attribute-based learning. | 10 |

**List of Laboratory Experiments: (minimum eight)**

1. Plot of polynomials having various orders M, show with different colors, fitted to a given data set.
2. Plot the root-mean-square error evaluated on the training set and on an independent test set for various values of M.
3. Plot the polynomial for M = 9 fitted to a given data set using the regularized error function for two values of the regularization parameter λ.
4. *Implementation of processing audio data in Python - Mel Spectrograms and how to generate them*.
5. Audio Noise Classification from Urban Sound database using Time Series Analysis and CNNs and compare their performance.
6. *Implementation of Enhancing Spectrograms features for optimal performance by hyper-parameter tuning and data augmentation.*
7. Perform Image Segmentation with Gaussian Mixture Model.
8. Implementation of Speech Recognition by Dynamic Programming.
9. Image classification using Convolutional Neural Networks (CNNs).
10. Implementation of attribute based learning for object categorization.

**Books Recommended:**

*Text books:*


1. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, 2006, Springer.
2. Francesco Camastra and Alessandro Vinciarelli, *Machine Learning for Audio, Image and Video Analysis*, 2007, Springer.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, *Deep Learning*, 1st Edn, The MIT Press.


*Reference books:*


1. Christopher M. Bishop, *Neural Networks for Pattern Recognition*, 1995, Clarendon Press, Oxford.
2. Tom M. Mitchell, *Machine Learning*,1997, McGraw-Hill.


**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

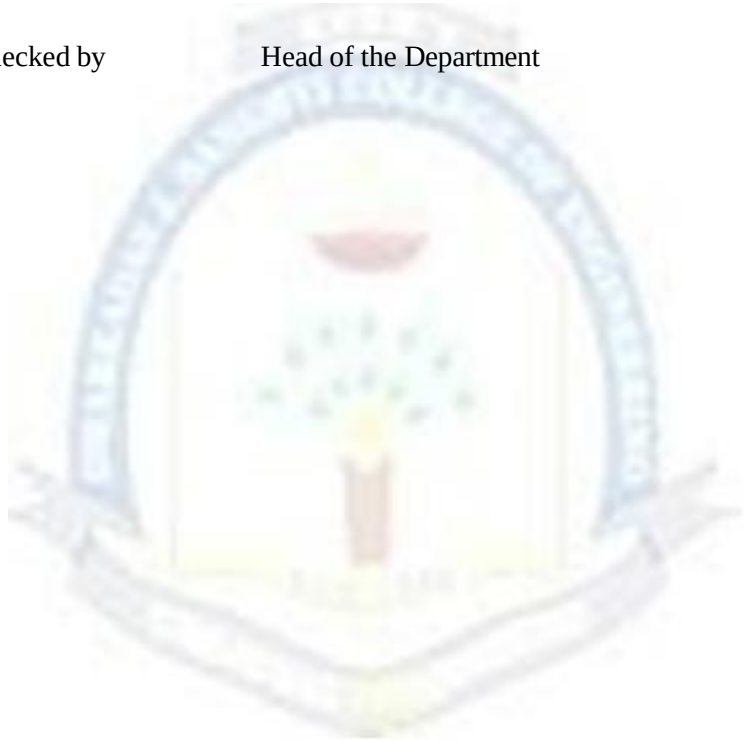
1. Term work shall consist of minimum 8 experiments, and a case study based on any one topic is compulsory.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Assignments, Case study): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal



**Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VIII (Autonomous)**
**(Academic Year 2022-2023)**

<table>
<tr><td colspan="8">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VIII</td></tr>
<tr><td colspan="8">Course: Project Stage - II</td><td colspan="3">Course Code: DJ19ECP801</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme<br>(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="4">--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td rowspan="3">--</td><td rowspan="3">10</td><td rowspan="3">--</td><td rowspan="3">5</td><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">200</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>--</td><td>--</td><td>100</td><td>100</td><td colspan="2">--</td><td>100</td></tr>
</table>

**Objectives:**

1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2. To train the students in preparing project reports and to face reviews and viva voce examination.

**Outcomes:** On completion of the course, learner will be able to:

1. Apply the technical knowledge gained from previous courses, identify problems and design solutions to solve real-life problems
2. Demonstrate technical skills required in an electronics industry for designing, building, testing electronic circuitry using modern software and hardware tools.
3. Apply project management skills (scheduling work, procuring parts, documenting technical and non-technical details and working within the confined deadline).
4. Develop and demonstrate troubleshooting ability in electronic circuits and systems (including software and hardware part of the systems).
5. Create technical reports, research paper and present the same to the evaluation authorities.

The final year students have already under gone project assignment in their seventh semester and in this semester the students are expected to continue the project work of stage I.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Oral & Practical:*

An approved external examiner and internal examiner appointed by the head of the institute together will assess during oral examination. The oral examination is a presentation by the group members on the project along with demonstration of the work done. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained.

***Continuous Assessment (B):***

*Termwork:*

The college should keep proper assessment record of the progress of project and at the end of the semester it should be assessed for awarding termwork marks. The termwork should be examined by approved internal faculty appointed by the head of the institute on the basis of following:

- Scope and objective of the project work.
- Extensive Literature survey.
- Progress of the work (Continuous assessment)
- Design, implementation, and analysis of the project work.
- Results, conclusions and future scope.
- Report in prescribed University format.

The final certification and acceptance of term work will be subject to satisfactory performance of project work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal