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)

Fourth Year B.Tech.

in

Electronics & Telecommunication Engineering

(Semester VII and VIII)

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

1st July, 2022

SEMESTER VII

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 VII (Autonomous)
(Academic Year 2022-2023)

Semester VII

Sr No	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	DJ19ECC701	Mobile Communication System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ECL701	Mobile Communication System - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19ECC702	Microwave Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ECL702	Microwave Engineering - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
3 @	DJ19ECEC7011	Radar Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ECEL7011	Radar Engineering - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ECEC7012	Big Data Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ECEL7012	Big Data Analytics - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ECEC7013	Embedded Systems	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ECEL7013	Embedded Systems- Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ECEC7014	Fundamentals of Speech and Audio Processing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ECEL7014	Fundamentals of Speech and Audio Processing - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ECEC7015	Computer Vision	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ECEL7015	Computer Vision - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ECEC7016	SAS	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ECEL7016	SAS - Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
4#	DJ19ILO7011	Product Lifecycle Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	3
	DJ19ILO7012	Management Information System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7013	Operations Research	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7014	Cyber Security and Laws	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7015	Personal Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7016	Energy Audit and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7017	Disaster Management and Mitigation Measures	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7018	Science of Well-being	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7019	Research Methodology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7020	Public Systems and Policies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
5	DJ19ECSBL4	IoT and Sensor Network- Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	2
	DJ19ECSBL5	Industrial Automation - Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
6	DJ19ECP701	Project Stage - I	--	4	--	2	--	--	--	--	50	50	--	--	--	50	50	100	2	2
		Total	12	14	--	19	12	300	75	--	50	425	100	100	100	175	275	700	19	

@ Any 1 Elective Course

Any 1 Institute Professional Elective

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

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="9">Program: Final Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="9">Course: Mobile Communication System</td><td colspan="3">Course Code: DJ19ECC701</td></tr>
<tr><td colspan="9">Course: Mobile Communication System - Laboratory</td><td colspan="3">Course Code: DJ19ECL701</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="5">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="5">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="5">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="5">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<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. Analog Communication
2. Digital Communication
3. Computer Communication Networks

Objectives:

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

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

1. Classify different types of propagation models.
2. Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.
3. Illustrate the fundamentals and system architecture of GSM, 2.5G, IS-95 and UMTS.

4. Elaborate on the concepts and principles 4G network deployment and optimization.
5. Identify the emerging technologies for upcoming mobile communication systems.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Mobile Radio Propagation:** Large scale fading: Free space propagation model, the three basic propagation mechanisms, reflection, ground reflection (two-ray) model. Small scale fading: Small scale multipath propagation, types of small-scale fading, Rayleigh and Ricean distributions.	**05**
2	**Fundamentals of Mobile Communication:** Introduction to wire1ess communication: The Cellular Concept System Design Fundamentals: Frequency Reuse, Handoff, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems. Features of all conventional multiple access techniques: Frequency division multiple access (FDMA), Time division multiple access (TDMA), Space spectrum multiple access (SSMA), space division multiple access (SDMA), SCFDMA, OFDM, GFDMA.	**10**
3	**Digital Telephony System(2G and 3G Systems):** GSM: GSM Network architecture, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM hand-off procedures. GSM evolution: GPRS and EDGE- architecture, radio specifications. IS-95: Architecture of CDMA system, CDMA air interface, power control in CDMA system, rake receiver. UMTS: Objectives, evolution path to 3G, network architecture, W-CDMA air interface, attributes of W-CDMA system, Cdma2000 cellular technologies: Forward and Reverse Channels.	**08**
4	**Advanced Techniques for 4G Deployment:** LTE Architecture, Physical layer: Frames, slots, and symbols, modulation, coding, Multi-antenna Techniques: Smart antennas, multiple input multiple output systems Cognitive radio: Architecture, spectrum sensing. Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals SDR: Architecture, limitations, advantages, disadvantages.	**07**

5	**4G Network Planning and Optimization:** Network Elements in a LTE Radio Network , User Equipment (UE), Base Station (eNodeB), Key Phenomena in LTE, Interference in LTE, Scheduling, Quality of Service. Radio Network Planning Process, Pre-Planning Phase, Detailed Network Planning LTE Radio Network Optimisation.	**07**
	Initial Tuning, Cluster Tuning, Market Level/Network Tuning, Self-organizing, Networks, Key Performance Indicators, LTE Advanced, Carrier Aggregation, MIMO Coordinated Multi-point Transmission and Reception (CoMP), Relay Nodes.	
6	**Road map towards 5G:** Introduction to Femtocell, Femtocell Attributes, Femtocell Standards Concept of Femtocells, Types of Femtocells Applications of Femtocells.	**04**

List of Laboratory Experiments: (minimum 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

Books Recommended:

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.

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="9">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
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<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<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 colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Pre-requisite:

1. Analog circuit design
2. Electromagnetics and Wave Propagation
3. Radio Frequency Circuit Design
4. Radiating Systems

Objectives:

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

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

1. Analyze propagation through guiding media using Wave equation and design various Impedance Matching Techniques.
2. Analyze functioning of different Microwave components.
3. Analyze Microwave Tubes and derive expressions of necessary performance parameters for them.

4. Implement communication systems using microwave communication bench set-up and software tool.
5. Understand measurement techniques to measure various circuit parameters at microwave frequency and carry out experimental verification for the same.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Basics of Microwave Communication Systems:** 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 interconnection of Two port networks. High Frequency parameters, Formulation of S- parameters, Properties of S- parameters.	**02**
2	**Waveguides and Impedance matching Network and Passive 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.	**10**
3	**Passive and Semiconductor Microwave Devices:** Tees, Hybrid ring, Directional couplers, Phase shifters, Terminations, Attenuators and Ferrite devices such as Isolators, Gyrators, 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).*	**12**
4	**Microwave Generation and Amplification:** Two Cavity Klystron, Multi-Cavity Klystron and Reflex Klystron. Helix Travelling Wave Tube and Cross Field Amplifier. Backward Wave Oscillator, Cylindrical Magnetron and Gyrotron.	**10**
5	**Microwave Measurements:** VSWR, Frequency, Power, Impedance, Attenuation, Dielectric Constant.	**03**

6.	**Microwave Application and Modern Trends in Microwave Engineering:** Effects of Microwave radiation on human body, Microwave hazards. Medical (Microwave Imagining, Microwave Diathermy) and Civil applications (Microwave heating, Instrumentation landing Systems, Radar Navigation Systems) of microwaves.	**03**

List of Laboratory Experiments: (minimum 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.

Books Recommended:

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.
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.

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="8">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="8">Course: Radar Engineering</td><td colspan="3">Course Code:DJ19ECEC7011</td></tr>
<tr><td colspan="8">Course: Radar Engineering - Laboratory</td><td colspan="3">Course Code: DJ19ECEL7011</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite:

1. Analog Communication
2. Digital Communication
3. Electromagnetics and Wave propagation

Objectives:

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

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

1. Understand generalized concept of Radar & its applications.
2. Analyze Radar range equation for various condition.
3. Identify different types of Radar for specific application.
4. Evaluate the design constraints for transmitter and receiver.

5. Gain ability to work in teams to solve complex problems and communicate effectively with technical reports / writeups.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Radar:** Basic Radar, Radar range equation. Block Diagram, Radar Frequencies. Applications of Radar.	**08**
2	**Radar Equation:** Detection of signal in noise. Receiver Noise and Signal-to-noise Ratio. Probability of detection and false alarm: Simple, complex Targets. Pulse Repetition Frequency.	**08**
3	**MTI and Pulse Doppler Radar :** Introduction to Doppler and MTI radar, Doppler frequency shift. Simple CW Doppler radar, MTI radar block diagram. Delay line canceler. Moving-target-detection. Pulse Doppler radar.	**10**
4	**Tracking Radar:** Mono pulse tracking. Conical scan and sequential lobbing. Limitation of tracking accuracy. Low angle tracking.	**0 6**
5	**Radar Transmitter and Receiver:** Radar RF power sources: Klystron, Travelling wave tube, Magnetron. Low power transmitter, high power transmitter. Advantages of solid state RF power source. Duplexer, and Mixer and their types. Receiver noise figure, Super heterodyne Receiver. Radar Display: Types of displays.	**0 8**

List of Laboratory Experiments: (minimum 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.

Books Recommended:

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 McGra Hill.
2. William L Melvin, James A Scheer, *Principles of Modern Radar*, 2nd Edn, Institution of Engineering and Technology.

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="9">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="9">Course: Big Data Analytics</td><td colspan="3">Course Code: DJ19ECEC7012</td></tr>
<tr><td colspan="9">Course: Big Data Analytics - Laboratory</td><td colspan="3">Course Code: DJ19ECEL7012</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme (Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="6">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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Pre-requisite:

1. Data Base Management System - Laboratory

Objectives:

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

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

1. Understand the key issues in big data management and its associated applications for business decisions and strategy.
2. Understand and Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop and NoSQL in big data analytics.

3. Evaluate Big Data processing by using MapReduce.
4. Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
5. Exploring the capabilities of big data using Apache Spark.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Big Data Analytics & Hadoop:** 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.	**06**
2	**NoSQL:** Introduction to NoSQL, NoSQL business drivers, NoSQL case studies. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) 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.	**08**
3	**MapReduce:** 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.	**08**
4	**Techniques in Big Data Analytics:** 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	**12**

	Recommendation Systems: Introduction, Collaborative-Filtering System, Content based recommendation system.	
5.	**Big Data Analytics using Apache Spark:** 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.	**08**

List of Laboratory Experiments: (minimum eight)

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup 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.

Books Recommended:

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.

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.

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Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VII (Autonomous)
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<tr><td colspan="8">Course: Embedded Systems</td><td colspan="3">Course Code:DJ19ECEC7013</td></tr>
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Pre-requisite:

1. Digital System Design
2. Integrated Circuit
3. Microprocessor & Microcontroller

Objectives:

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

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

1. Describe the Embedded System characteristics, design metrics and development life cycle.
2. Discuss different processor design techniques and architectures with example.
3. Identify different communication types and buses with different protocols.

4. Describe concepts and components of Real Time Operating system.
5. Gain ability to work in teams to solve complex problems and communicate effectively with technical reports / writeups.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Embedded System Overview:** Definition of Embedded System, Embedded Systems vs General Computing Systems, Classification, Major Application Areas, Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency. Embedded Product development life cycle.	**06**
2	**Processor:** Overview of Custom Single-Purpose Processors, General-Purpose Processors, Standard Single-Purpose Processors, RISC and CISC architectures, GCD example.	**08**
3	**Communication:** CAN bus, I2C, MOD bus, SPI, Examples on Parallel Communication, Serial Communication, Wireless Communication.	**06**
4	**Real Time Operating Systems (RTOS):** Operating system basics, Types of OS, Tasks, process, Threads, Multiprocessing and, Multitasking, Task scheduling, Threads, Process, Scheduling.	**06**
5	**Real Time Operating Systems (RTOS):** Task communications, Task synchronization, Device drivers, How to choose RTOS, Examples of RTOS.	**06**
6.	**Design examples and case studies of program model and programming with RTOS:** Digital Camera, Introduction to simple digital camera, Requirements and specifications, Design using Microcontroller and Microcontroller and CCDPP, Automatic Chocolate Vending Machine, Adaptive Cruise Control in car.	**08**

List of Laboratory Experiments: (minimum 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.

Books Recommended:

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.

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.

Term work shall consist of minimum 8 experiments, 1 Power Point Presentation and assignment.

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

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Syllabus for Fourth Year Electronics and Telecommunication Engineering Semester VII (Autonomous)
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<tr><td colspan="8">Course: Fundamentals of Speech and Audio Processing</td><td colspan="3">Course Code: DJ19ECEC7014</td></tr>
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</table>

Pre-requisite:

1. Signals and Systems
2. Digital Signal Processing

Objectives:

1. To understand basic concepts and methodologies for the analysis and modeling of speech signal.
2. To characterize the speech signal as generated by a speech production model.
3. To understand the mechanism of speech and audio perception.
4. To understand the digital representation of the speech waveform.
5. To perform the analysis of speech signal using STFT.

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

1. Demonstrate advanced Knowledge in Digital model representation of speech signal.
2. Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing.
3. Analyse speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
4. Formulate and design a system for speech recognition and speaker recognition.
5. Acquired knowledge about audio and speech signal estimation and detection.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Digital Representations of the Audio Waveform:** Sampling audio signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation.	**05**
2	**Digital Models for Speech signals:** Speech Production, Acoustic Phonetics and Auditory Perception, Anatomy and physiology of speech organs, articulatory phonetics, acoustic phonetics, acoustic theory of speech production, discrete time model for speech production. Ear physiology	**05**
3	**Time dependent processing of speech signals:** Short time energy and average magnitude, Short time average zero crossing rate, Speech V/S silence discrimination using energy & Zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing. Pitch period estimation based on FFT and harmonic peak detection method, estimation of formants using log spectrum.	**08**
4	**Short time Fourier Transform:** Introduction- Definition and Properties, Fourier Transform Interpretation ,Linear Filtering Interpretation, Sampling rates of $X_n(e^{jw})$in Time and Frequency, Filter Bank Summation Method of Short -Time Synthesis, Overlap Addition Method for Short -Time Synthesis.	**08**
5	**Homomorphic Processing:** Cepstral analysis of speech, mel frequency cepstral coefficients (MFCC), perceptual linear prediction (PLP), Pitch period estimation in cepstral domain, evaluation of formants using cepstrum.	**08**
6	**LPC and Parametric Speech Coding:** Review of lattice structure realization, forward and backward error filters, normal equations & its solutions, levinson-durbin algorithm, Berg's algorithm. Vocoder- Voice excited channel vocoder, Voice excited and error signal excited LPC vocoders , code excited LP (CELP) based vocoders, Adaptive predictive coding of speech, Auditory Modeling. Audio quality analysis: Objective analysis methods- PEAQ, Subjective analysis methods - MOS score. Speech Recognition using Dynamic Time Warping and Hidden Markov Models.	**10**

List of Laboratory Experiments: (minimum 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 periodograms 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.

Books Recommended:

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.

Evaluation Scheme:

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Laboratory: (Term work)

1. Term work shall consist of minimum 8 experiments, and an assignment.

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

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<tr><td colspan="8">Course: Computer Vision</td><td colspan="3">Course Code: DJ19ECEC7015</td></tr>
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</table>

Pre-requisite:

1: Applied Mathematics IV

2: Fundamentals of Digital Image Processing

Objectives:

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

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

1. Apply computer vision algorithms to edge detection, motion and object recognition.
2. Recognize geometrical relationships between 2D and 3D world.
3. Design and develop practical and innovative Image Processing and Computer Vision applications or systems.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Segmentation –I:** Edge Detection: - Canny, A model fitting method for edge detection – RANSAC LOG, DOG. Lines-Hough Transform, Image Pyramids and Gaussian derivative filters.	**07**
2	**Segmentation –II:** Key Point Localization, Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH	**08**
3	**Precursor:** Transformation Matrices – Homogeneous coordinates – Translation, Rotation Camera Models: Intrinsic and Extrinsic Camera Parameters, Homogeneous Coordinates, Perspective Projection Transformation,3-D Rotation of Points, Camera Calibration, Properties of Projection, Orthographic and Weak Perspective Projection.	**09**
4	**Optical Flow:** Computations for motion estimation and depth calculation, Horn and Schunk, Lucas and Kanade algorithms, Motion Segmentation. Convolution Neural Networks: Design and Implementation.	**08**
5	**Clustering Solutions for Segmentation:** Agglomerative Hierarchical Clustering – Algorithm, K-means Clustering, PCA and Eigenfaces, Linear Discriminant Analysis and Fisherfaces,	**08**

Books Recommended:

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.

List of Laboratory Experiments: (minimum 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).

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

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, 1 Power Point Presentation and assignment.

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="8">Program: Fourth Year B. Tech. in Electronics & Telecommunication Engineering</td><td colspan="4">Semester: VII</td></tr>
<tr><td colspan="8">Course: SAS</td><td colspan="4">Course Code: DJ19ECEC7016</td></tr>
<tr><td colspan="8">Course: SAS Laboratory</td><td colspan="4">Course Code: DJ19ECEL7016</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="8">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="4">Lectures</td><td rowspan="4">Practical</td><td rowspan="4">Tutorial</td><td rowspan="4">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">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="2">50</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral &Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td><td>Avg.</td></tr>
<tr><td>3</td><td>2</td><td>-</td><td>4</td><td>25</td><td>-</td><td>-</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite: Basic statistics and Database

Course Objectives: Students will try to:

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

Outcomes: Students will be able to

1. Able to familiar with Base SAS programming.
2. Understand and demonstrate visual analytics.
3. Able to design the report using reporter
4. View various reports using different media devices.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Base SAS:** **SAS Program :** Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax **Accessing Data :**Examining SAS Data sets, Accessing SAS Libraries **Producing Detail Reports:** Subsetting Report data, Sorting and Grouping Report data, Enhancing Reports **Formatting Data Values:** Using SAS Formats, User defined Formats	08
2	**Reading SAS Dataset , Spreadsheet and Database data** Reading SAS Dataset. Customize SAS Dataset. Router Reading Spreadsheet data Reading database data.	05
3	**Visual Analytics** Getting Stated with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page Administrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator. Demonstrations and Exercises.	04
4	**Using the Explorer** Selecting Data and defining Data Item properties Creating Visualisations, Enhancing Visualisations with Analytics Interacting with Visualizations and Explorations	08
5	**Designing Reports with Reporter** Creating a Simple Report Creating Data Items and Working with Graphs Working with Filters and Report sections Working with other objects Demonstrations and Exercises	08

6	**Viewing SAS VA Reports and Case Study** Creating Analyses and Reports. Viewing Reports on the Web Viewing Reports on the Mobile Device/ Office Analytics Case Study – Creating Analyses and Reports	06

Books Recommended:

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

Suggested List of Experiments:

Sr. No.	Title of the Experiment
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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus, 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's 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 the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEL6013** with minimum 06 experiments along with a mini project to be incorporated.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. 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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="8">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="8">Course: IoT and Sensor Network - Laboratory</td><td colspan="3">Course Code: DJ19ECSBL4</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td colspan="4">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="5">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="5">--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="5">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">25</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">1</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>--</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite:

1. Basic Electrical & Electronics
2. Electronics Measurement and Instruments
3. Microprocessor & Microcontroller
4. Embedded Systems

Objectives:

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

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

1. Identify different components of an IoT and Sensor network system.
2. Designing and affordability of IoT devices.
3. To explore the Industrial IoT, Industry 4.0, Connected Car applications.
4. Use Internet of Things for real time applications.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Internet of Things an overview, IoT Conceptual framework, IoT architectural View, Technology behind IoT, Sources of IoT, M2M Communication, Examples of IoT.	**02**
2	**Design Principles for Connected Devices:** IoT/M2M systems Designs Standardization, Communication Technologies, Data Enrichment, Data Consolidation, and device management, Designing and affordability, Energy efficiency in IoT.	**02**
3	**Design Principles for Web Connectivity:** Introduction, Web communication protocol for connected devices, Message communication protocols for connected devices, Internet based communication, IP addressing in the IoT.	**03**
4	**Data Acquiring, Organizing, Processing and Analytics:** Data acquiring and storage, Organizing the data, Transactions, Integration and Enterprise systems, Acquiring, Managing and storing processes.	**03**
5	**Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks:** Sensor technology, Industrial IoT and Automotive IoT, Actuator, Sensor data communication protocols, Wireless sensor networks technology, Embedded Computing Basics, Embedded Platforms for prototyping.	**04**

List of Laboratory Experiments: (minimum 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.

Books Recommended:

Textbooks:

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.

Evaluation Scheme:

Semester End Examination (A):

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="9">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="9">Course: Industrial Automation - Laboratory</td><td colspan="3">Course Code: DJ19ECSBL5</td></tr>
<tr><td colspan="9"></td><td colspan="3"></td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="8">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>
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<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">25</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">1</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>--</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite:

1. Basic Electrical &Electronics
2. Digital System Designs
3. Electronics Measurement and Instruments
4. Control Systems
5. Microprocessor & Microcontroller

Objectives:

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

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

1. Identify different components of an automation system.
2. Interface the given I/O device with appropriate PLC module.
3. Prepare PLC ladder program for the given application
4. Prepare a simple SCADA application.
5. Use Internet of Things for industrial automation

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction:** Need and benefits of Industrial Automation, Basic components of automation system, Types of automation, Fixed, Programmable, Flexible, Different systems used for Automation i.e. PLC, HMI, SCADA, DCS, Drives.	04
2	**Programmable Logic Controller (PLC):** Introduction, Block diagram, memory organization, IO modules (discrete and Analog), I/O modules selection criteria, Fixed and Modular PLC, PLC selection, PLC Installation, Advantage, Application.	06
3	**PLC Programming:** I/O addressing, Programming instructions (Relay, Timer, Counter, Delay, Logical, Data Handling, Comparison), Functional Block Diagram (FBD), Ladder Programming.	06
4	**Supervisory Control and Data Acquisition System (SCADA):** Introduction, Architecture/Block diagram, editors of SCADA, Interface SCADA with PLC, create SCADA screen for simple object, Application of SCADA like Traffic light control, water distribution, Industrial PCs, Mini Rugged PCs, Industrial Open Frame Panel PCs.	06
5	**Distributed Control System (DCS):** Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Advantages of DCS.	04

List of Laboratory Experiments: (minimum 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.

Books Recommended:

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. Bhoyar 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, Newnes international Publication.

Evaluation Scheme:

Continuous Assessment (A):

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 VII (Autonomous)
(Academic Year 2022-2023)

<table>
<tr><td colspan="8">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="3">Semester: VII</td></tr>
<tr><td colspan="8">Course: Project Stage - I</td><td colspan="3">Course Code: DJ19ECP701</td></tr>
<tr><td colspan="4" rowspan="3">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>
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<tr><td>--</td><td>--</td><td>50</td><td>--</td><td colspan="2">--</td><td>50</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. Apply project management skills (scheduling work, procuring parts, documenting technical and non-technical details and working within the confined deadline).
3. Create technical reports, research paper and present the same to the evaluation authorities

In final year group of maximum four students will be completing a comprehensive project work based on the courses studied. The project work may be internally assigned or may be externally assigned by the research institutes, industry etc. Each group will be assigned one faculty as a supervisor. This project work in final year may be extension of the Innovative Product Development (DJ STRIKE) Project work done in pre-final year.

The main intention of Project work is to enable students to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The Project work may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be

- Learning additional skills
- Development of ability to define, design, analysis and implementation of the problem and lead to its accomplishment with proper planning
- Learn the behavioural science by working in a group
- The project area may be selected in which the student intend to do further education and/or may be either intend to have employment or self-employment
- The topic of project should be different and / or may be advancement in the same topic of Innovative Product Development (DJ STRIKE) project
- The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Project work.

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 TW marks. The TW 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)
- Report in prescribed 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

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: Wireless Network</td><td colspan="3">Course Code: DJ19ECC801</td></tr>
<tr><td colspan="8">Course: Wireless Network - Laboratory</td><td colspan="3">Course Code: DJ19ECL801</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="3">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="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
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<tr><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. 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. Explain the fundamentals, architecture, design issues and standards and spectrum of various wireless network and compare them.
2. Compute different parameters of wireless networks.
3. Evaluate various wireless systems and deduce some conclusion.
4. Simulate various wireless systems using different simulation softwares.
5. Gain ability to work in teams to solve complex problems and communicate effectively with technical reports/ writeups.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Basics of Wireless Networks:** Introduction to Wireless Network, Classifications of wireless networks, Wireless Standards, Spectrum requirement for various wireless systems.	**04**
2	**Wireless Personal Area Networks:** 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:** 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 **Case Study:** Campus Wi-Fi installation.	**08**
4	**Wireless Sensor Network:** 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:** Applications of wireless sensor network, range of applications, examples of category 1 and 2 **Case Study:** Any one application of sensor network Wireless Body Area Network: Properties, Network Architecture, Network Components,	**06**

	Applications.	
6	**Middleware for Wireless Sensor Networks:** 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:** 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:** 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	**10**
3	**Optical Sources and Detectors:** 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. 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:** 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:** 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.	**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)

<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: Microwave Integrated Circuits</td><td colspan="3">Course Code: DJ19ECEC8011</td></tr>
<tr><td colspan="8">Course: Microwave Integrated Circuits - Laboratory</td><td colspan="3">Course Code: DJ19ECEL8011</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>
<tr><td colspan="4">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<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. 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:** Definition, characteristics, comparison with conventional circuits, field of application and limitations and criteria for the choice of substrate material in HMICS and MMICS. Thin film hybrid circuits, thick film hybrid circuits, art work, masking, photolithography, resistor stabilization, sawing, brazing process, wire bonding. 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:** Planar wave guides, non-TEM propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters. Microstrip open circuits and gaps, micro strip corners, step change in width. Dispersion analysis, micro strip characteristic impedance, symmetric-T junction, Green's functions, millimeter wave modelling of micro strip lines.	**08**
3	**Coupled Line Propagation:** 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. Coplanar wave guides: design considerations and coplanar line circuits.	**10**
4	**Microwave Amplifier Design:** Introduction, Definitions of Two-Port Power gains, derivation of power gains, stability circles, Test for unconditional stability. Single-stage Transistor amplifier design: Maximum gain (Conjugate Matching), constant-gain circles and design for specified gains, Low noise amplifier design. Broadband transistor amplifier design: Balanced amplifier, Distributed amplifiers, differential amplifiers. Power amplifiers, amplifier linearization methods, design of class A power amplifiers.	**12**
5	**Microwave Oscillator Design:** 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):

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: 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:** 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	**08**
2	**Network Layer:** IPv6,Packet format, Transition from IPv4 to IPv6,ICMP(v4 and v6) Review of IP addresses, Special addresses, NAT,CIDR: Address aggregation	**04**
3	**Multimedia Communication:** 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	**08**
4	**Security in Networks:** 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).	**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:** Advantages of Multirate Signal Processing, Interpolation and Decimation, Sampling Rate Conversion by Non Integer Factor.	**06**
2	**Power Spectrum Estimation:** **Non Parametric Method of Power Spectrum Estimation:** Periodogram, Modified Periodogram, Barlett Method, Welch's Method, Blackman-Tukey Approach **Parametric Methods of Power Spectrum Estimation:** 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:** Representation of Stationary Random Process, Forward and Backward Linear Prediction, Solution of Normal Equation(Levinson-Durbin and Schur Algorithm), AR Lattice and ARMA Lattice Ladder Filters, Weiner Filters for Filtering and Prediction.	**10**
4	**Adaptive Filters:** **Applications of Adaptive Filters:** System Identification, Adaptive Channel Equalization, Echo Cancellation, Adaptive Noise Cancellation, **Adaptive Algorithms:** LMS Algorithm, RLS Algorithm	**06**
5	**Wavelet Transform:** 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:** 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:** 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:** 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:** 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:** 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:** 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)

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<tr><td colspan="9">Program: Fourth Year Electronics and Telecommunication Engineering</td><td colspan="2">Semester: VIII</td></tr>
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<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

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:** 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).	08
2	**Space Segment:** Satellite subsystems: Transponder sub-system, Antenna subsystem, AOC Sub-system, TT&C Sub-system, power sub-system, Thermal sub-system, reliability and quality Assurance. Satellite stabilization, stabilization techniques.	08
3	**Earth station:** Design consideration, General configuration- Block diagram, Receive only type earth, transmit-receive type earth station. Antenna system, Feed system, Tracking system, LNA, HPA.	06
4	**Satellite Link:** 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	10

	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.	
5	**The Space Segment Access and Utilization:** 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.	**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)

Program: Fourth Year Electronics and Telecommunication Engineering	**Semester: VIII**
Course: Machine Learning for Signal Processing	**Course Code:** DJ19ECEC8016
Course: Machine Learning for Signal Processing - Laboratory	**Course Code:** DJ19ECEL8016

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. 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:** Linear Algebra: Vectors, Matrices and Tensors, Linear Dependence and Span, Norms, Eigen decomposition, Singular Value Decomposition. Probability Theory: The Chain Rule of Conditional Probabilities, Independence and Conditional Independence, Expectation, Variance and Covariance, Bayes' Rule. Digital Signal Processing: Audio Acquisition, Representation and Storage, Image and Video Acquisition, Representation and Storage.	05
2	**Linear Models for Regression:** 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:** Two class Classification, Multiclass Classification, Least Squares for Classification, Problems with Least Squares Loss, Perceptron Algorithm.	05
4	**Non Linear Models-Neural Networks:** Non Linear Regression, Parameter Optimization, Gradient descent Optimization, Evaluation of error-function derivatives, A simple example, Efficiency of backpropagation. Regularisation for Neural Networks: Data set Augmentation, Early Stopping, Bagging, Dropout.	08
5	**Probabilistic models and Expectation Maximisation Algorithm:** k- means clustering, Gaussian Mixture Model, Maximum likelihood for Gaussian Mixtures, EM for Gaussian Mixtures.	08
6	**Machine Learning for Audio Classification:** Time Series Analysis, LSTMs and CNNs. **Machine Learning for Speech Recognition:** Hidden Markov Models, Finite State Transducers and Dynamic Programming. **Machine Learning for Image Processing:** 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):

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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 (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="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">--</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="3">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