VI

B. Tech. Program (Electronics & Telecommunication Engineering)

Shri Vile Parle Kelavani Mandal's
Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJS22)

Third Year B. Tech

in

(Semester VI)

w.e.f. AY 2024-25

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

DJS22 Scheme for Third year Undergraduate Program in Electronics and Telecommunication:Semester VI(Autonomous)

(Academic Year 2024-2025)

Sr.No	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test Total (TT1 & TT2)	Term work	CA Total			
1	DJS22EC601	Digital Communication	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL601	Digital Communication Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJS22EC602	Radiating Systems	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL602	Radiating Systems Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
3	DJS22EC603	Computer Networks	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL603	Computer Networks Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
4	DJS22EC604	Fundamentals of Digital Image Processing	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL604	Fundamentals of Digital Image Processing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
5	DJS22EC6011	Basic VLSI	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL6011	Basic VLSI Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
6	DJS22EC6012	Control Systems	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6012	Control Systems Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22EC6013	Neural Network and Fuzzy Logic	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6013	Neural Network and Fuzzy Logic Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22EC6014	Operating Systems	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6014	Operating Systems Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22EC6015	Big Data Analytics	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6015	Big Data Analytics Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22EC6016	Radar Engineering	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6016	Radar Engineering Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJS22EC6017	Linear Algebra	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	
	DJS22EL6017	Linear Algebra Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
7	DJS22IHL	Professional and Business Communication Laboratory	--	4	--	2	--	--	--	--	--	--	--	--	--	50	50	50	1	1
8	DJS22ILLL2	Innovative Product Development IV	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	1
		Total	**15**	**16**	**--**	**23**	**20**	**325**	**125**	**--**	**25**	**475**	**100**	**75**	**175**	**200**	**375**	**850**	**22**	**22**

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (hrs.)
Theory	a. One Term test (based on 40 % syllabus)	20	1
	b. Second Term test (next 40 % syllabus) / presentation / assignment / course project / group discussion / any other.	15	1
	Total marks (a + b)	35	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

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 / * Computer based	Written paper based on the entire syllabus.	65	2
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
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.	As per the scheme	2

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Program: Electronic and Telecommunication Engineering	T.Y B. Tech	Semester: VI
Course: Digital Communication	Course Code: DJS22EC601	
Course: Digital Communication Laboratory	Course Code: DJS22EL601	

Pre-requisite:

1. Signal and System (DJS22EC304)
2. Engineering Mathematics –IV (DJS22EC401)
3. Analog Communication (DJS22EC501)

Objectives:

1. To learn about theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods
2. To draw signal space diagrams, compute spectra of modulated signals and apply redundancy for reliable communication.

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

1. Apply the basics of information theory and coding techniques to determine the minimum number of bits per symbol required to represent the source and the maximum rate at which a reliable communication can take place over the channel.
2. Describe and determine the performance of different waveform techniques for the generation of digital representation of signals.
3. Determine methods to mitigate inter symbol interference in baseband transmission system.
4. Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel of Communication systems.

Digital Communication (DJS22EC601)		
Unit	**Description**	**Duration**
1	**Information theory and source coding:** Block diagram and sub-system description of a digital communication system, measure of information and properties, entropy and it's properties, Source Coding, Shannon's Source Coding Theorem, Shannon-Fano Source Coding, Huffman Source Coding, Differential Entropy, joint and conditional entropy, mutual information and channel capacity, channel coding theorem, channel capacity theorem.	09
2	**Baseband Modulation and Transmission:** Discrete PAM signals and it's power spectra, Inter-symbol interference, correlative coding, equalizers, and eye pattern.	06

3	**Band pass Modulation and Demodulation:** Band pass digital transmitter and receiver model, digital modulation schemes Generation, detection, signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)Modulations, Binary Phase Shift Keying (BPSK) Modulation, Quaternary Phase Shift Keying (QPSK), Quadrature Amplitude Modulation (QAM), Comparison between bandwidth and bit rate, applications of digital modulation schemes.	12
4	**Error Control Systems:** Types of error control, error control codes **Linear Block Codes:** vector spaces, vector sub spaces, generator matrix, systematic linear block codes, parity check matrix, syndrome testing, error correction, and decoder implementation **Cyclic codes:** Algebraic structure of cyclic codes, binary cyclic code properties, encoding in systematic form, circuits for dividing polynomials, systematic encoding with shift register and error detection **Convolution Codes:** Time domain and transform domain approach, graphical representation, code tree, trellis, state diagram, decoding methods, maximum likelihood decoding, and free distance.	12
	Total	39

Digital Communication Laboratory (DJS22EL601)	
Exp.	**Suggested Experiment List**
1	Entropy and Mutual Information.
2	Source Coding Algorithms (Huffman coding).
3	Linear block codes (Error detection and correction).
4	Cyclic codes (comparison of performance of coded and uncoded system).
5	Convolutional Encoding.
6	ASK, FSK And PSK.
7	Generation and Detection of Binary Amplitude Shift Keying (BASK).
8	Generation of Binary FSK signal modulation (FSK).
9	Observing Eye pattern.

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.

Books Recommended:

Text books:

1. Haykin Simon, "*Digital Communication Systems*," John Wiley and Sons, New Delhi, 4th Edition, 2014.
2. H. Taub, D. Schlling, and G. Saha, "*Principles of Communication Systems*," Tata Mc-Graw Hill, New Delhi, 3rd Edition, 2012.

Reference Books:

1. Sklar B, and Ray P. K., "*Digital Communication: Fundamentals and Applications*," Pearson, Dorling Kindersley (India), Delhi, 2nd Edition, 2009.
2. T L Singal, "*Analog and Digital Communication*," Tata Mc-Graw Hill, New Delhi, 1st Edition, 2012.
3. P Ramakrishna Rao, "*Digital Communication*," Tata Mc-Graw Hill, New Delhi, 1st Edition, 2011.
4. M F Mesiya, "*Contempory Communication Systems*", Mc-Graw Hill, Singapore, 1st Edition, 2013.
5. Lathi B P, and Ding Z., "*Modern Digital and Analog Communication Systems*," Oxford University Press, 4th Edition, 2009.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Radiating Systems	Course Code: DJS22EC602	
Course: Radiating Systems Laboratory	Course Code: DJS22EL602	

Pre-requisite:

1. Radio Frequency Circuit Design (DJS22EC502)

Objectives:

1. To learn fundamental parameters of Antenna.
2. To learn about linear wire antenna elements and Antenna arrays.
3. To learn about Special types of Antennas.
4. To learn measurement procedures of Antenna parameters.

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

1. Explain and measure basic antenna parameters like radiation pattern, input impedance, gain and polarization.
2. Derive the field equations for the basic radiating elements like linear wire antenna and loop antenna.
3. Design of uniform linear and planar antenna arrays using isotropic and directional sources.
4. Design regular shape microstrip antennas and aperture antennas.

Radiating Systems (DJS22EC602)		
Unit	**Description**	**Duration**
1	**Antenna Fundamentals:** Review of Maxwells equations and vector potential wave equation. Antenna Parameters: Near field and far field radiation, dual equations for electric and magnetic current sources, radiation Mechanism, basic antenna parameters, Radiation pattern, radiation power density, radiation intensity, beam width, directivity, Antenna efficiency, Gain, beam efficiency, bandwidth, polarization, input impedance, antenna vector effective length and equivalent areas, antenna radiation efficiency, FRIIS transmission equation. **Measurement of Antenna parameters:** Input Impedance, Radiation Pattern, Gain (Two and Three antenna, method), Polarization.	09
2	**Wire Elements: Dipoles, Monopoles, Loops and Helical:** Infinitesimal dipole, radiation fields, radiation resistance, radiation sphere, near field, far field directivity, small dipole, finite length dipole, half wave length dipole, linear elements near or on infinite perfect conductors, Monopole antenna, Folded dipole. Design of dipole and monopole antenna. **Loop Antenna:** Small circular loop, comparison of small loop with short dipole, Ferrite loop, Radiation patterns, its parameters, and their applications.	09

	Helical Antennas: Input impedance matching, Axial mode and normal mode propagation, Circular polarization using Helical Antenna.	
3	**Arrays:** Linear arrays, Array of two isotropic point sources, linear arrays of N elements, principle of pattern multiplication applicable to non-isotropic sources, Phase scanning arrays, Broadside and End-fire Array, Increased Directivity end fire array, Calculations of Directivity, Beam width, Maxima and null directions for N-element Array, basics of planar arrays. Design of Yagi antenna and Log Periodic antenna.	**09**
4	**Microstrip Antenna:** **Microstrip antenna (MSA):** Introduction, Feeding Techniques, Regular Shape MSAs (Rectangular, Circular, Equilateral Triangular), Design of Regular shape MSAs.	**06**
5	**Aperture Antennas:** **Horn Antennas:** E-Plane Sectoral Horn, H-Plane Sectoral Horn, Pyramidal Horn, Conical Horn. **Reflector Antennas:** Introduction, Plane Reflector, Corner Reflector, Parabolic Reflector, Design considerations.	**06**
	Total	**39**

Radiating Systems Laboratory (DJS22EL602)	
Exp.	**Suggested Experiment List**
1	Study of antenna types.
2	Plot radiation pattern of dipole and monopole using antenna trainer kit/ simulation software.
3	Plot radiation pattern of dipole for varying length using simulation software.
4	Design of RMSA using simulation software.
5	Design of CMSA using simulation software.
6	Design of ETMSA using simulation software.
7	Plot radiation patterns of microstrip antenna using antenna trainer kit.
8	Design of broad side-end fire array.
9	Study of pattern multiplication.
10	Design of phase scanning array.
11	Gain measurement using three antenna method.
12	Radiation pattern measurement.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. C. A. Balanis, "*Antenna Theory Analysis and Design*", John Wiley & Sons, 3rd Edition, 2016.
2. G. Kumar, K. P. Ray, "*Broadband Microstrip Antenna*", Artech House, 1st Edition, 2002.

Reference Books:

1. R. E. Collin, "*Antennas and Radio Wave Propagation*", International Student Edition, McGraw Hill, 4th Edition, 1985.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Computer Networks	Course Code: DJS22EC603	
Course: Computer Networks Laboratory	Course Code: DJS22EL603	

Pre-requisite: Knowledge of

1. Analog Communication (DJS22EC501)

Objectives:

1. To Learn various hardware network components.
2. To understand network reference models and process involved in data communication.
3. To understand the protocols working at different layers.
4. To design and configure a network for an organization.

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

1. Compare OSI layered architecture with TCP/IP protocol suite and differentiate functions of each layer.
2. Define characteristics of physical media and differentiate among multiplexing techniques.
3. Describe responsibilities of the data link layer and explain the datalink layer protocols.
4. Design network and subnetwork and list the commands required to carry out investigations and troubleshooting.
5. Analyze transport layer protocols.

Detailed Syllabus: Computer Networks (DJS22EC603)

Unit	Description	Duration
1	**Introduction to Computer Network:** Reference Models, OSI model, overview of TCP/IP, layer functions, services, peer to peer protocols, sockets and ports, Data encapsulation **Networking devices:** Repeater, hub, bridge, switch and routers, Network topology.	06
2	**Introduction to Physical Layer Services:** Introduction to physical media, Guided transmission media: Coaxial cable, RJ 45, Optical fiber, twisted pair, bit transmission, frequency division multiplexing, Time division multiplexing.	03
3	**Data Link Layer:** Data link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols. **Sliding Window Protocols**: Stop and Wait protocol, Go-back-n protocol, Selective-repeat protocol. **Data Link Protocols**: HDLC: High-Level Data Link Control, Channel Allocation Problem, Multiple Access Protocols.	10

4	**Network Layer:** Network functions for the Network Layer Functions, **Routing Algorithms:** Distance vector and Link state routing, shortest path first algorithm: Dijikstra and Bellman Ford algorithm, Quality of Service. **Network Layer in The Internet:** The IP Protocol, IPv4 header, IP Addressing classfull and classless, CIDR notation, Subnetting, supernetting, Internet Control Protocols. **Interior Gateway Routing Protocol**: RIP, OSPF. **Exterior Gateway Routing Protocol**: BGP.	**10**
5	**Transport Layer:** The Transport Service, Elements of Transport Protocols. **The Internet Transport Protocol**: TCP and UDP, The Internet Transport Protocol: TCP:-Introduction to TCP, The TCP, Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modelling TCP Connection Management, TCP Transmission Policy, TCP Congestion Control, TCP Timer Management.	**10**
	Total	**39**

Computer Networks Laboratory (DJS22EL603)	
Exp.	**Suggested Experiment List**
1	To implement different networking command using Cisco packet tracer.
2	To study various hardware and software network components.
3	To configure the Web (HTTP and DNS), FTP and SMTP server using Cisco packet tracer.
4	To configure RIP protocol in a network using Cisco packet tracer.
5	To configure OSPF protocol in a network using Cisco packet tracer.
6	To establish TELNET session using Cisco packet tracer.
7	To design Firewall using standard and extended ACL's.
8	To study VLSM using Cisco packet tracer.
9	To implement Dijikstras algorithm.
10	To implement Bellman Ford algorithm.
11	To analyze network traffic: HTTP, TCP, UDP using Wireshark.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. A. S. Tanenbaum, "*Computer Network*", Prentice Hall, 4th Edition, 2017.
2. Behrouz A. Forouzan, "*Data Communication and Networking with TCP/IP Protocol Suite*", Tata McGraw-Hill, 6th Edition 2022.

Reference Books:

1. Kurose, Ross, "*Computer Networking*", Pearson, 7th Edition, 2017.
2. D. E. Comer, "*Computer Networks and Internets*", Pearson, 6th Edition, 2014.
3. Behrouz A. Forouzan, "*TCP/IP Protocol Suite*", Tata McGraw-Hill, 4th Edition, 2017.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Fundamentals of Digital Image Processing	Course Code: DJS22EC604	
Course: Fundamentals of Digital Image Processing Laboratory	Course Code: DJS22EL604	

Pre-requisite: Knowledge of

1. Engineering Mathematics-IV (DJS22EC401)
2. Digital Signal Processing (DJS22EC504)

Objectives:

1. To cover the fundamentals, mathematical models and transformation techniques in digital image processing.
2. To develop time and frequency domain techniques for image enhancement.

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

1. Interpret the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using transforms.
3. Evaluate, compare and contrast the techniques for image enhancement and image restoration.
4. Interpret and apply image segmentation and representation techniques for object recognition.

Fundamentals of Digital Image Processing (DJS22EC604)		
Unit	**Description**	**Duration**
1	**Digital Image Fundamentals:** Steps in Digital Image Processing, Components, Image Sampling and Quantization. **Color Image Processing:** Color Fundamentals Color models.	04
2	**Image Enhancement (point processing):** Image Negative, Thresholding, Gray level slicing with and without background, power law and log transform, Contrast Stretching, Histogram equalization and Histogram Specification. **Image Enhancement in Spatial Domain (Neighborhood processing):** Basics of Spatial Filtering, Generating Spatial Filter Masks–Smoothing and Sharpening Spatial Filtering. **Image Transforms:** 1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform, Slant Transform. **Image Enhancement in Frequency Domain**: The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters.	10

3	**Morphology:** Erosion and Dilation, Opening and Closing, The Hit or-Miss Transformation. **Restoration**: Noise models – Mean Filters – Order Statistics – Adaptive filters – wiener filter	07
4	**Point, Line, and Edge Detection:** Detection of Isolated Points, Line detection, edge models, basic and advance edge detection, Edge linking and boundary detection, Canny's edge detection algorithm. **Thresholding:** Foundation, Role of illumination, Basic Global thresholding, Otsu's method. **Region Based segmentation:** Region Growing, Region Splitting and merging, Relationships between pixels, Hough transform. **Region Identification:** chain code, simple geometric border representation, Fourier Transform of boundaries, Boundary description using segment sequences.	10
5	**Object Recognition:** Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Support vector machine, Kernels, cluster analysis, K means Clustering.	08
	Total	39

Fundamentals of Digital Image Processing Laboratory (DJS22EL604)	
Exp.	**Suggested Experiment List**
1	To perform basic Image Processing, Geometric, Arithmetic and Logical operations on images.
2	To perform Spatial Domain Image Enhancement using different Point Processing techniques
3	To perform Spatial Domain Image Enhancement using different Neighborhood Processing techniques.
4	To perform Histogram equalization.
5	Application of Harr transform in image processing.
6	To perform frequency domain Image Enhancement techniques.
7	To perform region-based segmentation.
8	To perform morphological operations on Image.
9	To perform edge detection using basic and advanced techniques.
10	To perform Image restoration using various filters.

11	To perform classification using Support Vector Machine.
12	To perform clustering using K-means algorithm.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Gonzales and Woods, "*Digital Image Processing*", Pearson Education, 3rd Edition, 2002.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "*Image Processing, Analysis, and Machine Vision*", Cengage Engineering, 3rd Edition, 2013.

Reference books:

1. Anil K.Jain, "*Fundamentals of Image Processing*", Prentice Hall of India, 1st Edition, 1989.
2. W. Pratt, *"Digital Image Processing"*, Wiley Publication, 3rd Edition, 2002.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Basic VLSI	Course Code: DJS22EC6011	
Course: Basic VLSI Laboratory	Course Code: DJS22EL6011	

Pre-requisite:

1. Electronics Circuit Design (DJS22EC302)
2. Digital System Design (DJS22EC303)
3. Integrated Circuits (DJS22EC402)

Objectives:

1. To highlight the circuit design issues in the context of VLSI technology.
2. To provide understanding of VLSI circuit design using different design styles.
3. To provide introduction to HDL programming.

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

1. Analyze transistor scaling and its effect on VLSI circuit performance.
2. Realize logic circuits using different design styles.
3. Describe operation of memory, storage circuits and data path elements.
4. Design digital circuits using HDL language.

Basic VLSI (DJS22EC6011)		
Unit	**Description**	**Duration**
1	**MOSFET Scaling:** Types of scaling, short channel effects. **Layout:** Lambda based design rules(CMOS), MOSFET capacitances.	06
2	**CMOS INVERTER Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and CMOS inverter. Comparison of all types of MOS inverters. Design of CMOS inverters and its layout. **Design styles:** Static CMOS, Dynamic CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino logic, C^2MOS, NORA logic, NP Domino logic, Realization of Multiplexer (up to 4:1 Mux), Encoder, Decoder, SR Latch, JK FF, D FF, 1 Bit Shift Register design in different design styles and their layouts.	12
3	**Memory and Storage circuits:** ROM array, SRAM (operation, design strategy, leakage currents, read /write circuits), layout of SRAM. DRAM (Operation of 1T, 3T, operation modes, refresh operation, Input-Output circuits), layout of DRAM.	08

4	**Data path design:** Full adder, Ripple carry adder, CLA adder, Carry Skip Adder, Carry Save Adder and carry select adder, Array Multiplier, Barrel shifter.	**08**
5	**Design methods:** Semi-custom Full custom design PLA PAL PROM FPGA PLD. Introduction to Verilog Programming.	**05**
	Total	**39**

Basic VLSI Laboratory (DJS22EL6011)	
Exp.	**Suggested Experiment List**
1	To study MOS characterization using simulation software.
2	Static analysis of CMOS Inverter.
3	Dynamic analysis of CMOS Inverter.
4	Multiplexer design using pass transistor and transmission gate logic style.
5	1-bit CMOS Adder design using static CMOS logic style.
6	1-bit CMOS mirror Adder design.
7	To write Verilog Program for flip flops.
8	To write Verilog Program for adders.
9	To write Verilog Program for multiplexers.
10	Design and simulation of barrel shifter circuit in SPICE.
11	To write Verilog code and simulation of barrel shifter.
12	To study MOS characterization using simulation software.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Sung-Mo Kang and Yusuf Leblebici, "*CMOS Digital Integrated Circuits Analysis and Design*", Tata McGraw Hill, 3rd Edition, 2012.
2. Samir Palnitkar," *Verilog HDL: A Guide to Digital Design and Synthesis*", PHI, 2nd Edition, 2017.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "*Digital Integrated Circuits: A Design Perspective*", Pearson Education, 2nd Edition, 2003.
2. P. Uyemura, "*Introduction to VLSI Circuits and Systems*", John Wiley & Sons, 1st Edition, 2006.
3. Frank Vahid, "*Digital Design with RTL Design, VHDL and VERILOG*", John Wiley and Sons Publisher, 2nd Edition, 2011.
4. Neil H. E. Weste, David Harris and Ayan Banerjee, "*CMOS VLSI Design: A Circuits and Systems Perspective*", Pearson Education, 3rd Edition, 2006.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Control Systems	Course Code: DJS22EC6012	
Course: Control Systems Laboratory	Course Code: DJS22EL6012	

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics (DJS22FECBE)
2. Engineering Mathematics-I (DJS22FEC11)
3. Engineering Mathematics-II (DJS22FEC21)

Objectives:

1. To provide fundamental concept of control systems.
2. To introduce mathematical modelling, time domain analysis & frequency domain analysis.
3. To develop concepts of stability and its assessment criteria of the system.
4. To study basic concepts of controllers.

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

1. Explain the basic concepts of control system.
2. Derive the mathematical model of different type of the systems.
3. Analysis of systems in time and frequency domain.
4. Find stability of system using appropriate criteria.
5. Apply the control theory to design the conventional controllers widely used in the industries.

Control Systems (DJS22EC6012)		
Unit	**Description**	**Duration**
1	**Introduction to Control Systems:** Introduction: Open loop, closed loop systems, feed forward control, & adaptive control systems, examples of control systems. Modeling: Types of models, impulse response model, transfer function model. Dynamic Response: Standard test signals, transient and steady state behavior control systems, steady state errors in feedback control systems and their types.	08
2	**Mathematical Modeling of Systems:** Conversion of block diagram to signal Flow Graph and Vice-versa., Transfer Function models of various Electrical systems, Block diagram reduction for single inputs single outputs(SISO) and multiple inputs multiple outputs(MIMO) systems, signal flow graph, Mason's gain rule.	10
3	**State Variable Models:** Basic concepts, state variable and state models for electrical systems, general state space representation, conversion between state space and transfer function, concept	07

	of state transition matrix, properties of state transition matrix, controllability and observability, analysis of LTI systems, with Examples.	
4	**Stability Analysis:** Concept of stability, Routh stability criterion, Root-locus, general rules for constructing root-locus, Magnitude and phase plot; Method of plotting Bode plot; Stability margins on the Bode plots, Nyquist stability criterions gain and phase margins. Case study on stability of Control System in Thermal Power Plant.	**10**
5	**Controllers & Compensators:** Introduction of PI, PD, and PID Controllers, Lead and Lag compensators. Case study on a model-driven PID control system.	**04**
	Total	**39**

Control Systems Laboratory (DJS22EL6012)	
Exp.	**Suggested Experiment List**
1	To Verify the effect of zero and pole to the second order closed loop control system.
2	To find static errors for type 0, type 1, type 2 control System.
3	To plot frequency response of a first order and second order control systems.
4	To find transfer function of a first order and second order control systems.
5	To verify the effect of Zero and pole to open loop transfer function of a second order. system with unity feedback.
6	To find controllability & observability of the given control system.
7	To design root locus for given control system.
8	To design Bode plot for first and second order control system.
9	To design Nyquist plot for given control system.
10	Verification of observability and controllability for given control system.
11	To find Transfer functions of P, PI, and PID controller.
12	To study Servo mechanism and characteristics of servo motor.

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.

Books Recommended:

Text books:

1. I. J. Nagrath, Madan.Gopal, "*Control System Engineering*", New Age International Publication, 7th Edition, 2021.
2. K.Ogata, "*Modern Control Engineering*", Pearson Education", 5th Edition, 2015.
3. Normon S. Nise, "*Control System Engineering*", John Wiley & Sons, 8th Edition, 2020.

Reference Books:

1. Madan Gopal, "*Control Systems Principles and Design*", Tata McGraw hill, 7th Edition, 2012.
2. Ajit K.Mandal, "*Introduction to Control Engineering: Modeling, Analysis and Design*", New Age International Publication, 2nd Edition, 2010.
3. S.Hasan Saeed, "*Automatic Control System*", S.K. Kataria & Sons, 9th Edition, 2017.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Neural Networks and Fuzzy Logic	Course Code: DJS22EC6013	
Course: Neural Networks and Fuzzy Logic Laboratory	Course Code: DJS22EL6013	

Pre-requisite:

1. Engineering Mathematics-I (DJS22FEC11)
2. Engineering Mathematics-IV (DJS22EC401)

Objectives:

1. To introduce the concepts and understanding of artificial neural networks and fuzzy logic.
2. To introduce neural network design concepts
3. To expose neural networks based methods to solve real world complex problems
4. To provide knowledge of fuzzy logic to design the real world fuzzy systems

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

1. Explain training of Neural Networks using training rules with consideration of parameters like overfitting, under fitting,
2. Calculate and update the weights of the neural networks to Specify the working and applications of different types of neural networks.
3. Design fuzzy sets for applications and solve fuzzy set theory problems.
4. Design engineering application using Neural Networks/ Fuzzy Logic.

Neural Networks and Fuzzy Logic (DJS22EC6013)		
Unit	**Description**	**Duration**
1	**Introduction to Neural Networks:** Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Potential Applications of ANN.	04
2	**Essentials of Artificial Neural Networks:** Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.	04
3	**Supervised Neural Networks:** Feed forward neural network, Single-Layer feed forward architecture-Perceptron, Multiple-Layer feed forward architecture, Types of feed forward networks, Multi-layer perceptron, Training MLP: The back-propagation algorithm, Introduction to the concept of Support Vector Machine based classifier, GRADIENT-DESCENT algorithm, Generalization, Factors to be considered, Assessing the success of learning, Metrics for evaluation of	10

	classification method, Steps to use neural networks to data, Over fitting, Detecting over fit models: Cross validation.	
4	**Unsupervised Learning Neural Networks:** Competitive Learning Networks – Maxnet, Mexican Hat Net, Kohonen Self-Organizing Networks – architecture, training algorithm, K-means, Radial Basis Function (RBF) neural network – architecture and algorithm, and Discrete Hopfield networks.	**10**
5	**Fuzzy logic:** Introduction to fuzzy logic, Basic Fuzzy logic theory, Fuzzy sets - properties & operations, Fuzzy relation - Operations on fuzzy relations, Fuzzy Membership functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzification and Defuzzification methods, Fuzzy Inference Systems, Mamdani Fuzzy Models, Fuzzy knowledge-based controllers, Sugeno Fuzzy Models.	**06**
6	**Applications of Fuzzy Logic and Fuzzy Systems:** Fuzzy pattern recognition, fuzzy C-means clustering, fuzzy image processing, Simple applications of Fuzzy knowledge-based controllers like washing machines, home heating system, and train break control.	**05**
	Total	**39**

Neural Networks and Fuzzy Logic Laboratory (DJS22EL6013)	
Exp.	**Suggested Experiment List**
1	Fuzzy Set Operations: AND, OR, D-Morgan's theorem.
2	(a)Simulation of Mamdani Fuzzy Inference System for washing machine control.
	(b) Summery of research paper based on Fuzzy logic.
3	Simulation of Sugeno Fuzzy Inference System for given application.
4	Simulation of Mamdani Fuzzy Inference System for image processing application. (Edge detection).
5	Write a program for perceptron training algorithm and test it for two input AND & OR gate function.
6	Write a program for training and testing of Multilayer Perceptron for two input EX-OR gate.
7	Write a program for training and testing of Multilayer Perceptron for character recognition application.
8	Program for Radial basis neural network for interpolation application.
9	Write a program for training and testing of RBF for pattern classification application.
10	Kohenan Self Organising map for image classification.
11	To Study the use of Microsoft Machine Learning Studio (classic) in Neural Network and Machine Learning.
12	Case study.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. S. N. Sivanandam and S. N. Deepa, "*Introduction to Soft Computing*", Wiley India Publications, 3rd Edition, 2018.
2. S. Rajasekaran, G.A. Vijayalakshmi Pai , "*Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications*", 2nd Edition , 2017.

Reference Books:

1. Thimothy J. Ross, "*Fuzzy Logic with Engineering Applications*", Wiley India Publications, 3rd Edition, 2011.
2. John Yen and Reza Langari, "*Fuzzy Logic- Intelligence, Control and Information*", Pearson Publications, 1st Edition, 1998.
3. J. S. R. Jang, C.T. Sun, and E. Mizutani, "*Neuro-Fuzzy and Soft Computing*", PHI, 1st Edition, 1996.
4. Simon Haykin, "*Neural Networks and Learning Machines*", Pearson Education, 3rd Edition, 2016.
5. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, "*Introduction to Neural Network Using MALAB*", Tata McGraw-Hill Publications, 1st Edition, 2017.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Operating Systems	Course Code: DJS22EC6014	
Course: Operating Systems Laboratory	Course Code: DJS22EL6014	

Pre-requisite:

1. Structured Programming using C (DJS23FCES101)

Objectives:

1. To introduce operating system as a resource manager, its evolutions and fundamentals.
2. To help student understand concept of process and different process (linear and concurrent) Scheduling policies.
3. To help student familiar with memory, file and I/O management policies.

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

1. Explain the fundamental concepts of OS.
2. Analyze the management policies adopted by processes, memory, File handling and I/O operations.
3. Apply the algorithms used for memory management, CPU scheduling and disk scheduling.
4. Apply concepts related to deadlock to solve the problems.
5. Analyze the functionalities of OS like Unix, Linux and Real Time Operating System.

Operating Systems (DJS22EC6014)		
Unit	**Description**	**Duration**
1	**Fundamental of Operating System (OS)** Definition, objectives, functions, evolution, services, types, and different views of OS Operating System as a resource manager, system calls, and shell, Monolithic systems, layered systems, client server model, monolithic kernel and Microkernel.	04
2	**Process Management** Process, process creation, process control block, process states, process state transition diagram, types of schedulers: preemptive and non- preemptive, types of scheduling algorithms, types of threads, multithreading models.	10
3	**Memory Management** Race condition, critical section, mutual exclusion, Deadlock Problem, deadlock characterization, deadlock prevention and deadlock avoidance deadlock detection and recovery, semaphores. Multiprogramming with fixed and variable partitions, memory allocation strategies, Logical and physical address space, paging and segmentation, Concept, performance of demand paging, page replacement algorithms.	10

4	**File Management and Input Output Management** File Naming, File Structure, File Types, File Access, File Attributes, File Operations, Memory Mapped Files, Implementing Files, contiguous allocation, linked list allocation, indexed allocations, Single level directory system, Two level directory system, Hierarchical Directory System, Principles of Input/output H/W: I/O Devices, Device Controllers, Direct Memory Access, Principles of Input/output S/W: Goals Of I/O S/W, Interrupt Handler, Device Driver, Device Independent I/O Software, Disks :RAID levels, Disks Arm Scheduling Algorithms, Management of free blocks.	**10**
5	**Real Time Operating System (RTOS)** Introduction, Characteristics of real-time operating systems, Real Time task Scheduling, Modeling Timing constraints, Table-driven scheduling, Cyclic schedulers, Earliest Deadline First (EDF) scheduling, Rate Monotonic Algorithm (RMA).	**05**
	Total	**39**

Operating Systems Laboratory (DJS22EL6014)	
Exp.	**Suggested Experiment List**
1	To implement linux commands.
2	To implement linux shell script.
3	To implement preemptive and non-preemptive algorithms.
4	Implement Banker's Algorithm for deadlock avoidance.
5	To implement concept of memory management.
6	To implement demand and virtual memory implementation.
7	To implement file allocation strategies.
8	To implement disk scheduling techniques.
9	To implement file organization techniques.
10	To implement RTOS scheduling techniques.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. A. S. Tanenbaum, "*Modern Operating Systems*", Pearson, 4th Edition, 2015.
2. Silberschatz A, Galvin P, and Gagne G, "*Operating System Concepts*", Wiley, 10th Edition, 2018.

Reference Books:

1. William Stallings, "*Operating System-Internal and Design Principles*", Pearson, 9th Edition, 2018.
2. Rajib Mall, "*Real Time Systems: Theory and Practice*", Pearson Education, 1st Edition, 2007.
3. Achyut S. Godbole, "*Operating Systems*", Tata McGraw Hill Education, 3rd Edition,2011.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Big Data Analytics	Course Code: DJS22EC6015	
Course: Big Data Analytics Laboratory	Course Code: DJS22EL6015	

Pre-requisite:

1. Data Base Management System laboratory (DJS22EL406)

Objectives:

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

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

1. Describe the key issues in big data management and its associated applications for business decisions and strategy.
2. Illustrate and Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop and NoSQL in big data analytics.
3. Evaluate Big Data processing by using Map Reduce.
4. Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
5. Exploring the capabilities of big data using Apache Spark.

Big Data Analytics (DJS22EC6015)		
Unit	**Description**	**Duration**
1	**Introduction to Big Data Analytics & Hadoop:** Introduction to Big Data, Big Data characteristics, Types of Big Data, Traditional vs. Big Data business approach. Technologies available for Big Data, Infrastructure for Big Data, Big Data challenges, Case Study of Big Data solutions. Introduction to Hadoop, Core Hadoop components, Hadoop Ecosystem, Physical architecture, Hadoop limitations.	08
2	**NoSQL:** Introduction to NoSQL, NoSQL business drivers, NoSQL case studies. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns. Analysing big data with a shared-nothing architecture, Choosing distribution models, master-slave versus peer-to-peer, Introduction to MongoDB, MongoDB commands.	07

3	**MapReduce:** **MapReduce and The New Software Stack:** Distributed File Systems, Physical organization of compute Nodes, Large scale file-system organization. **MapReduce:** The Map tasks, grouping by key, The Reduce tasks, Combiners, Details of MapReduce execution, Coping with node failures. Matrix vector multiplication using MapReduce, Relational operators using MapReduce	08
4	**Techniques in Big Data Analytics:** **Finding Similar Item**: Nearest Neighbour Search, Similarity of Documents. **Mining Data Streams**: Data Stream Management Systems, Data Stream Model, **Examples of Data Stream Applications:** Sensor Networks, Network Traffic Analysis. **Frequent Itemset Mining:** Market Basket Model- Applications, Association Rule- Confidence, Interest, Support, Apriori Algorithm - Pass1, Pass2 Recommendation Systems: Introduction, Collaborative-Filtering System, Content based recommendation system. **Link analysis**: Page rank algorithm, Structure of web.	10
5.	**Big Data Analytics using Apache Spark:** Introduction to Spark: Features, Spark built on Hadoop, Components of Spark. Resilient Distributed Datasets: Data sharing using Spark RDD, Iterative operations on Spark RDD, Interactive operations on Spark RDD, RDD transformations, Execution of word count transformation.	06
	Total	39

Big Data Analytics Laboratory (DJS22EL6015)	
Exp.	**Suggested Experiment List**
1	Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2	Execution of Hadoop file handling commands.
3	Installation of MongoDB and execution of CREATE, INSERT, DELETE and UPDATE operations.
4	Querying in MongoDB using FIND command, aggregate functions etc.
5	Designing of graphical data store and querying in Neo4j.
6	Execution of PIG SCRIPTING language.
7	Execution of HIVE SCRIPTING language.
8	Execution of Matrix Multiplication Using MapReducc.
9	Execution of Word Count using MapReduce.
10	Execution of Word Count using Apache Spark

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books:

1. Radha Shankarmani, M Vijayalakshmi, "*Big Data Analytics*", Wiley, 2nd Edition, 2016.
2. Alex Holmes, "*Hadoop in Practice*", *Manning Press*, Dreamtech Press, 2nd Edition, 2015.
3. Holden Karau, Andy Konwinski, Matei Zaharia, "*Learning Spark*" O'Reilly, 2nd Edition, 2015.

Reference Books:

1. Bart Baesens, "*Analytics in a Big Data World: The Essential Guide to Data Science and its Applications*", Wiley Big Data Series, 1st Edition, 2017.
2. Vignesh Prajapati, "*Big Data Analytics with R and Hadoop*", Packt Publishing Limited 1st Edition, 2013.
3. Tom White, "*Hadoop: The Definitive Guide*", O'Reilly Publications, 2nd Edition, 2016.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Radar Engineering	Course Code: DJS22EC6016	
Course: Radar Engineering Laboratory	Course Code: DJS22EL6016	

Pre-requisite:

1. Electromagnetic Wave Propagation(DJS22EC403)
2. Analog Communication(DJS22EC501)

Objectives:

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

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

1. Illustrate generalized concept of RADAR & its applications.
2. Solve problems using radar equations.
3. Describe types of radar for specific application.
4. Explain concept of tracking radar.
5. Evaluate the design constraints for transmitter and receiver.

Radar Engineering (DJS22EC6016)		
Unit	**Description**	**Duration**
1	**Introduction to Radar:** Basic Radar, basic ranger equation, Block Diagram, Radar Frequencies, Applications of Radar.	07
2	**Radar Range Equation:** Detection of signal in noise, Receiver Noise and Signal-to-noise Ratio, Probability of detection and false alarm: Simple, complex Targets, Pulse Repetition Frequency.	08
3	**MTI and Pulse Doppler Radar:** Introduction to Doppler and MTI radar, Doppler frequency shift, Simple CW Doppler radar, MTI radar block diagram, Delay line canceler, Moving- target-detection, Pulse Doppler radar.	10
4	**Tracking Radar:** Mono pulse tracking, Conical scan and sequential lobbing, Limitation of tracking accuracy, Low angle tracking.	06
5	**Radar Transmitter and Receiver:** Radar RF power sources: Klystron, Travelling wave tube, Magnetron, Low power transmitter, high power transmitter, Advantages of solid state RF power source, Duplexer, and Mixer and their types, Receiver noise figure, Radar Display: Types of displays.	08
	Total	39

Radar Engineering Laboratory (DJS22EL6016)	
Exp.	**Suggested Experiments List**
1	To study basic Radar and range equation.
2	To Study CW Radar and find the relative speed of the object.
3	Derive Radar range equation with noise figure and find the distance.
4	To study MTI Radar and find the blind speed.
5	Calculate pulse repetition frequency and velocity of the moving object.
6	To study various displays used in Radar systems.
7	To study clutters and its effects on Radar range equation.
8	To study delay line canceller.
9	Find the speed of the fan using Doppler Radar.
10	To study duplexer and mixer.
11	To study tracking Radar.

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.

Books Recommended:

Text books:

1. Merrill Skolnik," *Introduction to Radar Systems*", Tata McGra Hill, 2nd Edition, 2010.
2. G S N Raju, "*Radar Engineering*", Willey publication, 1st Edition,2020.
3. Bassem R. Mahafza, "*Radar Signal Analysis*", CRC press, 1st Edition, 2021.

Reference Books:

1. E David Jansing, "*Introduction to Synthetic Aperture Radar*", McGraw Hill, 2nd Edition, 2021.
2. Clive Alabaster, "*Pulse Doppler Radar*", SciTech Publishing, 2nd Edition, 2012.
3. William L Melvin, James A Scheer, "*Principals of Modern Radar*", SciTech Publishing, 1st Edition, 2014.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Linear Algebra	Course Code: DJS22EC6017	
Course: Linear Algebra Laboratory	Course Code: DJS22EL6017	

Pre-requisite:

1. Engineering Mathematics-IV (DJS22EC401)

Objectives:

1. Understanding basic concepts of linear algebra to illustrate its power and utility through applications.
2. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in Engineering.

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

1. Explain the abstract concepts of matrices and system of linear equations using decomposition Methods.
2. Demonstrate the basic notion of vector spaces and subspaces.
3. Apply the concept of vector spaces using linear transforms and inner product spaces applications in cryptography.

Linear Algebra (DJS22EC6017)		
Unit	**Description**	**Duration**
1	**System of Linear Equations:** Gaussian elimination and Gauss Jordan method Elementary matrices Permutation matrix inverse matrices System of linear equations LU factorizations.	06
2	**Vector Spaces:** The Euclidean space and vector space, subspace linear combination, span-linearly dependent-independent bases, dimensions, finite dimensional vector space, The four fundamental spaces, Rank and nullity Bases for subspace	12
3	**Linear Transformations:** Linear transformations, Basic properties, invertible linear transformation, matrices of linear transformations, vector space of linear transformations, change of bases	10
4	**Inner Product Spaces and Applications:** Dot products and inner products, the lengths and angles of vectors, matrix representations of inner products, Gram-Schmidt Orthogonalisation, QR factorization- Projection - orthogonal projections	07

5	**Applications:** An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption.	04
	Total	**39**

Linear Algebra Laboratory/Tutorial (DJS22EL6017)	
Tuts	**Suggested Tutorial List**
1	Gaussian elimination and Gauss Jordan Method
2	LU Factorizations
3	The Four Fundamental Spaces
4	Linear Transformations
5	Gram-Schmidt Orthogonalisation
6	QR Factorization
7	Linear Dependence and Independence
8	Least Squares Approximation
9	Case Study: Classical Cryptosystems

Minimum eight tutorials from the above suggested list or any other experiment/tutorial based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Jin Ho Kwak and Sungpyo Hong, *"Linear Algebra"*, Springer, 2nd Edition, 2004.
2. Bernard Kolman and David, R., *"Introductory Linear Algebra- An Applied First Course"*, Pearson Education, 9th Edition, 2011.

Reference Books:

1. Stephen Andrilli and David Hecker, "*Elementary Linear Algebra"*, Academic Press, 5th Edition, 2016.
2. Rudolf Lidl and Guter Pilz,, *"Applied Abstract Algebra"*, Springer, 2nd Edition, 2004.
3. Howard Anton, Robert C Busby, *"Contemporary Linear Algebra"*, Wiley, 1st Edition, 2003.
4. Gilbert Strang, *"Introduction to Linear Algebra"*, Cengage Learning, 5th Edition, 2015.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Professional and Business Communication Laboratory	Course Code: DJS22IHL	

Pre-requisite:
Basic course in Effective Communication Skills

Objectives:

1. To inculcate professional and ethical attitude at the workplace
2. To enhance communication and interpersonal skills
3. To develop effective employability skills
4. To hone written skills for technical documentation

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

1. Prepare technical documents using appropriate style, format, and language
2. Use employability skills to optimize career opportunities
3. Employ storytelling techniques in corporate situations
4. Conduct effective meetings and document the process
5. Demonstrate interpersonal skills in professional and personal situations
6. Describe cultural differences, etiquettes, and the concept of professional ethics

Detailed Syllabus: (unit wise)

Unit	Description	Duration
Technical Writing		
1	**Report Writing:** Types of reports, Basic structure of a report, collection of data through questionnaires, survey analysis, language and style in reports **Business Proposal Writing:** Types of business proposals, format of proposal, language and style, presentation of proposal **Plagiarism:** Types of plagiarism, consequences of plagiarism	06
Employment Skills		
2	**Group Discussion:** Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD **Resume Writing:** Types of resumes, structure, content and formatting of resume **Interview Skills:** Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview **Presentation Skills:** Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation	08
Corporate Story Telling		03
3	**Basics of storytelling:** Setting, characters, plot, crisis, climax, resolution, Benefits of storytelling **Types of stories:** Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOP's and interviews, storytelling to manage conflict or to motivate **Storytelling techniques:** Narration using verbal and non-verbal communication, Analysis of storytelling strategies of corporate master storytellers.	

Meetings and Documentation		
4	**Planning and preparation for meetings:** Planning layout of meetings, arranging logistics, defining roles and responsibilities **Strategies for conducting effective meetings:** Follow the agenda, record discussion, observe meeting decorum **Documentation:** Draft notice, agenda and minutes of meeting **Business meeting etiquettes:** Verbal and non-verbal aspects of etiquettes.	**02**
Introduction to Interpersonal Skills		
5	**Emotional Intelligence:** Definition, difference between IQ and EQ, how to develop EQ **Leadership:** Types of leadership, leadership styles, case studies **Team Building:** Difference between group and team, importance of teamwork, strategies to be a good team player **Time Management:** Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals, **Conflict Management:** Types of conflicts, strategies to manage conflict, case studies.	**05**
Cross-cultural communication and Professional ethics		
6	**Communication across cultures:** Understanding cultures and developing sensitivity towards cultural differences **Corporate etiquettes:** Telephone, dining, cubicle etiquette, etc. **Professional ethics:** Effective work habits, accountability, integrity and excellence.	**02**
	Total	**26**

Professional and Business Communication Laboratory

Laboratory (conducted batch wise) will comprise of activities and assignments based on the syllabus)

Books Recommended:

1. Fred Luthans, *"Organizational Behavior"*, McGraw Hill, edition
2. Lesiker and Petit, *"Report Writing for Business"*, McGraw Hill, edition
3. Huckin and Olsen, *"Technical Writing and Professional Communication"*, McGraw Hill
4. Wallace and Masters, *"Personal Development for Life and Work"*, Thomson Learning, 12th edition
5. Heta Murphy, *"Effective Business Communication"*, Mc Graw Hill, edition
6. Sharma R.C. and Krishna Mohan, *"Business Correspondence and Report Writing"*, Tata McGraw-Hill Education
7. Ghosh, B. N., *"Managing Soft Skills for Personality Development"*, Tata McGraw Hill. Lehman,
8. Bell, Smith, "Management Communication" Wiley India Edition, 3rd edition.
9. Dr. Alex, K.," Soft Skills", S Chand and Company
10. Subramaniam, R., "Professional Ethics" Oxford University Press.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact" Penguin Random House India Pvt. Ltd.

Evaluation Scheme:

Laboratory: (Term work)

Term work shall consist of 6 assignments, Group Discussion and Power Point Presentation based on the Business Proposal.

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

Tutorials ..... (25) Marks

Business Proposal..... (15) Marks

Group Discussion..... (10) Marks

TOTAL: ..... (50) Marks

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

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: Innovative Product Development IV	Course Code: DJS22ILLL2	

Pre requisite:

1. Analog Communication
2. Microcontroller & Applications-I and II (DJS22EC404 and DJS22EC503)

Objectives:

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

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

1. Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tools and methods.
2. Demonstrate the idea of project based learning by Integrating and synthesizing different perspectives of a project from relevant disciplines.
3. Develop an ability to work in teams and manage the conduct of the research study.

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

Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and Big data, Communication, Web and Application development, Robotics, AI and Machine learning

The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this course is to improve the students' technical skills, communication skills and team management skills by integrating technical knowledge, technical writing, presentation and teamwork. Each project group have already under gone project topic allotment followed by two reviews in their fifth semester and in this semester, the students are expected to continue the project work.

1. Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
2. In the first review of this semester, each group is expected to implement 60% of project.
3. In the second review of this semester, each group is expected to implement 90% of project.
4. The students may use this opportunity to learn different computational techniques towards development of a product.

5. Interaction with alumni mentor will also be appreciated for the improvement of project.

Evaluation Scheme:

Semester End Examination (A):

Laboratory:

Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on 100% implementation of their project.

Continuous Assessment (B):

Laboratory: (Term work)

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

1. Project progress
2. Documentation/Technical paper writing
3. Key findings
4. Validation of results
5. Product Development

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

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