Scheme for First Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester I (Autonomous)
(Academic Year 2024-2025)

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment				
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test	Term Work	CA Total (B)	Aggregate (A+B)	Credits earned
1	DJS24PECPC11	Statistical Signal Processing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC11	Statistical Signal Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
2	DJS24PECPC12	Microstrip Antenna Design	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC12	Microstrip Antenna Design Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
3	DJS24PECPE11	Advanced VLSI Design	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE11	Advanced VLSI Design Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE12	Error Correcting Codes	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE12	Error Correcting Codes Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE13	Next Generation Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE13	Next Generation Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE14	Advanced Image & Video Processing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE14	Advanced Image & Video Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE15	Embedded Systems	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE15	Embedded Systems Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE16	Optical Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE16	Optical Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
4	DJS24PELVS11	Mini Project-I	--	4	--	2	--	--	50	--	--	50	--	50	50	100	2
5#	DJS24POCOE11	Data Analytics	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE12	Intellectual Property & Patenting	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE13	Cyber Security and Laws	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE14	Agile Frameworks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE15	Design of Experiments	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE16	Operations Research	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
		Total	**12**	**10**	--	**17**	--	**240**	**125**	--	--	**365**	**160**	**125**	**285**	**650**	**17**

@ Any 1 Department Level Elective
# Any 1 Institue Level Elective

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Scheme for First Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester II (Autonomous)
(Academic Year 2024-2025)

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment				
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test	Term Work	CA Total (B)	Aggregate (A+B)	Credits earned
1	DJS24PECPC21	RF and Microwave Engineering	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC21	RF and Microwave Engineering Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
2	DJS24PECPC22	Advanced Wireless Communication Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC22	Advanced Wireless Communication Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
3@	DJS24PECPE21	Wavelets	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE21	Wavelets Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE22	IOT & Sensor Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE22	IOT & Sensor Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE23	Network and Cyber Security	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE23	Network and Cyber Security Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE24	Advanced Signal Analysis and Processing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE24	Advanced Signal Analysis and Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE25	Millimeter Wave Communication	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE25	Millimeter Wave Communication Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE26	Remote Sensing Concepts	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE26	Remote Sensing Concepts Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
4	DJS24PELVS21	Mini Project-II	--	4	--	2	--	--	50	--	--	50	--	50	50	100	1
5#	DJS24POCOE21	Machine Learning	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE22	Renewable Energy	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE23	Digital Marketing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE24	Project Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE25	Research Methodology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE26	Product Life Cycle Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
		Total	**12**	**10**	**--**	**17**	**--**	**240**	**125**	**--**	**--**	**365**	**160**	**125**	**285**	**650**	**17**

@ Any 1 Department Level Elective
# Any 1 Institue Level Elective

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Scheme for Second Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester III (Autonomous)
(Academic Year 2024-2025)

Semester III

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	Total (B)		
1	DJS24PECVS31	*Skill Development Course	3	--	--	3	--	--	--	--	--	--	--	50	50	50	3
2	DJS24PELLE32	Internship/On Job Training/Special topic Research Seminar	--	12	--	6	--	--	50	--	--	50	--	50	50	100	6
3	DJS24PEPEL33	Dissertation Phase I	--	12	--	6	--	--	--	--	--	--	--	100	100	100	6
		Total	**3**	**24**	--	**15**	--	--	**50**	--	--	**50**	--	**200**	**200**	**250**	**15**

*Skill Development Course specific to the Thesis topic

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Scheme for Second Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester IV (Autonomous) (Academic Year 2024-2025)

Semester IV

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	CA Total (B)		
1	DJS24PEPEL41	Dissertation Phase II	--	30	--	15	--	--	100	--	--	100	--	100	100	200	15
		Total	--	**30**	--	**15**	--	--	**100**	--	--	**100**	--	**100**	**100**	**200**	**15**

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Evaluation Scheme:

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (Mins.)
Theory	Term Test 1 (based on 40 % syllabus)	15	45
	Term Test 2 (on next 40 % syllabus)	15	45
	Assignment / course project / group discussion / presentation / quiz/ any other. (on next 20% syllabus)	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory/ Tutorial	Performance in the laboratory, tutorial & / assignment. (ICA Component Evaluation)	25	

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

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (Hrs.)
Theory	Written paper based on the entire syllabus.	60	2
Oral	Questions based on the entire syllabus.	25	2
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	25	2

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**												**Semester: I**	
Course: Statistical Signal Processing **Statistical Signal Processing Laboratory**												**Course Code:** **DJS24PECPC11** **DJS24PELPC11**	
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**	**Assignment**		**Total**		
				60			**15**	**15**	**10**		**40**		**100**
				Laboratory Examination			**Term work**					**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**					
				25	**--**	**--**	**15**	**10**				**25**	

Course Pre–requisite:

- Signals and Systems
- Applied Engineering Mathematics

Course Objectives:

- Provide knowledge of statistical techniques necessary to explain and explore the important applications in signal processing and telecommunication.
- Make the students conversant with those aspects of statistical decision and estimation which is indispensable tools required for the optimal design of telecommunication systems.

Course Outcomes: At the end of course, a student will be able to:

- Understand basics of linear algebra in communication engineering.
- Study and apply the concepts of random processes in telecommunication engineering.
- Develop and evaluate different signal detection and estimation techniques in diverse telecommunication systems.
- Compare optimal filtering, linear estimation, and Wiener/Kalman filtering.
- Construct Wiener and Kalman filters (time discrete) and state space models.

Module No.	Unit No.	Topics	Hrs.
1		**Linear Algebra**	10
	1.1	Signal spaces, metric spaces, vector spaces, norms and normed vector spaces, inner-product spaces, orthogonality, orthogonal subspaces, linear transformations: range and null space, orthogonalization of vectors, representation and approximation in vector spaces, matrix representation of least squares, geometry of linear equations, four fundamental subspaces of linear operator.	
	1.2	Properties of matrix inverses, results on matrix rank, pseudo inverses, matrix condition number, singular value decomposition (SVD).	
2		**Review of random variables and random processes**	10
	2.1	Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Schwarz Inequality Orthogonality principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and auto covariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process, Linear System with random input, Spectral factorization theorem and its importance, innovation process and whitening filter.	
	2.2	Random signal modelling: MA (q), AR (p), ARMA (p, q) models.	
3		**Parameter Estimation Theory**	06
	3.1	Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Cramer Rao bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties;	
	3.2	Bayesian estimation: Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.	
4		**Estimation of signal in presence of white Gaussian Noise**	08
	4.1	Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear Prediction of Signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.	
5		**Kalman Filter**	04
	5.1	State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.	
6		**Spectral analysis**	04
	6.1	Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Prametric method, AR (p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.	

Statistical Signal Processing Laboratory (DJS24PELPC11)	
Exp.	**Suggested List of Experiments**
1	Generate Binomial, Poisson, Exponential and other discrete distributions.
2	Generate a white noise process and a Gaussian random process.
3	Verification of the Central Limit Theorem.
4	Estimate AR, ARMA and MA model parameters.
5	Implementation of Levinson Durbin Algorithm.
6	Lattice filter realization of prediction error filters.
7	Spectrogram Analysis of Speech signals.
8	Implementation of the Least Mean Squares (LMS) algorithm.
9	Noise cancellation using Adaptive filtering.
10	Implementation of Kalman filter for tracking.

Text Books:

- M. Hayes, *Statistical Digital Signal Processing and Modelling*, John Willey and Sons, 1996.
- M. D. Srinath, P.K. Rajasekaran and R. Viswanathan, *Statistical Signal Processing with Applications*, PHI, 1996.
- D. G. Manolakis, V.K. Ingle and S.M. Kogon: *Statistical and Adaptive Signal Processing*, McGraw Hill, 2000.
- S. M. Kay: *Modern Spectral Estimation*, Prentice Hall, 1987.
- Todd K. Moon and Wynn C. Stirling, *Mathematical Methods and Algorithms for Signal Processing*, Pearson Education, Inc., 2000.
- Peyton Z. Peebles, *Probability, Random Variables and Random Signal Principles*, Mc-Graw Hill, 2000.
- Steven M. Kay, *Fundamentals of Statistical Signal Processing: Estimation Theory*, Vol 1, Prentice Hall, Englewood Cliffs, NJ, 2010.

Reference Books:

- R. E. Walpole, R. H. Myers, S. L. Myers and K Ye, *Probability and Statistics for Engineers and Scientists*, 8th Edn, Pearson Education, Asia, 2007.
- J. S. Milton and J. C. Arnold, *Introduction to Probability and Statistics*, Tata McGraw Hill, 4th Edn, 2007.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="2">Semester: I</td></tr>
<tr><td colspan="8">Course: Microstrip Antenna Design
Microstrip Antenna Design Laboratory</td><td></td><td colspan="2">Course Code:
DJS24PECPC12
DJS24PELPC12</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td></td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td></td><td colspan="4">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Course Pre–requisite:

- Electromagnetics and Wave Propagation
- Radio Frequency Circuit Design
- Radiating Systems

Course Objectives:

- To provide futuristic knowledge in Microstrip Antenna Designs.
- To explain various practices presently used in the designing of Microstrip Antennas.
- To develop ability and assess alternative Microstrip Antenna designs based on technical criteria.
- To familiarize with antennas arrays.

Course Outcomes: At the end of course, a student will be able to:

- Design and investigate Microstrip Antennas.
- Associate the elementary design of Microstrip Antennas to advanced communication applications.
- To understand the concept of next generation antennas.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Antenna**	04
	1.1	Antenna Terminologies: Radiation Resistance, Radiation Pattern, Beam width, Gain, Bandwidth.	
	1.2	Linear Wire Antennas: Infinitesimal Dipole, Small Dipole, Finite Length Dipole.	
	1.3	Introduction to Aperture Antennas	
2		**Introduction to Microstrip Antennas (MSAs) and Feeding Techniques**	08
	2.1	Introduction to Microstrip Antennas and its various Parameters. Advantages and limitations of Microstrip Antennas, Applications of Microstrip Antennas.	
	2.2	Microstrip Antenna Feeding Techniques.	
	2.3	Regular Shape Microstrip Antennas - Rectangular MSA (RMSA), Circular MSA (CMSA), Equilateral Triangular MSA (ETMSA) and their variations, Design of regular shape MSAs, Differentially Fed MSAs.	
	2.4	Introduction to Analytical Models for MSAs: Transmission Line Model, Cavity Model, Multiport Network Model.	
3		**Broadband and Multiband Microstrip Antennas**	06
	3.1	Various parameters affecting MSA Bandwidth: Substrate parameters, Feeding Techniques.	
	3.2	Bandwidth Enhancement using Thicker Substrate and Modified Feeding Techniques.	
	3.3	Multi-Resonator, Gap Coupled and Stack configurations: Radiating edge and non-radiating edge RMSA, Gap coupled stack variations of CMSA and ETMSA, Wideband MSAs using resonant slots.	
	3.4	Tunable MSA, Stub and Short Post loading, Tuning using Active Devices, Frequency Reconfigurable MSAs.	
4		**Compact Microstrip Antennas**	06
	4.1	Introduction to Compact Microstrip Antennas.	
	4.2	Shorted RMSAs, Partially Shorted RMSAs, RMSA with a Single Shorting Post, Effect of the Position of Single Shorting Post	
	4.3	Variations of Compact Shorted CMSAs and ETMSAs.	
	4.4	Introduction to broadband variations of shorted MSAs.	
5		**Dual and Circular Polarized Microstrip Antennas**	06
	5.1	Necessity of Dual and Circularly Polarized Antennas.	
	5.2	Techniques to realize Circularly Polarized MSAs: Single and Dual Feed MSAs, Differentially Fed MSAs	
	5.3	Coaxially fed narrow slit and slot cut circular polarized MSAs, Modified patch shapes in MSAs, MSAs embedded with resonant slots.	
	5.4	Techniques to realize dual polarized MSAs.	
6		**Planar and Printed Monopole Antennas**	06
	6.1	Introduction to Planar Monopole, RMSA suspended in air with orthogonal ground plane, Calculation of the lower frequency of Planar Monopole Antennas, Effect of various parameters of Planar Rectangular Monopole Antennas.	
	6.2	Various planar printed monopole antennas with equal areas.	
7		**Microstrip Antenna Arrays**	06
	7.1	Microstrip line fed MSAs, Design of Series fed network, Design of corporate feed network, Realization of 2 x 2 MSA array	
	7.2	Non-linear array, Binomial distribution, Triangular distribution	

Microstrip Antenna Design Laboratory (DJS24PELPC12)	
Exp.	**Suggested experiments**
1	Designing and Simulation of RMSA, CMSA and ETMSA.
2	Designing and Simulations of Wideband MSA.
3	Design of Circularly Polarized MSA.
4	Designing of Multiband MSA.
5	Designing of Planar Monopole.
6	Designing of Shorted Compact Microstrip Antenna.
7	Designing of Gap Coupled Microstrip Antenna.
8	Designing of Dual Polarized Antenna.
9	Analysis of Fractal Antennas using simulations.
10	Implementation of Technical Paper from refereed journal

Text Books:

- C. A. Balanis, *Antenna Theory & Design*, 2nd Edn, Wiley and sons.
- Girish Kumar, K. P. Ray, *Broadband Microstrip antennas*, 1st Edn, Artech House.
- K. L.Wong, *Compact and Broadband Microstrip Antenna*, 1st Edn, Artech House.
- Frank Gross, *Smart Antennas for Wireless Communications with MATLAB*, McGraw Hill, 2005.

Reference Books:

- Ramesh Garg, *Microstrip Antenna Design Handbook*, 1st Edn, Artech House.
- James R. James, Peter S. Hall, *Handbook of Microstrip Antennas, Vol. I & II*, Institution of Engineering and Technology, 1989.
- Chen Sun, Jun Cheng, and Takashi Ohira, *Handbook on Advancements in Smart Antenna Technologies for Wireless Networks*-Information science reference, New York, 2008.

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="2">Semester: I</td></tr>
<tr><td colspan="8">Course: Advanced VLSI Design
Advanced VLSI Design Laboratory</td><td></td><td colspan="2">Course Code:
DJS24PECPE11
DJS24PELPE11</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
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</table>

Course Pre–requisite:

- Integrated Circuits
- Digital VLSI

Course Objectives:

- Importance of testing & verification of CMOS VLSI circuits.
- Underlying methodologies for analysis and design of fundamental CMOS Circuits.
- The issues associated with power dissipation in VLSI Circuits.
- Importance of HDL and designing using FPGA.

Course Outcomes: At the end of the course, a student will be able to:

- Design CMOS circuits using different logic styles.
- Analyse and design Low power VLSI circuits.
- Design circuits using Hardware descriptive language.
- Design logic circuits using programmable logic devices.

Module No.	Unit No.	Detailed Content	Hrs.
1		**MOSFET based Design styles:**	10
	1.1	MOS transistor switches, The transmission gate, CMOS logic structures, static and dynamic CMOS design.	
	1.2	Method of Logical effort for transistor sizing, Stick diagrams, colour-coded mask layout using Lambda-based (or micron-based) design rules.	
2		**Low power VLSI:**	08
	2.1	Sources of power dissipation in CMOS circuits: Static power dissipation; Diode leakage current, sub-threshold leakage current, gate and other tunnel currents; Dynamic power dissipation; Short circuit power; Switching power.	
	2.2	Leakage power minimization approaches, Variable-threshold voltage CMOS (VTCMOS) approach, Multi-threshold voltage CMOS (MTCMOS) approach, Dual-V_t assignment approach, Transistor stacking; Adiabatic switching circuits.	
3		**MOS based Programmable Logic Devices:**	08
	3.1	Types of programmable logic devices, PROM, Programmable Array Logic, Programmable Logic Arrays; Comparison among PLDs.	
	3.2	Implementation of function using PLD.	
4		**HDL coding:**	10
	4.1	Use of CAD, design methodologies, arithmetic modules, and design of complex sequential systems. Logic design with HDL: Introduction to HDL, logic design with behavioural models of combinational and sequential logic, architectures for arithmetic processors.	
	4.2	Introduction to FPGA architectures: Overview, programming technologies, configurable logic block, Designing with FPGAs: Design flow for FPGAs, prototyping with FPGAs.	
5		**Testing & Verification of VLSI circuits:**	04
	5.1	Scope of testing & verification in VLSI design process, issues in test and verification of complex chips, Fault models, Automatic test pattern generation.	
	5.2	Design for testability, Scan design.	

Advanced VLSI Design Laboratory (DJS24PELPE11)	
Exp.	**Suggested experiments**
1	Design and simulation of multiplexer circuits based on different logic styles.
2	Design and simulation of 1-bit full adder circuit using static CMOS style.
3	Layout diagram and post-simulation of CMOS inverter circuit.
4	Design and simulation of low power digital CMOS circuits based on adiabatic switching.
5	VHDL/Verilog coding to realize binary adder circuit.
6	VHDL/Verilog coding to realize multiplexer/demultiplexer circuit.
7	VHDL/Verilog coding to realize various flip flops.
8	VHDL/Verilog coding to realize counter.
9	VHDL/Verilog coding to realize registers.
10	VHDL/Verilog coding to realize finite state machine.

Batch wise laboratory work of minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt

Text Books:

- Sung Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits Analysis and Design*, 1st Edn, Tata McGraw Hill.
- Randall L. Geiger, Phillip E. Allen, Noel R. Strader, *VLSI Design Techniques for Analog and Digital Circuits*, 1st Edn, Tata McGraw Hill.
- Douglas L. Perry, *VHDL: Programming by example*, 4th Edn, Tata McGraw Hill.
- P. K. Lala, *Digital Circuit Testing and Testability*, 1st Edn, Academic Press.
- Kaushik Roy, Sharat C. Prasad, *Low power CMOS VLSI circuit design*, 1st Edn, Wiley Inter-Science Publications.

Reference Books:

- R. Jacob Baker, *CMOS: Circuit Design, Layout and Simulation*, 3rd Edn, John Wiley & Sons.
- Sedra Smith, *Microelectronic Circuits*, 7th Edn, Oxford University Press.
- D. A. Neamen, *Electronic Circuit Analysis and Design*, 2nd Edn, Tata McGraw Hill.
- Gary Yeap, *Practical Low Power Digital VLSI Design*, 1st Edn, Springer US, Kluwer Academic Publishers.
- Kiat Seng Yeo, Kaushik Roy, *Low Voltage Low Power VLSI Subsystems*, 1st Edn, Tata McGraw Hill.
- Samir Palnitkar, *Verilog HDL*, 2nd Edn, Pearson Education.
- Jan M. Rabaey, A. Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits*, 2nd Edn, Pearson Education.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: I</td></tr>
<tr><td colspan="8">Course: Error Correcting Codes
Error Correcting Codes Laboratory</td><td></td><td colspan="3">Course Code:
DJS24PECPE12
DJS24PELPE12</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="12">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td></td><td colspan="5">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Course Pre –requisite:

- Digital Communication
- Fundamentals of probability
- Applied Mathematics

Course Objectives:

- To provide students a sound knowledge of traditional and modern coding theory, the motivation behind synthesis of channel coding techniques.

Course Outcomes: At the end of course, a student will be able to

- Design channel codes for the physical layer and storage applications.
- Design and analyse channel codes for wired/wireless communication systems.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Algebra**	06
	1.1	Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2^m) and its basic properties.	
	1.2	Computation using Galois Field GF (2^m) Arithmetic, Vector spaces and Matrices.	
2		**Linear Codes**	08
	2.1	Block codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes, Reed –Muller codes, Repetition codes ,Product codes and Interleaved codes.	
	2.2	Bounds on size of codes: Hamming bound, Singleton bound, Plotkin bound, Gilbert-Varshamov bound	
3		**Cyclic Codes**	06
	3.1	Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes –Encoding using Feedback shift register circuits.	
	3.2	Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder.	
	3.3	Error trapping decoding, Cyclic Hamming codes, Golay code, Shortened cyclic codes, extended cyclic codes.	
4		**BCH Codes**	08
	4.1	Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction.	
	4.2	Non –binary BCH codes: q –ary Linear Block Codes, Primitive BCH codes over GF (q), Reed –Solomon Codes.	
	4.3	Decoding of Non –Binary BCH and RS codes: Berlekamp -Massey Algorithm.	
5		**Convolutional Codes**	06
	5.1	Encoding of Convolutional codes, Structural properties, Distance properties	
	5.2	Viterbi Decoding Algorithm for decoding, Soft –output Viterbi Algorithm,	
	5.3	Stack and Fano sequential decoding Algorithms, Majority logic decoding.	
6		**Low density Parity check codes and Turbo Codes**	06
	6.1	Low density parity check codes and Decoding of low density parity check codes: Belief propagation algorithm on BSC and AWGN channels	
	6.2	Introduction to Turbo coding and their distance properties, Design of Turbo codes, Turbo decoding.	
	6.3	Application of codes.	

Error Correcting Codes Laboratory (DJS24PELPE12)	
Exp.	**Suggested experiments**
1	Implementation of Linear Block codes (n,k)
2	Implementation of Cyclic codes
3	Implementation of Reed –Muller codes
4	Encoding of Convolutional codes
5	Repetition codes
6	Implementation of Low Density Parity check codes (LDPC)
7	Computation using Galois Field GF (2m) Arithmetic
8	Implementation of Viterbi Decoding Algorithm
9	Design of Turbo codes
10	Application of Turbo codes

Text Books:

- Shu Lin & Daniel J. Costello, Jr. *"Error Control Coding"* Prentice Hall, Second Edition, 2004.
- S. B Wicker, *Error Control Systems for Digital Communication and Storage*, Prentice Hall International, 1995.
- Blahut R. E, *Theory and Practise of Error Control Codes*, Addisson Wesley, 1983
- Blahut R.E., *Algebraic codes for Data transmission*, Cambridge University Press, 2003

Reference Books:

- Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Interscience, 2006.
- F. J. MacWilliams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977
- Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="2">Semester: I</td></tr>
<tr><td colspan="8">Course: Next Generation Networks
Next Generation Networks Laboratory</td><td></td><td colspan="2">Course Code:
DJS24PECPE13
DJS24PELPE13</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
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</table>

Course Pre –requisite:

- Computer Networks
- Mobile Communication
- Wireless Networks

Course Objectives:

- To provide a technical overview of Next-generation networks.
- To learn various Next-generation technologies and services.
- To understand the architecture, protocols and functionalities of Next-generation networks.

Course Outcomes: At the end of the course, a student will be able to

- Describe technical features and design considerations of the next-generation networks.
- Apply the concept of convergence of network services.
- Understand the transition of IP networks to NGN.
- Demonstrate technologies for next-generation network.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Next-generation Network and ITU standards:**	08
	1.1	Introduction to next-generation networks: Communicating in the new Era, New Era of Networking, Technologies influencing change, Internet protocol, Optical anywhere, wireless access, building blocks for NGN, IP everywhere, VOIP, Multi service flexible networks architecture, VPNs, Optical Networks, Wired and Wireless Networks, NGN Services, Network Infrastructure convergence, services convergence, from technology push to service pull.	
2		**IMS and Convergent Management IMS Architecture:**	10
	2.1	IMS services, QoS Control and Authentication, Network and Service management for NGN, IMS advantages.	
	2.2	Next-Generation OSS Architecture - standards important to OSS architecture, Information framework, OSS interaction with IMS, NGN OSS function/ information view reference model, DMTF CIM, Push to Talk over Cellular (PoC) Service, MS-Based FMC Service.	
3		**NGN Services:**	06
	3.1	VoIP, IPTV, rich multimedia, future web, Quality of Service (QoS),Quality of Experience (QoE) in NGN.	
	3.2	Control and Signalling protocols for NGN, NGN security, Service convergence, Business, and regulatory aspects of NGN.	
4		**MPLS and VPN Technology:**	12
	4.1	Technology overview–MPLS & QoS, Frame-Based MPLS, Cell-Based MPLS, MPLS Services, MPLS Benefits for Service Providers, MPLS Example Benefits for Large Enterprises, MPLS multicast, IPv6 and MPLS - Technology overview, Future of MPLS – Integrating IP and optical networks, Future Layer2 layer3 services.	
	4.2	Virtual Private Networks, IP VPNs, IP Security (IPSec), IPSec Protocols for Data Integrity, Access VPNs IPSec VPNs for Remote Access, Secure Socket Layer (SSL) VPN for Remote Access, Wireless Remote-Access VPNs, MPLS VPNs for Remote Access, Intranet VPNs, MPLS Layer 3 VPNs, MPLS Layer 2 VPNs, Layer 2 Tunneling Protocol version 3 (L2TPv3) VPNs, Multicast VPNs (MVPNs), Extranet VPNs, Multiservice VPNs over IPSec.	
5		**NGN Management and Applications:**	04
	5.1	Configuration, Accounting, performance, security, case study for MPLS, Future enhancements – Adaptive self-healing networks.	
	5.2	Transition of IP networks to NGN, Future packet-based network (IPv6 NGN), NGN Applications: Internet connectivity, e-commerce, call center, third party application service provision, UMTS, WAP, WiMAX, integrated billing, security and directory enable networks.	

Next Generation Networks **(DJS24PELPE13)**	
Exp.	**Suggested experiments**
1	Introduction of Wireless sensor network applications and its simulation
2	Network Simulator installation of wireless sensor network using NS2.
3	Write TCL script for transmission between mobile nodes using NS2.
4	Write TCL script for sensor nodes with different parameters using NS2.
5	Network Topology creation and REST API introduction.
6	Influencing flows via cURL commands.
7	Create a network and run a simple performance test.
8	Mininet Random Topology Generator.
9	Configure IPsec tunnel
10	Implement the Common Information Model in an OSS environment.

Text Books:

- Gerardus Blokdyk, *Next Generation Network –A Complete Guide*,1st Edn, 5STAR Cooks
- Robet Wood, *Next Generation Network Services*, 1st Edn, Pearson Education.
- Miikka Poikselka, Georg Mayer, Hisham Khartabil, Aki Niemi, *The IMS: IP Multimedia Concepts and Services*, 2nd Edn, Wiley publication.
- Thomas Plevyak, Veli Sahin, *Next-generation Telecommunication Networks,Services and Management*, 1st Edn, Wiley & IEEE Press Publications.
- Robert Wood, *MPLS and Next Generation Networks: Foundations for NGN and Enterprise Virtualization*, CISCO Press.

Reference Books:

- Neill Wilkinson, John, *Next Generation Network Services*, 1st Edn, Wiley Publication.
- Monique J. Morro, Azhar Sayeed, *MPLS and Next-Generation Networks: Foundations for NGN and Enterprise Virtualization*, Cisco Press.
- Jyh- ChengChen and Tao Zhang , *IP-Based Next-Generation Wireless Networks: Systems, Architectures, and Protocols*, 1st Edn, Wiley publication.
- Hsiao Hwa Chen, MohsenGuizani, *Next Generation Wireless Systems and Networks*, 1st Edn, Wiley publication.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: I**
Course: Advanced Image & Video Processing Advanced Image & Video Processing Laboratory		**Course Code:** **DJS24PECPE14** **DJS24PELPE14**

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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Digital Image and Video Processing Concepts
- Digital Signal Processing
- Fundamental of Digital Image Processing
- Statistical Signal Processing

Course Objectives:

- This course introduces students to fundamental problems in image and video processing as well as their state-of-the-art solutions.
- The course will prepare the students to capture the images and perform 3D reconstruction of the same.

Course Outcomes: At the end of course, a student will be able to

- Illustrate fundamental concepts related to multidimensional signal processing, feature extraction, pattern analysis.
- Recognize geometrical mapping between 2D and 3D world.

Module No.	Unit No.	Topics	Hrs.
1		**Digital Image formation and Low level processing**	06
	1.1	Fundamentals of image formation	
	1.2	Transformation: Orthogonal, Affine, Euclidian, Projective	
	1.3	Image Enhancement, Histogram processing	
2		**Feature Extraction Techniques**	07
	2.1	Feature Extraction using Edges - Canny, LOG, DOG, Lines-Hough Transform, Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters.	
	2.2	Pattern Analysis and Dimensionality Reduction: Mixture of Gaussians, PCA, LDA, ICA; Non-parametric methods.	
3		**3D Image Reconstruction**	06
	3.1	Shape from X, Light at Surfaces, Phong Model, Reflectance Map, Albedo estimation, Photometric Stereo, Use of surface smoothness constraints. Shape from texture, color, motion and edges, Shape from focus.	
4		**Digital Video Formats and Standards**	07
	4.1	REC.601 Digital Video Format	
	4.2	The Common Intermediate Format (CIF)	
	4.3	The Source Intermediate Format (SIF)	
	4.4	Video Compression Standards: MPEG, ITU-T standards, Video Compression Codecs: Open Source and Proprietary Codecs.	
5		**Motion Estimation and Motion Compensation**	07
	5.1	Complexities involved in motion estimation, Motion representation	
	5.2	Motion estimation Criteria: Error Minimization using Exhaustive Search, Gradient based search, Multi-resolution search. Block matching algorithms-EBMA, 2D log search, HBMA, Fourier Based Alignment, Incremental refinement, Phase Correlation method. Solution for the aperture problem.	
	5.3	Optical Flow Computations for motion estimation and depth calculation, Horn and Schunk , Lucas and Kanade algorithms.	
6		**Object based tracking in videos**	07
	6.1	Mean shift method, Background subtraction methods, GMM, background subtraction, non- negative matrix factorization.	

Advanced Image & Video Processing Laboratory (DJS24PELPE14)	
Exp.	**Suggested List of Experiments**
1	Develop a program to detect object in an image (Object Detection using SIFT and HOG)
2	Develop a program to segment an image using K-Means Clustering
3	Harris Corner detection
4	Implement a canny edge detection in python using open CV
5	Optical Flow computation algorithm
6	Implement a Gabor filter for feature extraction.
7	Develop a program to perform basic video operations (adaptive thresholding, smoothing, edge detector and bitwise operations).
8	Develop a program to track an object in a video.
9	Develop a program for content based image retrieval / scene detection.
10	Develop a program to recognize a face in an image (Haar Cascade classifier)
11	Hough transform for circles

Text Books:

- Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer-Verlag London Limited 2011.
- D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, , Pearson Education 2003
- R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, Addison- Wesley 1992.
- O. Marques, *Practical Image and Video Processing using Matlab*, IEEE Press., Wiley,2011

Reference Books:

- K. Fukunaga; *Introduction to Statistical Pattern Recognition*, Second Edition, Academic Press, MorganKaufmann, 1990.

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)

<table>
<tr><td colspan="8">Program: First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="2">Semester: I</td></tr>
<tr><td colspan="8">Course: Embedded Systems
Embedded Systems Laboratory</td><td></td><td colspan="2">Course Code:
DJS24PECPE15
DJS24PELPE15</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td></td><td colspan="11">Evaluation Scheme</td></tr>
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</table>

Course Pre –requisite:

- **Microprocessor and Microcontroller**

Course Objectives:

- Understand various design issues in embedded systems
- Understand ARM architecture and its programming concepts
- Design real time embedded application development using RTOS

Course Outcomes: At the end of course, a student will be able to

- Describe the design procedures involved in product development process
- Understand various advanced architectures and programming models
- Design Software and Hardware partition for a given application
- Understand and design communication protocols in Embedded Systems

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Embedded Systems**	**06**
	1.1	Architecture of Embedded System, Design Methodology, Design Metrics, General Purpose Processor, System On chip.	
	1.2	Embedded system design and development: Embedded system design, Life-Cycle Models, Development tools, Introduction to Development Platform Trends	
2		**Embedded Processor**	**09**
	2.1	CORTEX series features, Improvement over classical series, CORTEX ARM processors series, Features and applications, Survey of CORTEX based controllers from various manufacturers.	
	2..2	ARM-M3 Based Microcontroller LPC1768: Features, Architecture block diagram & its description, System Control, Clock & Power Control, Pin Connect Block. CMSIS Standard, Bus Protocols Ethernet, CAN, USB, Bluetooth.	
3		**Real Time Operating System**	
	3.1	Programming models for Single-Core and Multi-Core structures.	
	3.2	Free RTOS Scheduling and Task Management – Real-time scheduling, Task Creation, Inter task Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts.	
4		**Software / Hardware Partitioning**	**07**
	4.1	Co design overview , Co-simulation, synthesis and verifications ,Re-configurable computing -System on Chip (SoC) and IP cores	
	4.2	Low-Power RT Embedded Systems - On-chip Networking .	
5		**Embedded Communication**	**08**
	5.1	GPS, GSM, Bluetooth, Zigbee module interfacing, data processing and communication.	
	5.2	RTOS for 1D Signal Processing and 2D Signal processing. RTOS for fault Tolerant Applications, and Control Systems.	
		Total	**39**

Embedded Systems Laboratory (DJS24PELPE15)	
Exp.	**Suggested experiments**
1	Programming of available GPIO pins of the corresponding device using native programming language. Interfacing of I/O devices like LED/Switch etc., and testing the functionality.
2	Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value
3	Building and hosting a simple website(static/dynamic) on the device and make it accessible online. There is a need to install server (eg: Apache) and thereby host the website.
4	Interfacing the regular USB webcam with the device and turn it into fully functional IP webcam & test the functionality.
5	Use the development board while connecting to a wifi network using a USB dongle and at the same time providing a wireless access point to the dongle.
6	Chronos device is a programmable Texas instruments watch which can be used for multiple purposes like PPT control, Mouse operations etc., Exploit the features of the device by interfacing with devices.
7	Transforming the development board into a regular FM transmitter capable of transmitting audio at desired frequency
8	Displaying the RSS news feed headlines on a LCD display connected to device. This can be adapted to other websites like twitter or other information websites. Python can be used to acquire data from the internet.
9	Monitor the voltage level of the battery and indicating the same using multiple LED's (for ex: for 3V battery and 3 LEDs, turn on 3 LED's for 2-3V, 2 led's for 1-2V, 1 led for 0.1-1V & turn off all for 0V)
10	Flashing the OS on to the development board into a stable functional state by porting desktop environment with necessary packages.

Batchwise laboratory work of minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

- Dr. K.V.K. Prasad, *Embedded/Real-Time Systems: Concepts Design & Programming*, Dreamtech, 2003.
- F. Vahid & T. Givargis, *Embedded System Design*, Wiley, 1999.
- Richard Barry, Using the FreeRTOS Real Time Kernel - a Practical Guide - Cortex-M3.
- Communicating Embedded Systems: Networks Applications, Francine Krief (Editor) February 2010, Wiley-ISTE

Reference Books:

- P Marwedel, Embedded System Design, Springer publication Christopher Hallinan
- Wolf, W., *Computers as Components: Principles of Embedded Computing System Design*, Morgan Kaufmann, San Francisco, 2001.
- Embedded Linux Primer: A Practical Real-World Approach, Second Edition, Pearson

Education Publication
- Fu. K. S., Gonzalez. R. C. & Lee C.S.G., *Robotics control, sensing, vision and intelligence*, McGraw Hill Book co, 1987.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will comprise of total five question.
2. All question carries equal marks.
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3
4. All questions are compulsory.
5. End Term examination weightage is of 60 Marks.

Continuous Assessment (B):

Theory:

1. Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approximately 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour. There will be continues evaluation which carries 10 Marks.
2. Sum of the marks scored in both the two tests and assignment will be considered for final grading.

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**											**Semester: I**
Course: Optical Networks Optical Networks Laboratory											**Course Code:** **DJS24PECPE16** **DJS24PELPE16**
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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Optical Communication
- Digital Communication

Course Objectives:

- To provide a technical overview of Optical Networks.
- To learn various protocols and optical networks.
- To understand design aspect of WDM networks.

Course Outcomes: At the end of the course, a student will be able to

- Interpret functions of various optical network components.
- Compare different multiplexing techniques and optical network architectures.
- Understand components and designing aspects of WDM networks.
- Explain photonic packet switching concepts and access networks.
- Analyze different network management functions.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Optical Networks**	06
	1.1	OPTICAL Components: Couplers, Isolators and Circulators, Multiplexes and Filters Optical Amplifiers. Transmitters, Detectors, Switches, Wavelength Converters	
	1.2	Introduction to Optical Networks, Metropolitan-Area Networks, Broadcast and Select Networks–Topologies for Broadcast Networks, Media-Access Control Protocols.	
2		**Client Layers of the Optical Layer**	08
	2.1	SONET/SDH: Multiplexing, VCAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure	
	2.2	Optical Transport Network: Hierarchy, Frame Structure, Multiplexing.	
3		**WDM Network and Management**	08
	3.1	WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, Optical Cross connects.	
	3.2	Configuration Management: Equipment Management, Connection Management, Adaptation Management, Optical Safety.	
4		**WDM Network Design**	08
	4.1	Cost Trade-Offs: A Detailed Ring Network Example, LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion, Dimensioning Wavelength-Routing Networks.	
5		**Photonic Packet Switching and Access Networks**	10
	5.1	Optical Time Division Multiplexing: Bit Interleaving, Packet Interleaving, Optical AND Gates, Synchronization, Tunable Delays, Optical Phase Lock Loop, Header Processing, Buffering, Burst Switching.	
	5.2	Access Networks: Network Architecture Overview, Enhanced HFC, Fiber to the Curb (FTTC) , PON Evolution.	

Optical Networks (DJS24PELPE16)	
Exp.	**Suggested experiments**
1	To study and plot the refractive index profile for step index and graded index fibre using MATLAB.
2	To study the optical communication Analog and digital Link using trainer kit.
3	To Measure propagation and bending loss in 660nm optical fiber.
4	To Measure the Numerical Aperture of the 660nm optical fiber.
5	To study Frequency modulation and demodulation over Fiber Optics Link using 660 nm and 850/950 nm LED.
6	To calculate Photodetector Noise and Signal-to-Noise Ratio using MATLAB.
7	To study and design Link Power Budget using MATLAB.
8	To study optical component and WDM.

Text Books:

- Kumar Sivarajan, Rajiv Ramaswamy, Morgan Kauffman, *Optical Networks: A Practical Perspective*, 3rd Edn, Elsevier Publication Elsevier India Pvt. Ltd.
- C. Siva Ram Moorthy, Mohan Gurusamy, *WDM Optical Networks: Concept, Design and Algorithms*, 1st Edn, Prentice Hall of India.
- Vivek Alwayn, *Optical Network Design and Implementation*, 2004, Pearson Education.
- Harry G. Parros, *Connection Oriented Networks*,2005, Wiley

Reference Books:

- Hussein T. Mouftab and Pin-Han Ho, *Optical Networks: Architecture and Survivability*, 2002, Kluwer Academic Publishers.
- Biswanath Mukherjee, *Optical Communication Networks*, McGraw Hill, 1997.
- Ulysees Black, *Optical Networks*, 2007, Pearson education.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	M. Tech	Semester: I
Course: Mini Project I (DJS24PELVS11)		

Pre-requisite:

Domain knowledge of any Program Specific Outcome (PSO) of the EXTC curriculum.

Objectives:

1. Project Implementation with reference to the subjects in the various domains of EXTC, UG & PG curriculum, with a view to strengthen research.
2. To explore and identify real-world social and industrial problems, to realize feasible solutions with added business value, based on conventional or innovative methods/practices.

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

1. Identify problem statement, design and develop project in predefined timeline.
2. Provide problem solutions by learning/exploring various ideas from multi-disciplinary domains across different disciplines.
3. Draw proper inferences through theoretical/ simulations/ experimental and analyze the impact of the proposed method towards design and development of the product.
4. Develop and enhance skills associated with literature survey, hardware and software co-integrations, documentation, development and testing leading to innovative product or a paper publication in a reputed journal.

Syllabus:

Domain knowledge (any field of knowledge and beyond) needed from the following areas for the effectiveimplementation of the product:

Electronic devices and circuits, Integrated circuits, Control systems, Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and Big data, Web and Application development, Robotics, Artificial Intelligence (AI), Machine learning (ML), CAD design and Additive manufacturing (3d printing).

The above areas can be updated (expanded), based on the needs of technological innovations and development needed for a specific project.

Evaluation Scheme:

Every student performance will be reviewed once in a semester by review panel formed by the Head of Department. The evaluation is based on the following criteria:

1. Innovative ideas and Motivation
2. Objectives, Expected outcome and long-term social impact
3. Literature survey and Comparative Methodology
4. Timeline, progress and execution (Project Implementation)
5. Documentation/ synopsis of project report.
6. Overall presentation

Marks scored in the mid-semester review will be considered as a part of the term work.

The final certification and acceptance of Term work ensures satisfactory performance and the outcome of evaluation centered about evaluation scheme.

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)

<table>
<tr><td colspan="5">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="5">Semester: I</td></tr>
<tr><td colspan="5">Course: Data Analytics</td><td></td><td colspan="5">Course Code:
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<tr><td colspan="4" rowspan="3">Teaching Scheme
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</table>

Course Pre –requisite:

- Fundamentals of probability
- Applied Mathematics

Course Objectives:

- To build the strong foundation in statistics which can be applied to analyze data and make predictions.

Course Outcomes: At the end of course, a student will be able to:

1. Interpret data using descriptive statistics.
2. Demonstrate sampling distributions and estimate statistical parameters.
3. Develop hypothesis based on data and perform testing using various statistical techniques.
4. Perform analysis of variance on data.
5. Examine relations between data.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Statistics**	06
	1.1	Types of statistics, population vs sample Measures of Central Tendency: arithmetic mean, properties, weighted mean, properties, median, mode, grouped and ungrouped data, empirical relation between the mean, median and mode, geometric mean, harmonic mean, relation between arithmetic, geometric and harmonic mean, outlier.	
	1.2	Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, properties, variance, root mean square deviation, empirical relations between measures of dispersion, absolute and relative dispersion, coefficient of variation, moments, Pearson's β and γ coefficients, skewness, kurtosis, population parameters and sample statistics, histogram, frequency polygon Measures of position: quartiles, interquartile range, semi interquartile range, percentiles, percentile rank, 10–90 percentile range, box and whisker plot	
2		**Sampling distribution and Estimation**	08
	2.1	Sampling distribution: Central limit theorem, population distribution, chi-square distribution, Z - distribution, student's t-distribution, F-Distribution.	
	2.2	Statistical Estimation: Characteristics of estimators, consistency, unbiasedness, unbiased estimates, efficient estimates, sufficient estimators, point estimates, interval estimates, determination of sample size for estimating mean and proportions, estimates of population parameters, probable error	
3		**Hypothesis Testing for data driven decision making**	12
	3.1	Hypothesis testing: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p-Value, critical region, level of significance	
	3.2	Confidence interval: Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations Goodness of fit test using Kolmogorov-Smirnov test and Anderson Darling test	
	3.3	Tests using z-statistics: difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ, difference between two sample means, one tailed and two tailed tests Test using t-statistics: difference between sample mean and population mean, difference between two independent sample means, difference between means from the same group; Test using F-statistics: equality of population variance Test using chi-square statistics: test of independence, goodness of fit	
4		**Analysis of Variance (ANOVA) for data analysis**	08
	4.1	Sample size calculation, one way ANOVA, POST-HOC Analysis (Tukey's Test), randomized block design, two way ANOVA	
5		**Examining Relationship**	08
	5.1	Correlation: Scatter plot, covariance, Karl Pearson's coefficient of correlation, hypothesis test for correlation, correlation vs causation, extreme data values, limits of correlation coefficient, Rank correlation, Spearman's rank correlation coefficient, Repeated ranks, partial and multi correlation	
	5.2	Regression: linear regression analysis, lines of regression, regression	

		coefficients, scatter plot with regression lines, hypothesis test for regression, multiple regression, coefficient of determination, residuals, collinearity, influential observations	

Text Books:

- Ken Black, *Business Statistics for Contemporary Decision Making*, John Wiley & Sons, Inc. Sixth Edition.
- Anderson Sweeney Williams, *Statistics for Business and Economics*, Cengage Learning, 2011.

Reference Books:

- Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, Cengage Learning, 2011.
- Douglas C. Montgomery, George C. Runger, *Applied Statistics & Probability for Engineering*, John Wiley & Sons, Inc, 2002

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(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: I</td></tr>
<tr><td colspan="8">Course: Intellectual Property & Patenting</td><td></td><td colspan="3">Course Code:
DJS24POCOE12</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
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</table>

Course Objectives:

- Understanding, defining and differentiating different types of intellectual properties (IPs).
- Assessing different IP management (IPM) approaches.
- Exposure to the Legal management of IP and understanding of real life practice of IPM.

Course Outcomes: At the end of course, a student will be able to:

- Recognize the crucial role of IP for the purposes of product and technology development.
- Understand how and when to file a patent.
- Apply the knowledge to understand the entire ecosystem.
- Derive value from IP and leverage its value in new product and service development.

Module No.	Topics	Hrs.
1	**Intellectual Property Law** Introduction and the need for intellectual property right (IPR), Intellectual Property laws, IPR in India: Genesis and development, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, Types of IPR	05
2	**Patents and Trademarks** Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices. Concept of Trademarks, Different kinds (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board.	08
3	**Copyrights and Design** Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection	10
4	**Patenting** Introduction to the Indian Patent System Patent Law as Concepts, IPR as a group of rights, Patent Rights, Fundamental of Patents, and Patent Law in India. Understanding the Patents Act and the Rules.	08
5	**Patent Drafting and Searching** Anatomy of a patent application Adequate disclosure The art of drafting patent claims Patent searching: (A) Purposes and techniques (B) Available On-line tools	06
6	**Actions for patent infringement** Interpretation of claims Doctrine of equivalents Product testing as a possibly infringing use Doctrine of exhaustion Legal and equitable remedies for infringement	05

Text Books:

- Feroz Ali, *The Law of Patents -With A Special Focus On Pharmaceuticals In India*, LexisNexis, 2011.
- Ronald D. Slusky, *Invention Analysis and Claiming – A Patent Lawyer's Guide*, Second Edition, American Bar Association, 2012.
- Feroz Ali, *The Touchstone Effect – The Impact of Pre-grant Opposition on Patents*, LexisNexis, 2009.

Reference Books:

- Drucker. F. Peter, *Innovation and Entrepreneurship*, Harper business, 2006.
- Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning, 2013.
- Prabuddha Ganguli, *Intellectual Property Rights– Unleashing The Knowledge Economy*, Tate Mc Graw Hill Publishing Company Ltd. 2001.
- Martin Roger, *The Design of Business*, Harvard Business Publishing, 2009.

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<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: I</td></tr>
<tr><td colspan="8">Course: Cyber Security and Laws</td><td></td><td colspan="3">Course Code:
DJS24POCOE13</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="11">Evaluation Scheme</td></tr>
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</table>

Pre-requisite: Knowledge of

- Computer Network
- Information Security

Objectives:

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

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

- Understand the distinct types of cybercrime and security issues E Business.
- Analyses distinct types of cyber threats and techniques for security management.
- Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.
- Impart the knowledge of Information Technology Act and legal framework of right to privacy, data security and data protection.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Cybercrime**: Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism ,Virus & Worm's ,Email Bombing ,Pornography ,online gambling ,Forgery ,Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation,,Software Piracy, Electronics/ Digital Signature, Phishing ,Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks,SQL Injection, Buffer Over Flow ,Attacks on Wireless Networks ,Phishing Identity Theft (ID Theft). **Cyber offenses: How** criminal plan the attacks, Social Engg, Cyber stalking, Cybercafe and Cybercrimes, Botnets, Attack vector.	12
2	**Cyber Threats Analysis** Knowledge of Dynamic and Deliberate Targeting, Knowledge of Indications and Warning. Knowledge of Internal Tactics to Anticipate and/or,Emulate Threat Capabilities and Actions. Knowledge of Key Cyber Threat Actors and their Equitie, Knowledge of Specific Target. Identifiers and Their Usage **Cyber Security Management** Knowledge of Emerging Security Issues, Risks, and Vulnerabilities	08
3	**Electronic Business and legal issues** Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business , paper vs paper less contracts, E-Commerce models- B2B, B2C,E security. E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections, Security for E-Commerce.	06
4	**Indian IT Act** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments. **Security aspect in cyber-Law** The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law.	08
5	**Security Industries Standard Compliances** IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance). SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project., GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls).	08

Books Recommended:

Reference Books

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New-Delhi.
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
5. Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
6. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi
8. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.
9. William Stallings, Cryptography and Network Security, Pearson Publication
10. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
9. Website for more information, A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

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<table>
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First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: I</td></tr>
<tr><td colspan="8">Course: Agile Frameworks</td><td></td><td colspan="3">Course Code:
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</table>

Pre-requisite: Knowledge of

- Software Engineering

Objectives:

- To focus on the phases of agile project management.
- To equip the student on the scaling techniques for agile projects.
- To analyze the performance of agile projects.
- To develop the skills of the students on product development.
- To equip the students on agile delivery and risk mitigation.

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

- Summarize the concepts of agile practices and business objectives.
- Gain knowledge on the phases of agile development framework.
- Have an exposure on the scaling factors and models to be developed for agile projects.
- Acquire knowledge on the agile performance measurement.
- Develop the product based on agile factors with risk mitigation.
- Describe the role of agile in enterprise management and incremental delivery.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Agile Frameworks:**	05
	1.1 Agile definitions and historical context, Agile Values and Principles found in the Agile Manifesto, Misconceptions about Agile	
	1.2 Selecting an Approach that Fits: Choosing between an Agile or Traditional Approach, Selecting the Right Agile Approach	
2	**Agile Methodologies:**	06
	2.1 The Agile Methodologies: Common Themes, Methodology Descriptions, Extreme Programming, Scrum, Feature Driven Development, The Crystal Methodologies, Adaptive,Software Development, Dynamic Systems Development Method, Lean Software Development, Starting Monday: Investigate Further	
3	**Extreme Programming (XP):**	07
	3.1 Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts, Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility, Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives	
4	**Planning Agile Projects:**	10
	4.1 Planning for Agile Teams • Scrum Teams • XP Teams • General Agile Teams • Collaboration Rooms • Team Distribution	
	4.2 Agile Project Lifecycles • Typical Agile Project Lifecycles • Activities within each Phase • Create product vision • Producing a Minimum Marketable Feature	
	4.3 Release Planning • Creating the Product Backlog • User Stories • Prioritizing and Estimating • Creating the Release Plan	
	4.4 Monitoring and Adapting • Task Boards and Information Radiators • Control Limits, Variance and Trend Analysis • Managing Risks and Issues • Retrospectives	
5	**Agile Estimations And Leading Agile Teams**	07
	5.1 Introduction to Agile Estimations, Needs, Stakeholders, Estimation Stages, Estimation Styles and Process. Velocity, Sprint Velocity	
	5.2 Skills needed by Agile Leaders, Emotional Intelligence, Listening Skills, Command and Control vs. Servant Leadership, Adaptive Leadership, Collaboration, Facilitation, Problem Solving and Participatory Decision-Making Skills, Coaching and Mentoring Teams, Conflict Resolution	
6	**Advanced Emerging Techniques and Case Studies**	04
	6.1 Learn, value streams and Kanban models, Lean, Crystal, DevOps and continuous deployment strategies, Scaling agile processes, Case study	

Books Recommended:

Text books:

1. The art of Agile Development, James Shore and Shane Warden, 11th Indian Reprint, O'Reilly, 2018

References Books:

1. Learning Agile, Andrew Stellman and Jennifer Greene, O'Reilly, 4th Indian Reprint, 2018
2. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5th Indian Reprint, 2015
3. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004

Web Resources (For our Reference):

1. https://www.xpand-it.com/blog/top-5-agile-methodologies/
2. https://apc01.safelinks.protection.outlook.com/GetUrlReputation

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<table>
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(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
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<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>Assignment</td><td>Total</td><td rowspan="2"></td></tr>
<tr><td colspan="5">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td colspan="5">Laboratory Examination</td><td colspan="4">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</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td><td></td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td></td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of

- Applied Statistics.
- Regression and Analysis of Variance.

Objectives:

- To understand the issues and principles of Design of Experiments (DOE).
- To list the guidelines for designing experiments.
- To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization.

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

- Plan data collection, to turn data into information and to make decisions that lead to appropriate action.
- Apply the methods taught to real life situations.
- Plan, analyze, and interpret the results of experiments.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction** Strategy of Experimentation, Typical Applications of Experimental Design, Guidelines for Designing Experiments, Response Surface Methodology.	06
2	**Fitting Regression Models** Linear Regression Models, Estimation of the Parameters in Linear Regression Models. Hypothesis Testing in Multiple Regression, Confidence Intervals in Multiple Regression, Prediction of new response observation, Regression model diagnostics, Testing for lack of fit.	06
3	**Two-Level Factorial Designs and Analysis** The 2^2 Design, The 2^3 Design, The General 2^k Design, A Single Replicate of the 2^k Design, The Addition of Center Points to the 2^k Design, Blocking in the 2^k Factorial Design, Split Plot Designs.	07
4	**Two-Level Fractional Factorial Designs and Analysis** The One-Half Fraction of the 2^k Design, The One-Quarter Fraction of the 2^k Design, The General 2^{k-p} Fractional Factorial Design, Resolution III Designs, Resolution IV and V Designs, Fractional Factorial Split-Plot Designs.	07
5	**Conducting Tests** Testing Logistics, Statistical aspects of conducting tests, Characteristics of good and bad data sets, Example experiments, Attribute Vs Variable data sets.	07
6	**Taguchi Approach** Crossed Array Designs and Signal-to-Noise Ratios, Analysis Methods, Robust design examples.	06

Books Recommended:

Reference Books:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
2. D. C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley
4. W. J. Dimond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer, A. M. Dean, and D. T. Voss

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester I (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: I</td></tr>
<tr><td colspan="8">Course: Operations Research</td><td></td><td colspan="3">Course Code:
DJS24POCOE16</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td></td><td colspan="4">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
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<tr><td>3</td><td>2</td><td>--</td><td>3</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td><td></td></tr>
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</table>

Pre-requisite: Knowledge of

- Fundamental concepts of Mathematical statistics.

Objectives:

- To formulate a real-world problem as a mathematical programming model.
- To understand the mathematical tools that are needed to solve optimization problems.
- To use mathematical software to solve the proposed models.

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

- Convert a real-world problem in to a Linear Programming Problem and Interpret the solution obtained using Simplex method or other algorithms.
- Understand reasons of formation of queues, Classify various queuing systems and Apply performance parameters defined for various queuing systems for decision making in real life situations.
- Describe concept of simulation and Apply Monte Carlo Simulation technique to systems such as inventory, queuing and Develop solutions for them.
- Solve the Game and explore the optimal strategies.
- Identify the decision situations which vary with time and Analyze them using principle of dynamic programming to real life situations.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Linear Programming Problem** Introduction to Operations Research (OR), Decision situations, Decision making process, Concept of Optimization, Mathematical Models. Linear Programming: Linear Programming Problem - Mathematical Formulation, Finding Optimal solution using Graphical method, Simplex method, Big-M method, Two Phase method, Special cases, Principle of Duality.	09
2	**Special Cases of LPP** Transportation problem: Formulation - Finding Optimal solution, Degeneracy. Assignment problem: Formulation - Finding Optimal solution. Travelling Salesman Problem.	07
3	**Dynamic Programming** Introduction - Bellman's Principle of optimality - Applications of dynamic programming to capital budgeting, inventory, employment smoothening, cargo loading and shortest path problem.	08
4	**Game Theory** Introduction - Minimax (Maximin) Criterion and optimal strategy - Solution of games with saddle points – 2 x 2 games - dominance principle - m x 2 & 2 x n games, Iterative Method.	06
5	**Queuing Model** Introduction - Poisson arrivals - Exponential service time. Single Channel – Single server - Infinite population and finite population models, Multichannel - Single server - Infinite population models. Constant Service rate - Single Channel – Single server - Infinite population.	06
6	**Simulation** Definition - Methodology of simulation – Monte Carlo Simulation Technique - applications to Inventory and Queuing problems – Advantages and Limitations of Simulation. Simulation Languages.	06

Books Recommended:

Reference Books:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009.
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut.
5. Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons.

Prepared by Checked by Head of the Department Principal

Scheme for First Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester II (Autonomous)
(Academic Year 2024-2025)

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment				
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test	Term Work	CA Total (B)	Aggregate (A+B)	Credits earned
1	DJS24PECPC21	RF and Microwave Engineering	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC21	RF and Microwave Engineering Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
2	DJS24PECPC22	Advanced Wireless Communication Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPC22	Advanced Wireless Communication Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
3@	DJS24PECPE21	Wavelets	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE21	Wavelets Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE22	IOT & Sensor Networks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE22	IOT & Sensor Networks Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE23	Network and Cyber Security	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE23	Network and Cyber Security Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE24	Advanced Signal Analysis and Processing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE24	Advanced Signal Analysis and Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE25	Millimeter Wave Communication	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE25	Millimeter Wave Communication Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24PECPE26	Remote Sensing Concepts	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24PELPE26	Remote Sensing Concepts Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
4	DJS24PELVS21	Mini Project-II	--	4	--	2	--	--	50	--	--	50	--	50	50	100	1
5#	DJS24POCOE21	Machine Learning	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE22	Renewable Energy	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE23	Digital Marketing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE24	Project Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE25	Research Methodology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24POCOE26	Product Life Cycle Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
		Total	**12**	**10**	**--**	**17**	**--**	**240**	**125**	**--**	**--**	**365**	**160**	**125**	**285**	**650**	**17**

@ Any 1 Department Level Elective
# Any 1 Institue Level Elective

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Evaluation Scheme:

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (Mins.)
Theory	Term Test 1 (based on 40 % syllabus)	15	45
	Term Test 2 (on next 40 % syllabus)	15	45
	Assignment / course project / group discussion / presentation / quiz/ any other. (on next 20% syllabus)	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory/ Tutorial	Performance in the laboratory, tutorial & / assignment. (ICA Component Evaluation)	25	

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

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (Hrs.)
Theory	Written paper based on the entire syllabus.	60	2
Oral	Questions based on the entire syllabus.	25	2
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	25	2

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: II**
Course: RF and Microwave Engineering RF and Microwave Engineering Laboratory		**Course Code:** **DJS24PECPC21** **DJS24PELPC21**

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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Electromagnetic Wave propagation
- RF Circuit Design
- Radiating Systems
- Microwave Engineering
- Radar Engineering

Course Objectives:

- To provide state-of-art knowledge in RF circuits and microwave systems.
- To explain various methodologies presently prevalent for design of active and passive RF circuits.
- To enable students to make system level design decisions.
- To teach students Computer aided design tools for analysis and design of circuits

Course Outcomes: At the end of course, a student will be able to

- Characterize devices at higher frequencies.
- Design and analyze RF circuits and components.
- Design and analyze amplifiers, oscillators and mixers at microwave frequencies.
- Design and analyze power dividers, couplers at microwave frequencies.
- Analyze EMI and EMC in RF circuit.

Module No.	Unit No.	Topics	Hrs.
1		**Passive Lines and Impedance Matching Network Design**	05
	1.1	Strip lines, Microstrip lines and coupled lines: Analysis and design	
	1.2	Smith Chart and Impedance matching using lumped and distributed parameters,	
	1.3	Binomial & Chebyshev Multi-section Matching Transformer	
2		**Device Characterization**	08
	2.1	ABCD Parameters, S-parameters: Properties and characterization	
	2.2	Two-port power gain expressions	
	2.3	Stability Criterion	
3		**Amplifier Design**	10
	3.1	Single stage amplifier design: Design for maximum gain, Design for specified gain (For Unilateral case only)	
	3.2	Low noise amplifier design	
	3.3	Power amplifier design.: Characteristics of power amplifier and classes of amplifiers, design of class A power amplifier	
4		**Oscillators and Mixers**	06
	4.1	One-port and two-port microwave oscillator design, Dielectric Resonator Oscillator Design	
	4.2	Analysis of phase noise in oscillators.	
	4.3	Mixers: Characteristics, Various types of Mixers: Single ended diode mixers, FET mixers, Balanced mixers, Image reject mixers and other types of mixers	
5		**Power Dividers, Directional Couplers, Attenuators**	08
	5.1	Power Dividers: Two-way, Three-way and Four-way Equal Power Dividers, Unequal, Broadband and Compact Power Dividers	
	5.2	Directional Couplers: Coupled Line Directional Couplers, Branch Line Couplers, and Rat race Coupler.	
	5.3	Attenuators: Fixed and Variable Attenuators.	
6		**Microwave Systems and EMI, EMC Techniques**	05
	6.1	Microwave Systems: RF Harvesting System, High Power Microwave System, Microwave Imaging System.	
	6.2	Natural sources of EMI, EMI from Circuits, apparatus and open site test area.	
	6.3	Radiated and conducted EMI measurements.	
	6.4	Grounding, shielding , bonding, shielding and EMI filters.	
	6.5	EMC, cables, connectors, components and EMC Standards.	

RF and Microwave Engineering Laboratory (DJS24PELPC21)	
Exp.	**Suggested experiments**
1	Parametric study of Transmission Line.
2	Introduction to VNA, Spectrum analyzer and RF Source.
3	Single stage amplifier design: Design for maximum gain (Smith Chart).
4	Single stage amplifier design: Design for specified gain (Smith Chart).
5	Low Noise Amplifier design (Smith Chart).
6	One-port and two-port microwave oscillator design.
7	Dielectric Resonator Design.
8	Design and simulation of Wilkinson Power Divider (Equal and Unequal).
9	Design and simulation of Quadrature Coupler.
10	Design and simulation of attenuators

Text Books:

- Guillermo Gonzalez, *Microwave Transistor Amplifiers: Analysis and Design*, 2nd Edn. Pearson Publication.
- David Pozar, *Microwave Engineering*, 4th Edn, Wiley Publication.

Reference Books:

- Matthew M. Radmanesh, *Radio Frequency and Microwave Electronics*, Pearson Education.
- F. Giannini, G. Leuzzi, *Non-linear Microwave Circuit Design*, Wiley Publication.
- W. Prasad Kodali, *Engineering Electromagnetic compatibility: Principles, Measurement, Technologies and computer model*, 2nd Edn, Wiley IEEE Press Publication.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: II**
Course: Advanced Wireless Communication Networks Advanced Wireless Communication Networks Laboratory		**Course Code:** **DJS24PECPC22** **DJS24PELPC22**

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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre–requisite:

- Digital communication
- Mobile and Wireless Communication, Sensor Network

Course Objectives:

- To analyze multichannel parameters.
- To develop the concepts of emerging technologies.
- To design core network and radio access network for 5G.
- To understand the working of Software Defined Radio.

Course Outcomes: At the end of course, a student will be able to:

- To evaluate multichannel characteristics.
- To outline the emerging technologies for upcoming Wireless Communication.
- To assess network architecture of 5G.
- To identify the need for Software Defined Networks.

Module No.	Unit No.	Topics	Hrs.
1		**Multichannel and Multicarrier Communication**	06
	1.1	Multichannel Digital Communication in AWGN Channels for Binary Signals.	
	1.2	Multicarrier Communication : Single Carrier vs. Multicarrier Modulation OFDM Basics , Modulation and Demodulation in an OFDM Systems , Spectral Characteristics of Multicarrier Modulation , Peak to average power ratio in Multicarrier Modulation, Channel coding considerations in Multicarrier Modulation.	
	1.3	Linear Equalization : Peak Distortion Criterion , Mean Square error (MSE)Criterion , Performance Characteristics of the MSE equalizer	
2		**Introduction to 3GPP standards(Physical layer)**	08
	2.1	Introduction, system overview: Frequency bands and spectrum flexibility, network structure, protocol structure	
	2.2	Physical layer: Frames, slots, and symbols, modulation, coding, multiple-antenna techniques Logical and Physical Channels: Mapping of data onto (logical) sub-channels. Physical layer procedures: Establishing a connection, retransmissions and reliability, scheduling, power control, handover.	
	2.3	Physical Layers: Introduction – Transport Channels and their Mapping to the Physical Channels-Spreading and Modulation – User Data Transmission – Signalling-Physical Layer Procedures-Terminal Radio Access Capabilities	
3		**4G LTE**	07
	3.1	3GPP TSG for E-UTRAN, Origin of E-UTRAN, General Features of E-UTRAN	
	3.2	E-UTRAN Study Items	
	3.3	E-UTRAN Radio Interface Protocols, E-UTRAN Protocol Architecture E-UTRAN Layer 1, E-UTRAN Layer 2	
4		**5G Core Network**	07
	4.1	Introduction	
	4.2	Architecture of 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, Signaling Protocol Architecture	
	4.3	Massive MIMO	
5		**5 G Radio access Network**	06
	5.1	The Evolved UMTS Terrestrial Radio Access Network – 3GPP Architecture, Carrier Aggregation,	
	5.2	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.	
	5.3	Signalling Protocols - Signalling Protocol Architecture , Signalling Radio Bearers	
6		**Software Defined Networks**	06
	6.1	Software defined radio: Basic SDR – Software and Hardware Architecture of an SDR – Spectrum Management – Managing unlicensed spectrum – Noise Aggregation	
	6.2	Cognitive Radio Technology: Why Cognitive Radio, History of Cognitive Radio, SDR to Cognitive Radio	

Advanced Wireless Communication Networks (DJS24PELPC22)	
Exp.	**Suggested experiments**
1	Study of OFDM transceiver system
2	Study of Channel Equalizer
3	Study of SDR system
4	Simulation of 4G system
5	Simulation of 5G systems
6	Study of MIMO system
7	Case study on cognitive radio
8	Case study of 3GPP standards
9	Case study of 5G networks in smart cities
10	Study of OFDM transceiver system

Text Books:

- Theodore S. Rappaport, "Wireless communications - principles and practice", Pearson, 2nd edition**.**
- T.L. Singal, "Wireless communications", Mc Graw Hill Education, 2010.
- Andreas F. Molisch, "Wireless Communications", Wiley publication. 2nd edition.
- John G. Proakis, "Digital Communication", McGraw –Hill International Editions, 4th Edition.
- Christopher cox, Chris cox, "An Introduction to 5G; "The New radio, 5G network and beyond" 1st Edition.

Reference Books:

- Tolga M. Duman, Ali Ghrayeb, "Coding for MIMO Communication Systems", Wiley publication, 2008.
- Hsiao-Hwa Chen, Mohsen Guizani "Next Generation Wireless Systems and Networks", Wiley publication, 2006.
- Cordeiro Agrawal, "Adhoc and Sensor Networks", Word Scientific, 2006

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**											**Semester: II**
Course: Wavelets Wavelets Laboratory											**Course Code:** **DJS24PECPE21** **DJS24PELPE21**
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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Signals & Systems
- Discrete Time Signal Processing

Course Objectives:

- To familiarize with wavelet theory, its implementation and representation.
- To understand the fundamentals of multirate signal processing and its applications.
- To study the theory and construction of wavelets and its practical implementations.

Course Outcomes: At the end of course, a student will be able to:

- Implement adaptive filters for a given application; study and apply the techniques of power spectrum estimation and wavelet theory for various applications.
- Apply Signal Processing tools to biomedical signal processing and musical sound processing.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to multirate systems and wavelets:**	
	1.1	Fundamentals of multirate systems: Basic multirate operations and their spectral representation, Fractional Sampling rate alteration, Interconnection of building blocks, Noble identities, polyphase representations, Efficient structures for decimation and interpolation **Filters**. Wavelets as a mathematical tool	08
	1.2	Classification of Wavelets:	
		Continuous and Discrete wavelet transforms.	
2		**Discrete wavelet transform and orthogonal wavelet decomposition:**	
	2.1	Approximations of vectors in nested linear vector subspaces	06
	2.2	Multi-resolution Analysis of L2(R),	
	2.3	Haar Scaling function, Haar wavelet, Haar wavelet decomposition, Haar wavelet packets and application.	
3		**MRA Ortho-normal wavelets and their relationships to filter banks:**	
	3.1	Construction of an ortho-normal MRA, Wavelet basis for the MRA Digital filtering interpretation,	07
	3.2	Examples of orthogonal basis generating wavelets,	
	3.3	Interpreting ortho-normal MRA for discrete time signals, Generating scaling functions and wavelets from filter coefficients.	
4		**Continuous wavelet transform:**	
	4.1	Definition of CWT, Continuous wavelet transform and short time Fourier transform, Scaling functions and wavelet functions,	07
	4.2	Uncertainty principle and time-frequency tiling	
5		**Biorthogonal wavelets:**	
	5.1	Biorthogonality in vector space, Biorthogonal Wavelet systems, Construction of biorthogonal wavelet systems	06
	5.2	Frequency domain approach for designing wavelets: derivation of Daubechies wavelets, Wavelet Packets	
6		**Wavelength Transform and applications:**	
	6.1	DTWT for image compression, audio compression, JPEG 2000 standard,	05
	6.2	Wavelet based de-noising, Speckle removal,	
	6.3	Edge detection and object isolation, Image fusion, Object detection.	

Advanced Image & Video Processing Laboratory (DJS24PELPE14)	
Exp.	**Suggested List of Experiments**
1	Short Time Fourier Transform analysis of signals
2	Implement Scaling and wavelet functions for different kernels
3	CWT analysis of signals
4	Tree decomposition using wavelets and wavelet packets
5	Implementation of Interpolation and decimation
6	MRA of signals and images
7	Smoothing and Sharpening of images using wavelets
8	DWT for image compression (EZW and SPIHT)
9	EEG / ECG denoising using wavelet transform
10	Image Fusion using wavelets

Text Books:

- Sanjit k. Mitra , *Digital signal processing* , McGraw-Hill, 2013
- K. P. Soman, K. I. Ramachandran, N. G. Resmi, PHI-2006, Insight into wavelets from theory to practice, Prentice Hall India, 2005
- S.V. Narasimhan, Nandini Bassumalick, S. Veena, *Introduction to Wavelet Transform*, Narosa publication, 2011.

Reference Books:

1. P. P. Vaidyanathan, *Multirate Systems & Filter banks*, Prentice Hall, 1993
2. Raguveer M. Rao and Ajit S. Bopardikar, *Wavelet Transforms – Introduction and applications*, Pearson Education, 2008.
3. S. Mallat, *Wavelet signal Processing*, Academic Press, 1996.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: II**
Course: IoT & Sensor Networks IoT & Sensor Networks Laboratory		**Course Code:** **DJS24PECPE22** **DJS24PELPE22**

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**	**Assignment**	**Total**		
				60			**15**	**15**	**10**	**40**		**100**
				Laboratory Examination			**Term work**				**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**				
				25	**--**	**--**	**15**	**10**		**25**		

Course Pre–requisite:

- Sensors and Networks
- Embedded System
- Mobile and Wireless Communication
- Cloud computing

Course Objectives:

- To learn various architectures of Communication Networking.
- To describe IoT and Sensor Network techniques.
- To discuss IoT reference layer and various protocols and software.
- To design cloud architecture of IoT and its security.
- To develop various models for IoT applications.

Course Outcomes: At the end of course, a student will be able to:

- Identify the IoT networking components with respect to OSI layer.
- Design and develop IoT based sensor systems.
- Select IoT protocols and software.
- Evaluate the wireless technologies for IoT.
- Design architecture of IoT for various applications.
- Appreciate the need for IoT Trust and variants of IoT.

Module No.	Unit No.	Topics	Hrs.
1		**Roadmap to IoT**	08
	1.1	Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer.	
2		**Sensing and Actuation**	08
	2.1	Sensor Technology (Resistive, Capacitive, Transistor-based sensors), Analog Sensors, Digital Sensors, Principle of RFID, RFID IoT Systems, Components of RFID System, RFID Technological and Security Challenges, RFID Applications, WSN Architecture (Layered Architecture, Multi-Cluster Architecture), WSN Protocols (S-MAC, SPINS, SNEP, µ-TESLA), WSN IoT Applications.	
	2.2	Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Intel Edison, Beagle Board.	
3		**IoT protocols and Softwares**	06
	3.1	MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols.	
	3.2	Case study : Energy efficiency networks for IoT	
4		**Use of Cloud Computing in IoT**	07
	4.1	Defining Cloud Computing, Understanding Cloud Architecture.	
	4.2	Understanding Abstraction and Virtualization.	
	4.3	Exploring Platform as a Service, Using Google Web Services.	
5		**IoT Security**	05
	5.1	Introduction, Vulnerabilities, Security requirements and Threat Analysis.	
	5.2	Use Cases and Misuse cases.	
	5.3	IoT Security Tomography and layered Attacker Model.	
	5.4	Security Models, Profiles and Protocols for IoT.	
6		**IoT Applications**	07
	6.1	Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0, IoT standards.	

IoT & Sensor Networks (DJS24PELPE22)	
Exp.	**Suggested List of Experiments** (minimum eight)
1	Tutorial based on current trends and advancements on IoT
2	Study, discussion, and installation of ARM/Arduino/ESP 32/ RPi
3	Interfacing the sensor with ARM/Arduino / ESP 32 / RPi
4	Interfacing the motor drivers with ARM/ Arduino / ESP 32 / RPi
5	Real time data analysis using sensors, processors, and gateway
6	Interfacing the camera module with ARM/ Arduino / ESP 32 / RPi
7	Real time data base management system using sensors, processors, and gateway
8	Implementation of IoT system Using Messaging and Transport
9	Implementation of data transfer using wireless devices
10	Configuration and using the cloud platform

Text Books:

- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.
- Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016.
- Vijay Madisetti, Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 2015.
- Kazem Shoraby,Daniel Minoli,Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Applications" John Wiley and Sons, 2007.
- Raj Kamal, "Internet of Things: Architecture and Design Principles", Mc Graw Hill, 1st Edition.
- Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.
- Behrouz A. Forouzan, "TCP/IP Protocol Suite, 3/E", McGraw-Hill Education (India) Pvt Limited, 2005.

Reference Books:

- Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st Edition, Wiley, 2014.
- Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2013.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: II**
Course: Network and Cyber Security Network and Cyber Security Laboratory		**Course Code:** **DJS24PECPE23** **DJS24PELPE23**

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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Computer Communication Networks

Course Objectives:

- To introduce various techniques to implement security mechanisms for network and cyber security.
- To discuss security implications on Organizations with the help of Risk Management and Incident preparation.

Course Outcomes: At the end of course, a student will be able to:

- Describe security threats and apply security techniques using cryptosystems.
- Describe different network security mechanisms.
- Define cybercrime, cybercriminals, and Intellectual property and discuss security implications on organizations.
- Incorporate approaches for incident analysis and response, for risk management and digital evidence collection and evidentiary reporting in forensic acquisition.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Network and Cyber Security**	07
	1.1	Need for network security, Attacks and Their classification.	
	1.2	Network Vulnerabilities and control.	
	1.3	Security services and mechanisms.	
	1.4	Impact of Security on Enterprises.	
	1.5	Risk Factors and Cost Analysis.	
2		**Cryptography and Cryptosystems**	07
	2.1	Classical and modern cryptography, stream and block ciphers.	
	2.2	Message digest digital signature, digital certificate, certificate authority, and cryptanalysis.	
	2.3	DES/AES/RSA/RC4/MD5/SHA algorithms.	
	2.4	Implementing security using symmetric and Public-Key cryptography.	
3		**Security in Networks**	06
	3.1	Network security basics.	
	3.2	TCP/IP Model and Port no., Protocol flaws, Enterprise wide network Design and Vulnerabilities.	
	3.3	Reconnaissance of network, Packet sniffing, Session Hijacking, ARP Spoofing Web site.	
	3.4	web server vulnerabilities, Denial of Service, SSL and IP Sec protocol Firewall, intrusion detection system and Honey pots.	
4		**Cyber security Principles and best Practices**	07
	4.1	Cybercrimes, Cybercriminals, Cyber offences, Cybercrimes in Mobile and Wireless Devices, Tools and Methods used in Cybercrimes.	
	4.2	Network reconnaissance, scanning and sniffing, gaining access.	
	4.3	Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence.	
5		**Cyber security Implications on Organizations, Standards and Cyber laws**	07
	5.1	Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control Security Policy, Compliance, and Business Continuity.	
	5.2	Cyber Incident Preparation: Incident Detection and Analysis, Containment, Eradication, and Recovery, Proactive and Post-Incident Cyber Services.	
	5.3	Forensics: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting.	
	5.4	The Indian IT Act and new amendments.	
6		**System Security and Case Study**	06
	6.1	Security Operations Center (SOC), Network Operations Center (NOC).	
	6.2	Network Security Audit.	
	6.3	SET, Biometric Security, Digital Immune System.	
	6.4	Cloud Security. Wi-Fi Security, Mobile and Cellular Security.	

Network and Cyber Security (DJS24PELPE23)	
Exp.	**Suggested List of Experiments**
1	Overview of Cryptography using Cryptool
2	Understanding various networking commands like ARP, RARP, ping, tracert, telnet, nslookup.
3	Explore and analyze network vulnerabilities using open source tools.
4	To study Network Monitoring tools
5	Network audit using NMAP GUI
6	Monitoring and Management network using SNMP by simulation using CISCO PACKET TRACER
7	Network Statistics and Measurement using NTOP
8	LAN troubleshooting using Wireshark
9	Monitoring of services and servers using Cacti

Text Books:

- Behrouz Forouzan , *Cryptography and Network Security* , McGraw Hill Publication, 2007
- William Stallings, *Cryptography and Network Security: Principles and Practice*, Prentice Hall, 2016.
- Nina Godbole, Sunil Belapure, *Cyber Security*, John Wiley Publications, 2011.
- Pfleeger and Pfleeger, *Security in Computing*, Pearson Publications, 2018
- M. Whitman, *Management of Information Security*, Cengage Publications, 4th Edn, 2014
- B. Menezes, Network Security and Cryptography, Cengage Learning India,2010

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**											**Semester: II**
Course: Advanced Signal Analysis and Processing Advanced Signal Analysis and Processing Laboratory											**Course Code:** **DJS24PECPE24** **DJS24PELPE24**
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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Course Pre –requisite:

- Signals and Systems
- Digital Signal Processing
- Statistical Signal Processing

Course Objectives:

- The aim of this course is to provide in-depth treatment on methods and techniques in Power spectrum estimation, Adaptive filtering, Wavelet transforms.
- Applications of Signal Processing to real world problems.

Course Outcomes: At the end of course, a student will be able to:

- Implement adaptive filters for a given application; study and apply the techniques of power spectrum estimation and wavelet theory for various applications.
- Apply Signal Processing tools to biomedical signal processing and musical sound processing.

Module No.	Unit No.	Topics	Hrs.
1		**Spectrum Estimation**	09
	1.1	**Non- Parametric methods of Power Spectral Estimation:** Estimation of spectra from finite duration observation of signals	
	1.2	**Non-parametric Methods for Periodogram estimation:** Bartlett, Welch and Blackman and Tukey methods.	
	1.3	**Parametric Methods of Power Spectrum Estimation:** AR, MA & ARMA models for power spectrum estimation. Yule-Walker method for the AR model parameter	
2		**Introduction to Adaptive systems**	04
	2.1	Introduction, Characteristics, Examples of Adaptive systems,	
	2.2	Applications. The adaptive system -linear combiner Description, Weight vectors.	
	2.3	Desired response performance function- Gradient and mean square error.	
3		**Adaptive Signal Processing and Applications**	08
	3.1	FIR Adaptive filters - Adaptive Direct Form FIR Filters based on steepest descent method -Widrow Hoff LMS Adaptive algorithm.	
	3.2	Applications: Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation.	
4		**Wavelet Theory**	10
	4.1	Fourier Transform and its Limitations – Short Time Fourier Transform – Introduction to time frequency analysis, Heisenberg uncertainty principle, Basic concepts of Decimation and Interpolation.	
	4.2	Continuous Wavelet Transform – Discrete Time Wavelet Transform- Multi-resolution analysis: Haar Wavelet, Daubechies Wavelet, Filter bank theory.	
	4.3	Application of wavelet theory to signal de-noising, signal compression.	
5		**Application of Digital Signal Processing to Biomedical Signal Processing**	06
	5.1	Detection of fetal heartbeats during labor-fetal ECG, ECG pre-processing	
	5.2	QRS template, QRS detection methods, performance measure for QRS detection. Adaptive removal of ocular artefacts from human EEGs- Methods for removal and control of ocular artefacts, system testing and experimental results.	
6		**Application of Digital Signal Processing in Musical Sound Processing**	05
	6.1	Musical sound processing - Time domain operations- single echo filter, multiple echo filter, Reverberation, Flanging, Chorus generator.	

Advanced Signal Analysis and Processing Laboratory (DJS24PELPE24)	
Exp.	**Suggested experiments**
1	To find the power spectrum estimation by Welch method.
2	To plot and compare the periodogram (using rectwin)and modified periodogram (using Bartlet windows) of a finite duration sequence.
3	To plot the Spectrogram of chirp signal.
4	To simulate Echo of a signal in Simulink.
5	To plot different types of Wavelets and their Spectrum.
6	Denoise a Signal by using Wavelet Transform.
7	To Perform Noise cancellation Using LMS Algorithm.
8	Unknown Channel Identification using LMS Algorithm.
9	Noise removal from ECG signal Using Digital Filter.
10	To simulate Reverberation and Chorus using Simulink.

Text Books:

- John G. Proakis and Dimitris G. Manolakis, *Digital Signal Processing*, Prentice Hall India, 2005.
- Bernard Widrow and Samuel D.Strearns, *Adaptive Signal Processing*, Pearson Edu. Asia 2002.
- S. M. Kay, *Modern Spectrum Estimation Theory and Application*, Prentice Hall, 1987.
- K. P. Soman, K.I. Ramchandran and N. G. Reshmi, *Insight into Wavelets: From theory to practice*, 3rd Edn, Prentice Hall, 2010.
- Raghuveer. M. Rao and Ajit S.Bopardikar, *Wavelet Transforms -Introduction to theory and applications*, Pearson Education, Asia, 2000.
- Rangaraj M. Rangayyan, *Biomedical Signal Analysis- A Case Study Approach*, Wiley 2002.
- Willis J. Tompkins, *Biomedical Digital Signal Processing*, Prentice Hall, 1999.
- Sen M Kuo, Bob H Lee and W Tian, *Real Time Signal Processing Fundamentals, Implementations and Applications* Springer, Wiley Publishers, 3rd Edn, 2013.
- S. K. Mitra, *Digital Signal Processing*, TMH, 2001.

Reference Books:

- Simon Haykin, *Adaptive Filter Theory*, Pearson Edu, 2013.
- D. C. Reddy, *Biomedical Signal Processing Principles and Techniques*, Tata Mc Graw-Hill, 2005.
- A. H. Sayed, *Adaptive filters*, Wiley Student Ed, 2010.
- S. Thomas Alexander, *Adaptive signal processing-Theory and Applications*, Springer –Verlag, 1986.
- I. Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.
- S. Mallat, A *wavelet tour of signal processing*, Academic press, 3rd Edn, 2008.
- Burrus, C. Sidney, Ramesh A. Gopinath, and Haitao Guo. *Introduction to wavelets and wavelet transforms*, Prentice Hall Inc. 1997.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="6">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="5">Semester: II</td></tr>
<tr><td colspan="6">Course: Millimeter Wave Communication
Millimeter Wave Communication Laboratory</td><td></td><td colspan="5">Course Code:
DJS24PECPE25
DJS24PELPE25</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td></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="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assignment</td><td>Total</td></tr>
<tr><td colspan="4">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="4">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td>3</td><td>2</td><td>--</td><td>3</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td></td><td>25</td></tr>
</table>

Course Pre –requisite:

- Wave Theory and Propagation
- Radio Frequency Modelling and Antennas
- Microwave and Radar Engineering

Course Objectives:

- To provide state-of-art knowledge in millimeter wave communication systems.
- To explain various methodologies presently prevalent for design of active and passive circuits.
- To enable students to make system level design decisions w.r.t millimeter wave systems.

Course Outcomes: At the end of course, a student will be able to

- Explain design constraint in communication systems at microwave and millimeter wave frequencies
- Explain design consideration in Millimeter wave communication components and antennas
- Understand diversity over MIMO channels

Module No.	Unit No.	Topics	Hrs.
1		**Millimeter Wave Characteristics**	10
	1.1	Development of Millimeter Wave Standards, Coexistence with Wireless Backhaul	
	1.2	Review Of Modulations For Millimeter Wave Communications:	
	1.3	MIMO antenna, Phased Array antennas	
2		**Millimeter Wave Transceivers**	06
	2.1	Block Diagram of millimeter wave transmitter, Power Amplifier, Low-Nosie Amplifier	
	2.2	Millimeter Wave Link Budget, Transceiver Architecture	
	2.3	Transceiver Without Mixer, Receiver Without Local Oscillator	
3		**Millimeter Wave Antennas**	10
	3.1	Path Loss and Antenna Directivity, Antenna Beam width, Maximum Possible Gain-to-Q, Polarization	
	3.2	Beam Steering Antenna, Millimeter Wave Design Consideration, Production and Manufacture	
	3.3	Millimeter Wave MIMO: Spatial Diversity of Antenna Arrays, Multiple Antennas, Multiple Transceivers, Noise Coupling in a MIMO System.	
4		**Advanced Diversity Over MIMO Channels and Beam Steering**	08
	4.1	Potential Benefits for Millimeter Wave Systems, Spatial and Temporal Diversity	
	4.2	Spatial and Frequency Diversity, Dynamic Spatial, Frequency and Modulation Allocation	
	4.3	The Need for Beam-Steering/Beam-Forming, Adaptive Frame Structure, Advanced Beam Steering and forming Technology	
5		**Single-Carrier Frequency Domain Equalization**	06
	5.1	Advantages of SC-FDE over OFDM for Millimeter Wave Systems	
	5.2	Preamble Design, Adaptive Channel Estimation	
	5.3	Frequency Domain Equalization, Decision Feedback Equalization.	

Embedded Systems Laboratory (DJS24PELPE25)	
Exp.	**Suggested experiments**
1	On/Off Keying (OOK) and Phase Shift Keying (PSK) modulation simulation using MATLAB
2	Frequency Shift Keying (FSK) and Quadrature Amplitude Modulation (QAM) modulation simulation using MATLAB
3	Orthogonal Frequency Division Multiplexing (OFDM) modulation simulation using MATLAB
4	Simulation of millimeter wave antenna and study of its parameters using CST Studio Suite
5	Study characteristics of OFDMA system using MATLAB Simulink
6	Study characteristics of MIMO model using MATLAB Simulink
7	Design and simulation of phased antenna array using CST Studio Suite
8	Design and simulation of MIMO antenna array using CST Studio Suite
9	Case Study on Any of the mentioned topics: RF beamforming, Modulation techniques for mm-wave communications, Advanced diversity over MIMO channel, millimeter wave antennas

Batch-wise laboratory work of minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

- Millimeter wave communication systems, Huang K., Wang Z., Wiley-IEEE Press, 2011
- Advanced Electronic Communication Systems. W Tomasi, PHI, 1988.
- Phased Array Antennas, R. C. Hansen, Wiley Publishers, 2009.
- RF Circuit Design, Richard Chi Hsi Li, Wiley Publishers, 2012.

Reference Books:

- Electronic Communication Systems, II Edition, Roy Blake Thomsar.
- Electronic Communication, Kemealy & Dakis, TMH

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II
(Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**											**Semester: II**	
Course: Remote Sensing Concepts Remote Sensing Concepts Laboratory											**Course Code:** **DJS24PECPE26** **DJS24PELPE26**	
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**	**Assignment**	**Total**		
				60			**15**	**15**	**10**	**40**		**100**
				Laboratory Examination			**Term work**				**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**				
				25	**--**	**--**	**15**	**10**		**25**		

Course Pre –requisite:

- Fundamentals of Digital Image Processing
- Satellite Communication
- Advanced Image & Video Processing

Course Objectives:

- To congregate the basic concepts and fundamentals of physical principles of remote sensing.
- To Disseminate basic concepts and applications of Electromagnetic Spectrum in Remote Sensing, Energy balance and Data acquisition platforms, sensors and their characteristics
- To create a firm basis for successful integration of remote sensing in any field of application.
- To introduce digital image processing tools and techniques

Course Outcomes: At the end of course, a student will be able to:

- Explain physical principles and sensing process in remote sensing
- Describe preprocessing requirements and discuss various Digital Image Processing techniques.
- Identify the earth surface features from satellite images
- Apply the concepts of remote sensing for ecological applications

Module No.	Unit No.	Topics	Hrs.
1		**Physics of Remote Sensing**	07
	1.1	Definition, History and Overview of Remote Sensing, concepts & principle	
	1.2	Electromagnetic Radiation, Terms and Definitions, wavelength Regions and their significance, Black body radiation, Laws of Radiation, Energy sources and radiation principles, Energy interactions in the atmosphere, Energy interactions with earth surface features, Spectral reflectance curves. Physical basis of spectral signatures of the objects and Spectral Signature for Vegetation, Soil, Water and Snow.	
2		**Data Acquisition**	08
	2.1	Airborne and space born sensors, Imaging and non-imaging sensors, Passive and active remote sensing.	
	2.2	Spectral, radiometric and spatial resolutions, Temporal resolution of satellites, signal to noise ratio, LiDAR data acquisition and processing	
	2.3	Satellites and orbits, Kepler's laws, Major-Semimajor axis & Eccentricity, Velocity, Period, Polar orbiting satellites, Multispectral, thermal and hyperspectral sensing, Some remote sensing satellites (LANDSAT, SPOT, IRS, IKONOS, Quickbird, Geoeye, Kompsat, Worldview II & III etc.) and their features.	
3		**Image Enhancement and filtering techniques**	10
	3.1	Concepts of digital image and its characteristics, Sources of image degradation - Image restoration and Noise Abatement , Radiometric and Geometric correction technique, linear and nonlinear transformation for geometric corrections, Look-up Tables (LUT) and Types of image displays and FCC, Radiometric enhancement techniques, Spatial enhancement techniques, Contrast stretching	
	3.2	Linear and non-linear methods, Low Pass Filtering: Image smoothing, High Pass Filtering: Edge enhancement and Edge detection, Gradient filters, Directional and non-directional filtering	
	3.3	Concept of color, Color composites, Density slicing, Thresholding, Intensity-Hue-Saturation (IHS) images, Time composite images	
4		**Pattern Recognition**	08
	4.1	Concept of Pattern Recognition, Multi-spectral pattern recognition, Spectral discrimination, Signature bank	
	4.2	Parametric and Non-Parametric classifiers, Unsupervised classification methods, Supervised classification techniques, Limitations of standard classifiers.	
5		**Remote Sensing Applications**	06
	5.1	Watershed management, Forest mapping & monitoring, Rainfall-runoff modeling, Irrigation management, Flood mapping, Drought assessment, Environmental monitoring.	

Course Code: Remote Sensing Concepts Laboratory (DJS24PELPE26)	
Exp.	**Suggested Experiments**
1	To observe and understand the principles of black body radiation and its variation with temperature
2	To perform image enhancement using spatial filters
3	To perform image restoration using Weiner and Median Filter
4	To Implement linear transformations (e.g., scaling, rotation, translation) to correct geometric distortions in images.
5	To implement histogram equalization/contrast stretching algorithms to enhance the radiometric appearance of digital images.
6	To estimate Land Surface Temperature
7	To generate spectral signature curve.
8	To classify objects in multispectral satellite imagery using basic thresholding techniques and spectral indices
9	To perform supervised classification of satellite images using the Semi-automatic Classification plugin in QGIS
10	To perform unsupervised classification of satellite images using the Semi-automatic Classification plugin in QGIS

Text Books:

- Paul J Gibson, Clare H Power and John Keating, *Introductory Remote Sensing - Principles and Concepts*, Routledge, 2000.
- Paul J Gibson and Clare H Power, *Introductory Remote Sensing - Digital Image Processing and Applications*, Routledge, 2000.
- F.F. Sabins Jr, W.H. Freeman & Co., *Remote Sensing - Principles and Interpretation*, 3rd Edn, New York, 1997.
- R.A. Schowengerdt, *Remote Sensing - Models and Methods for Image Processing*, 3rd Edn, Academic Press.

Reference Books:

- Lillesand Thomas M., Kiefer Ralph & Jonathan Chipman, *Remote Sensing and Image Interpretation*,: 3rd Edn, John Wiley.
- John B Campbell, *Introduction to Remote Sensing*, Guilford Publications, 2011.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	M. Tech	Semester: II
Course: Mini Project -II (DJS24PELVS21)		

Pre-requisite:

Domain knowledge of any Program Specific Outcome (PSO) of the EXTC curriculum.

Objectives:

1. To realize the functional solution as per the project requirements.

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

1. Incorporate project-based learning that allows students to identify and transfer existing ideas into new applications.
2. Present their project work in a technical report improving their documentation skills.
3. Integrate inter-disciplinary concepts, which help them to get internships,jobs, admission for higher studies.
4. The project will serve as a pre cursor to his/her M. Tech thesis dissertation topic.

Syllabus:

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

Electronic devices and circuits, Integrated circuits, Control systems, Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and big data, Web and Application development, Robotics, Artificial Intelligence (AI), Machine learning (ML), CAD design and Additive manufacturing (3d printing).

The above areas can be updated (expanded), based on the needs of technological innovations and development needed for a specific project/product.

Evaluation scheme:

Every student will be reviewed individually once in a semester by review panel based on the following criteria:

1. Project progress
2. Documentation/Technical paper writing
3. Overall presentation and Teamwork
4. Validation of results (functional testing results)
5. Project Development with a view leading to his/her M. Tech thesis.

Marks scored in the mid semester review will be considered as part of term work.

The final certification and acceptance of Term work ensure satisfactory performance and the outcome of evaluation centered about evaluation scheme.

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II(Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course: Machine Learning</td><td></td><td colspan="3">Course Code:
DJS24POCOE21</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td></td><td colspan="5">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>Assignment</td><td>Total</td></tr>
<tr><td colspan="3">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">--</td><td rowspan="3">3</td><td colspan="3">Laboratory Examination</td><td colspan="4">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td></td></tr>
</table>

Course Pre –requisite:

- Statistical Signal Processing

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To become familiar with regression methods, classification methods and clustering methods.
- To introduce students to the basics of Genetic Algorithms.

Course Outcomes: At the end of course, a student will be able to:

- Analyze the applications, which can use Machine Learning Techniques.
- Understand and Apply regression, classification and clustering methods to the database.
- Interpret the difference between supervised and unsupervised learning methods.
- Understand the working of Reinforcement learning.
- Understand basic concepts of Genetic Algorithms.

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Machine Learning**	
	1.1	Machine Learning Terminologies , Types of ML , Goals and Applications of ML , Choosing the right Algorithm.	06
	1.2	Designing a Learning System: The concept learning task, concept learning as search General to specific ordering of hypothesis, Find-S, Candidate elimination Algorithm.	
2		**Regression and Tree based Learning**	
	2.1	Linear Regression , Logistics Regression	
	2.2	Introduction, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, hyperspace, search in decision tree learning, issues in decision tree learning.	10
3		**Probability and Instance based Learning**	
	3.1	Probability theory and Bayes rule, Naive Bayes learning algorithm.	08
	3.2	Introduction, K-nearest neighbour learning, case based learning, radial basis functions.	
4		**Clustering and Unsupervised Learning**	
	4.1	Learning from unclassified data, K-means Clustering, Expectation maximization Algorithm, Semi supervised learning with EM using labelled and unlabelled data.	08
	4.2	Supervised Learning after clustering, Choosing number of clusters.	
5		**Supervised and Reinforcement Learning**	
	5.1	Techniques of Supervised Learning: Supervised Learning Overview, Linear Model (Numerical Functions), Perceptron Learning Algorithm (PLA) – Classification, From Linear to Nonlinear, Adaptive Perceptron Learning Algorithm (PLA), Classification, Support Vector Machine (SVM), Extension to Multi-class Problems.	10
	5.2	Reinforcement Learning: Overview, Example and Uses.	
6		**Genetic Algorithms**	
	6.1	Genetic Algorithms: Introduction, genetic operators, genetic programming, models of evolution & learning, parallelizing genetic algorithm.	06

Text Books:

- Peter Harrington, *Machine Learning In Action*, DreamTech Press, 2012.
- Ethem Alpaydın, *Introduction to Machine Learning*, MIT Press, 2014.
- Tom M.Mitchell, *Machine Learning*, McGraw Hill Science, 1997.
- Stephen Marsland, *Machine Learning An Algorithmic Perspective* CRC Press 2014.
- Christopher Bishop, *Pattern recognition and machine learning*, Springer, 2006.
- Stuart J. Russell and Peter Norvig, *Artificial Intelligence A Modern Approach*, 2nd Edn, Pearson Education.
- George F Luger, *Artificial Intelligence*, Low Price Edn, 4th Edn, Pearson Education.

Reference Books:

- William W.Hsieh, *Machine Learning Methods in the Environmental Sciences: Neural Networks and Kernels*, Cambridge, 2009.
- Han Kamber, *Data Mining Concepts and Techniques*, 3rd Edn, Morgann Kaufmann Publishers.
- Margaret H. Dunham, *Data Mining Introductory and Advanced Topics*, Pearson Education, 2006.
- Elaine Rich and Kevin Knight, *Artificial Intelligence*, 3rd Edn, Pearson Education.

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<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course: Renewable Energy
Renewable Energy Laboratory</td><td></td><td colspan="3">Course Code:
DJS24EPGC115
DJS24EPGL115</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td></td><td colspan="12">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td></td><td colspan="5">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="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assignment</td><td>Total</td></tr>
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</table>

Course Objectives:

- Understand the renewable energy resources availability, potential and suitability as a substitute for conventional energy resources in future energy demand.

Course Outcomes: At the end of course, a student will be able to:

- Identify sustainable energy solutions for sustainable development
- Analyze renewable energy resources availability and utilization
- Demonstrate competency in renewable systems analysis independently.

Module No.	Topics	Hrs.
1	**Introduction** Renewable and non-renewable energy sources, global and Indian scenario. **Energy alternatives** The solar option, nuclear option, tar sands and oil shale, tidal energy, geothermal energy.	05
2	**Solar energy** Solar radiation, availability, measurement and estimation, solar thermal conversion devices such as flat plate collector, tubular collector, solar air collector, solar concentrator and storage. **Applications** Crop drying, distillation, water heating, electric power generation. **Solar photovoltaic** Photovoltaic cell technologies, generations of solar cell, electrical characteristics, photovoltaic module and array, photovoltaic module system components and design.	10
3	**Biomass energy conversion** Biomass characteristics and their availability, biofuel production processes, bio-methane, bio-hydrogen, alcoholic fermentation, biodiesel, microbial fuel cell, biomass based steam power plant, combined cycle power plant, cogeneration plant, Energy from Waste.	08
4	**Wind energy** Wind turbines, aerodynamics, types of turbines wind energy conversion system, wind turbine generator types, advantages and disadvantages. **Hydro power** Water turbines, hydroelectric system theory, measurement and components, advantages and disadvantages of hydroelectric system.	08
5	**Geothermal energy** Structure of earth, geothermal resources, exploration of geothermal energy. **OTEC** Principle, applications. **Tidal** Principle, power calculation, tidal modes of operation. **Wave** Wave motion, energy conversion and devices applications.	06
6	**Economic analysis** Initial and annual costs, present worth calculation, annual savings, payback period.	05

Text Books

- Vaughn C. Nelson, Kenneth L. Starcher, Introduction to Renewable Energy (Energy and the Environment, CRC Press, UK, 2016.
- B. K Khan, *Non-Conventional Energy Resources*, TMH New Delhi, 2013.
- J. A. Duffie and W. A. Beckman, *Solar Engineering of Thermal Processes*, John Wiley, New York, 2013.

Reference Books:

- D. Y. Goswami, F. Kreith and J. F. Kreider, *Principles of Solar Engineering*, Taylor and Francis, Philadelphia, 2015.
- S. P. Sukhatme, *Solar Energy - Principles of thermal collection and storage*, Tata McGraw-Hill, New Delhi, 2008. (Classic Book)
- J. Twidell and T. Weir, *Renewable Energy Resources*, E & F N Spon Ltd, London, 1986. (Classic Book)

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II (Autonomous)
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<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course: Digital Marketing</td><td></td><td colspan="3">Course Code:
DJS24POCOE23</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td></td><td colspan="4">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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Pre-requisite:

- Knowledge of Marketing

Objectives:

- To learn the fundamentals of Digital marketing.
- To understand the use of content strategy and social media marketing and email marketing.
- To understand the role of Search Engine Optimization.
- To apply techniques in display advertising

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

- Apply B2B and B2C contexts to plan content marketing.
- Develop and measure impact of content that works well for your target audience.
- Manage social media presence, and create effective content for each platform.
- Optimize search engine presence through on-site and off-site activities, develop target keyword list, optimize website UX and design, and execute a link building campaign.
- Create, execute, and optimize an effective Ad campaign. Display and set up advertising works.
- Create an email marketing strategy, create and execute email campaigns, and measure the results.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	Marketing Fundamentals: Welcome to Digital Marketing, The Digital Marketing Framework, What: Your Business Welcome to Digital Marketing, The Digital Marketing Framework, What: Your Business Who& When: Your Customer, Where: Marketing Channels, why: Marketing Objectives & KPIs.	08
2	Content Strategy: Plan Your Content Strategy, Create Content, Distribute & Promote Content, Optimize Website UX & Landing Pages, Measure Impact.	08
3	Social Media Marketing: Social Media Marketing (Organic), Social Media Landscape, Social Media Channels, Social Media Content, Implement & Monitor Campaigns, Measure Impact, Social Media Advertising (Paid), Intro to Social Media Advertising, Platforms for Social Ads, Facebook – Getting Started, Facebook - Create Ad Sets, Facebook - Create and Manage Ads	06
4	Search Engine Optimization (SEO): Search Engine Marketing with AdWords (SEM), How Search Works Keywords, On-Site SEO: Optimize UX & Design, Off-Site SEO: Link-building, SEO Audit & Future of SEO, Adwords & Keyword Selection, Create Text Ads, CPC Bidding, Navigate AdWords, SEM Metrics & Optimization	06
5	Display Advertising: How Do Display Ads Work? Display Ads &Targeting, Sales Models, Display Ads in AdWords, Video Advertising	06
6	Email Marketing: Email List Generation, Create an Effective Email Campaigns, and Create an Email Plan, Measure Results.	05

Books Recommended:

Text Books:

1. B2B Digital Marketing: Using the Web to Market Directly to Businesses – Miller
2. Digital Marketing: An Integrated Marketing approach –Star Business series.2019
3. Social Media Marketing All-In-One for Dummies by Jan Zimmerman and Deborah Ng, 2017
4. Google Adwords for Beginners: A Do-It-Yourself Guide to PPC Advertising
5. Digital Marketing, 1st edition, Vandana Ahuja, Oxford University Press.

Reference Books:

1. Digital Marketing for Dummies by Ryan Deiss and Russ Hennesberry, 2017
2. Digital Marketing Handbook: A Guide to Search Engine Optimization – Shivani Karwal
3. Introduction to Programmatic Advertising by Dominik Kosorin, 2016
4. The Webinar Way: The Single Most Effective Way to Promote Your Services, Drive Leads & Sell a Ton of Product by Sherri Rose, 2012
5. Social Media Marketing: Strategies for Engaging in Facebook, Twitter & Other Social Media by Liana Evans, (2010), Que Publishing.

Web Resources (For our Reference):

1. https://learndigital.withgoogle.com/digitalgarage/course/digital-marketing
2. https://onlinecourses.swayam2.ac.in/cec22_mg01/preview
3. https://onlinecourses.swayam2.ac.in/cec21_mg09/preview

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II (Autonomous)
(Academic Year 2024-2025)

<table>
<tr><td colspan="8">Program:
First Year M. Tech. Electronics & Telecommunication Engineering</td><td></td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course: Project Management</td><td></td><td colspan="3">Course Code:
DJS24POCOE24</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td></td><td colspan="10">Evaluation Scheme</td></tr>
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</table>

Objectives:

- Identify key areas of concern over Project Life Cycle (PLC) and use of project management principles across all the phases of PLC.
- Make them understand the importance and necessity of project plan.
- Make them understand the importance of team and how to work as a team member, share best project management practices.

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

- Assess a project by establishing a business case and accordingly prepare a project proposal.
- Develop a project plan.
- Identify task inter-dependencies, construct and analyze a network diagram
- Monitor and control the performance of the project.
- Demonstrate Team work and team spirit and resolve conflicts.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**An overview of Project Management:** What is project? Characteristics of project, Project Vs Operations, Project Goals, Project Life Cycle (typical & atypical), Evolution of Project Management, Need of Project Management, Different forms of Project Management, Project Environment, PMBOK. Remote (Virtual) Project Management: Introduction, benefits, challenges, tools for remote project management.	**05**
2	**Project Initiation and Planning:** Project Feasibility, Request for Proposal (RFP), Business Case, Project selection and approval process, Project Proposal, Project Contracting. Planning steps, Project Management Process, Project Charter, Project Planning Framework, Work Breakdown Structure (WBS), Linear Responsibility Chart, Gantt Chart.	**05**
3	**Project Time Management**: Network Diagrams (AOA &AON), Critical Path, PDM network, PERT, CPM, Resource Loading, Resource Leveling, Goldratt's Critical Chain.	**07**
4	**Project Cost Management:** Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Top down and bottom-up budgeting, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts.	**04**
5	**Project Human Resource Management:** Formal & Informal organization, project team, multidisciplinary teams, project leadership, ethics in projects, multicultural projects, Role of project manager. The nature of change, the change management plan, dealing with resistance and conflicts. Remote collaboration and its current state, future prospect of remote collaboration, managing remote teams effectively.	**06**
6	**Project Communication Management:** Monitoring and controlling the project, the project communications plan, project metric – Earned Value Management, data collection and reporting, reporting performance and progress, information distribution.	**04**
7	**Project Risk Management, Project Quality Management:** Basic concepts, Identification, Assessment, and Response plan. Quality Planning, Quality Assurance, Quality Control	**04**
8	**Project Procurement Management and Project Closure:** Introduction, project procurement management, outsourcing. Project implementation, administrative closure, project evaluation.	**04**

Books Recommended:

Text books:

1. John M. Nicholas, Project Management for Business and Technology, 4th edition, Pearson Education.
2. Jack T. Marchewka, Information Technology Project Management, 4th edition, Wiley India, 2009.

Reference Books:

1. E-Book –A Guide to Project Management Body of Knowledge (PMBOK ® Guide), 5th edition, Project Management Institute PA, USA.
2. Claudia M. Baca, Patti M. Jansen, PMP: Project Management Professional Workbook, Sybex Publication.
3. S. J. Mantel, J. R. Meredith and etal., Project Management 7thedition, Wiley India, 2009.
4. Joel Henry, Software Project Management, A real-world guide to success, Pearson Education, 2008.
5. Gido and Clements, Successful Project Management, 2ndedition, Thomson Learning
6. Hughes and Cornell, Software Project Management, 3rdedition, Tata McGraw Hill
7. Joseph Phillips, IT Project Management, end edition, Tata McGraw Hill
8. Robert K. Wyzocki, Effective Project Management, 5th edition, Wiley
9. Brown, K. A. Project Management, McGraw Hill, 2002.
10. Dinsmore, P. C. (Ed.), The AMA Handbook of Project Management. AMACOM, 1993.
11. https://www.pmi.org
12. https://www.projectmanager.com

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Syllabus for First Year M. Tech in Electronics and Telecommunication Engineering-Semester II (Autonomous)
(Academic Year 2024-2025)

Program: **First Year M. Tech. Electronics & Telecommunication Engineering**		**Semester: II**
Course: Research Methodology		**Course Code: DJS24POCOE25**

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**	**Assignment**	**Total**	
				60			**15**	**15**	**10**	**40**	**100**
				Laboratory Examination			**Term work**			**Total Term work**	**50**
3	**2**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			
				25	**--**	**--**	**15**	**10**		**25**	

Pre-requisite: Knowledge of

- Research concepts.

Objectives:

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

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

- Understand research concepts, types, significance and importance of research profile.
- Prepare a preliminary research design for projects in their subject matter areas.
- Accurately collect, analyze and report data.
- Review and analyze research findings.
- Prepare the research report.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction and Basic Research Concepts:** Meaning of Research, Objectives of Research, Types of Research, Significance of Research, Research Methods versus Methodology, Criteria of Good Research, Problems Encountered by Researchers in India. **Creating Research Profile:** Google Scholar, ResearchGate, ORCID and Publons.	07
2	**Defining the Research Problem**: Identifying and Selecting the Research Problem, Necessity of Defining the Research Problem, Technique Involved in Defining a Problem, Importance of literature review in defining a Research Problem, Literature review from primary and secondary sources, research databases, institution repository, searching the web, critical literature review, identifying research gap areas from the literature, developing theoretical background and research framework. **Research Design:** Meaning, Types and Significance. **Research Questions and Hypothesis:** Variables and their linkages, characteristics of a good Hypothesis, Research question and formulation of Research hypotheses, Basis for hypotheses.	09
3	**Sample Design:** Sample Design – Meaning and Significance, Essentials of a good sampling. Stages in Sample Design, Sampling methods/techniques, Sampling Errors. **Measurement and Scaling:** Classifications of Measurement Scales, Sources of Error in Measurement, Scaling, Scale Classification Bases, Scaling techniques, Deciding the Scale.	07
4	**Data Collection and Analysis:** Sources of Data, Types of Data, Methods of Collecting Data, data processing and analysis with statistical packages, hypothesis testing, generalization and interpretation.	06
5	**Research Writing:** Synopsis, Article/Research Paper, Research Proposal for funding agencies, Thesis, Dissertation, Book-Chapter. Layout, structure and format of a Research Report, Criteria of Good Research Writing, Precautions for Writing Research Reports, Patent possibilities. Software for paper formatting, like LaTeX/MS Office. **Indexation & Citation Style:** Concept of Indexing, Indexed by Scopus, PubMed, EBSCO, Web of Science, ISI Indexing, etc. MLA, APA, IEEE, ISO, Chicago, etc. style of citation in Bibliography, Reference Management Software like, Zotero, Mendeley, etc. **Publications from Research:** Identifying the relevant journal and its publisher, predatory journals, Journal Rankings, Research presentation in Conferences, Conferences proceedings.	07
6	**Research Ethics:** Research Ethics, Importance of Research Ethics, Scientific Misconduct, Similarity check (Turnitin, Quetext, Plagiarism Detector, Ouriginal software) and Their Prevention, Acknowledgement. **IPR:** Intellectual Property Rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS).	06

Books Recommended:

Reference Books:

1. Dawson, Catherine, Practical Research Methods, New Delhi, UBS Publishers Distributors, 2002.
2. C.R. Kothari, Gaurav Garg, Research Methodology: Methods and Techniques, New Age International 4th Edition, 2018.
3. Ranjit Kumar, Research Methodology a step-by-step guide for beginners, SAGE Publications Ltd 3rd Edition, 2011.
4. Donald R. Cooper, Pamela S. Schindler, J.K. Sharma, Business Research Methods, 12/e (SIE), McGraw-Hill Education, 2018.
5. Wadehra, B.L., Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing, 2000.

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<tr><td colspan="8">Program:
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<tr><td colspan="8">Course: Product Life Cycle Management</td><td></td><td colspan="3">Course Code:
DJS24POCOE26</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="2"></td><td colspan="9">Evaluation Scheme</td></tr>
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<tr><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">--</td><td rowspan="3">3</td><td colspan="3">Laboratory Examination</td><td colspan="4">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">50</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><td></td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td></td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of

- Product development process.
- Environmental science.

Objectives:

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

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

- Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
- Illustrate various approaches and techniques for designing and developing products.
- Understand the need for Product Life Cycle Assessment (LCA) and Life Cycle Cost Analysis.
- Demonstrate the various PLM Applications, Modules, and virtual product development tools for components, machining and manufacturing plant.
- Appreciate the significant effect of effective marketing strategies and integration of PLM with other business modules.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Fundamentals of Product Life Cycle Management (PLM):** Overview of product and product life cycle (PLC), background and concept of product life cycle management (PLM), Need for PLM, Elements/components of PLM, PLM paradigm and environment, Internal and external factors affective PLM, phases involved in PLM, PLM life cycle model and implementation (case study) PLM strategies and principles, organization's visions in line with PLM, strategy identification and selection, change management for PLM etc**.**	10
2	**Product Design and Development:** Product, Product structure, product design process and product analysis, New Product design and it's need, organization and decomposition in product design, Design for X and Robust design, Strategies for recovery at end of life, recycling, human factors in product design and concurrent engineering etc. What is product development? New product development – strategies and process, and successful product development.	08
3	**Product Life Cycle Assessment (LCA) and Life Cycle Cost Analysis:** Detailed methodology, ISO framework and phases of LCA, Application, benefits and limitations of LCA, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.	07
4	**PLM applications and software solutions:** Industry/Product specific Applications of PLM. Product Data Management (PDM) – concept and implementation, Product portfolio management, computer aided design and manufacturing, Digital manufacturing, Product modelling and simulations. (Industry case studies and examples to explain the benefits of PLM and related software tools)	06
5	**Integrating PLM Systems with other Aspects of Business and Environment:** Integration of PLM systems with Supply Chain Management, Enterprise resource planning, industry 4.0, Sustainable product development and Design for environment etc.	07
6	**Effective Marketing Strategies to Improve Life Cycle of Product:** Understanding marketing, Role of marketing in PLC and organization performance, Identifying business opportunities through market analysis, Consumer/Buyer behavior pattern etc. Developing effective marketing strategies – Differentiating and Positioning product, developing new product, product lines and width, pricing strategies, Market	04

	segmentation and Identifying target market, Advertising, branding, customer relations and managing market channels.	

Books Recommended:

Reference Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105.
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229.
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314.
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265.

Prepared by Checked by Head of the Department Principal

Syllabus for Second Year M. Tech. (Electronics & Telecommunication Engineering) Semester III and IV (Autonomous) - Academic Year 2023-2024

Scheme for Second Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester III (Autonomous) (Academic Year 2024-2025)

Semester III

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	Total (B)		
1	DJS24PECVS31	*Skill Development Course	3	--	--	3	--	--	--	--	--	--	--	50	50	50	3
2	DJS24PELLE32	Internship/On Job Training/Special topic Research Seminar	--	12	--	6	--	--	50	--	--	50	--	50	50	100	6
3	DJS24PEPEL33	Dissertation Phase I	--	12	--	6	--	--	--	--	--	--	--	100	100	100	6
		Total	**3**	**24**	--	**15**	--	--	**50**	--	--	**50**	--	**200**	**200**	**250**	**15**

*Skill Development Course specific to the Thesis topic

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Scheme for Second Year M. Tech. Program in Electronics & Telecommunication Engineering: Semester IV (Autonomous) (Academic Year 2024-2025)

Semester IV

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	CA Total (B)		
1	DJS24PEPEL41	Dissertation Phase II	--	30	--	15	--	--	100	--	--	100	--	100	100	200	15
		Total	--	**30**	--	**15**	--	--	**100**	--	--	**100**	--	**100**	**100**	**200**	**15**

Prepared by **Checked by** **Head of Dept** **Vice Principal** **Principal**

<table>
<tr><td colspan="8">Program: Second Year M. Tech. Electronics & Telecommunication Engineering</td><td colspan="4">Semester: III</td></tr>
<tr><td colspan="8">Course: Skill Development Course</td><td colspan="4">Course Code: DJS24PECVS31</td></tr>
<tr><td colspan="8">Course: --</td><td colspan="4">Course Code: --</td></tr>
<tr><td colspan="4" rowspan="3">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="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">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">100</td><td>--</td><td>--</td><td>--</td><td>100</td></tr>
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<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project/ Presentation</td></tr>
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</table>

Guidelines for NPTEL Credit Course:

1. The NPTEL online credit course should to be finalized by the student in consultation with the project guide/supervisor.
2. The course shall be of advanced or recent topics and should be relevant to the area of the project selected.
3. The selected NPTEL course should have a duration of 12 weeks or more.
4. The NPTEL course will be considered equivalent to 3 credits for course mentioned in 3 above.
5. NPTEL courses of 4 or 8 weeks will not be considered for credit transfer.
6. Students should register and complete the course and examination in semester III itself.
7. Only scores above 40% will be considered for grant of credits.
8. The student is required to share his exam score with the institute.

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<table>
<tr><td colspan="8">Program: Second Year M. Tech. Electronics & Telecommunication Engineering</td><td colspan="3">Semester: III</td></tr>
<tr><td colspan="8">Course: Internship/On Job Training/Special topic Research Seminar</td><td colspan="3">Course Code: DJS24PELLE32</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>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project/ Presentation</td></tr>
<tr><td>50</td><td>--</td><td>--</td><td>--</td><td>50</td><td>50</td></tr>
</table>

Guidelines for Internships/On Job Training:

1. Students can take up internship/training programme in industry related to Electronics & Telecommunication Engineering.
2. The number of hours required to be engaged should be a minimum of 12 hours weekly.
3. The duration of the internship should be 3 months at least.
4. Students should compile the report in standard format and present it in front of a Panel of Examiners.

Guidelines for Assessment of Internships:

1. Work done during the internship should be assessed jointly by a panel of Internal Examiners.
2. A power point presentation along with report should be presented in from of the panel members.
3. Feedback from the reporting manager of the student in the industry should evaluated.
4. Internship should be assessed based on the following points:
   - · Quality of work done during the internship
   - · Students understanding of the work
   - · Quality of Report and Oral Presentation
   - · Feedback from Internal guide and Reporting manager from industry**.**

Guidelines for Special Topic Seminar:

1. Special Topic Seminar should be based on thrust areas in Electronics & Telecommunication Engineering.
2. Students should do literature survey, identify the topic of seminar and finalize it with consultation of Guide/Supervisor.
3. Students should use multiple literatures (at least 10 papers from Refereed Journals/conferences) and understand the topic and research gap.
4. Students should compile the report in standard format and present it in front of a Panel of Examiners (Pair of Internal and External examiners).

Guidelines for Assessment of Special Topic Seminar:

1. Special Topic Seminar should be assessed jointly by a pair of Internal and External Examiners.
2. Special Topic Seminar should be assessed based on the following points:
   - Quality of Literature survey and Novelty in the topic

- Relevance to the specialization
- Understanding of the topic
- Quality of Written and Oral Presentation

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<table>
<tr><td colspan="8">Program: Second Year M. Tech. Electronics & Telecommunication Engineering</td><td colspan="3">Semester: III</td></tr>
<tr><td colspan="8">Course: Dissertation Phase I</td><td colspan="3">Course Code: DJS24PEPEL33</td></tr>
<tr><td colspan="8">Course: --</td><td colspan="3">Course Code: --</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>--</td><td>--</td><td>--</td><td>--</td><td>100</td><td>100</td></tr>
</table>

Guidelines for Dissertation Phase I

Students should do literature survey and identify the problem for Dissertation and finalize it in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The report should be compiled strictly as per the standard report writing guidelines.

Guidelines for Assessment of Dissertation Phase I

1. Dissertation Phase I will be assessed by a panel of internal examiners. The assessment will consist of a mid-semester review/progress evaluation for 50 marks and an end semester progress evaluation for 50 marks.

2. Dissertation Phase I should be assessed based on the following points:
   - Quality of Literature survey and Novelty in the problem
   - Clarity of Problem definition and Feasibility of problem solution
   - Relevance to the specialization
   - Clarity of objective and scope

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<table>
<tr><td colspan="9">Program: Second Year M. Tech. Electronics & Telecommunication Engineering</td><td colspan="3">Semester: IV</td></tr>
<tr><td colspan="9">Course: Dissertation Phase II</td><td colspan="3">Course Code: DJS24PEPEL41</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme (Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
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<tr><td rowspan="3">--</td><td rowspan="3">30</td><td rowspan="3">--</td><td rowspan="3">15</td><td colspan="3">Laboratory Examination</td><td colspan="2">Term work</td><td rowspan="2">Term Work Total</td><td rowspan="3">200</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Presentation/ Publication</td></tr>
<tr><td>100</td><td>--</td><td>--</td><td>50</td><td>50</td><td>100</td></tr>
</table>

Guidelines for Dissertation Phase II

Students should attempt solution to the identified problem by analytical/simulation/experimental methods. The solution is to be validated with proper justification and the thesis should be compiled strictly as per the standard report writing guidelines.

Guidelines for Assessment of Dissertation Phase II

Dissertation phase II will be assessed by a panel of internal examiner/guide and external examiner, appointed by the Research Approval Committee (RAC). The assessment will be based on the final thesis and the presentation. Prior to evaluation of the final thesis, assessment at the institute level will be carried out by the Research Approval Committee.

The final presentation and the thesis should highlight the following points of the project:

- Literature survey
- Problem definition
- Research and Design
- Execution
- Experimental and Simulation results
- Conclusion and future work
- Published material (Publications in reputed conference / journals is mandatory)

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