V

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 V)

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 & Telecommunication Engineering : Semester V (Autonomous)

(Academic Year 2024-25)

Sr. No	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test Total (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJS22EC501	Analog Communication	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL501	Analog Communication Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
2	DJS22EC502	Radio Frequency Circuit Design	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL502	Radio Frequency Circuit Design Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
3	DJS22EC503	Microcontroller & Applications-II	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL503	Microcontroller & Applications-II Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
4	DJS22EC504	Digital Signal Processing	3	--	--	3	2	65	--	--	--	65	20	15	35	--	35	100	3	4
	DJS22EL504	Digital Signal Processing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
5	DJS22EC505	Data Structures & Algorithms	1	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	1	2
	DJS22EL505	Data Structures & Algorithms - Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
6	DJS22A3	Environmental Engineering	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	DJS22ILLL1	Innovative Product Development-III	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	1
		Total	**14**	**12**	**--**	**19**	**20**	**260**	**50**	**--**	**100**	**410**	**80**	**60**	**140**	**150**	**290**	**700**	**19**	**19**

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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: Electronics & Telecommunication Engineering	T.Y. B. Tech	Semester: V
Course: Analog Communication	Course Code: DJS22EC501	
Course: Analog Communication Laboratory	Course Code: DJS22EL501	

Pre-requisite:

1. Electronics Circuit Design (DJS22EC302)
2. Signals & Systems (DJS22EC304)

Objectives:

1. To understand basics of communication systems and effect of noise on communication.
2. To understand various continuous and pulse modulation, demodulation techniques.
3. Get acquainted with various types of multiplexing techniques and their use in communication.

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

1. Compare internal and external noise and its effect on communication system.
2. Examine analog modulation and demodulation techniques along with various analog receivers.
3. Apply sampling theorem to analog and digital pulse modulation and demodulation techniques.
4. Compare Frequency division and time division multiplexing and de-multiplexing techniques for communication system.

Analog Communication(DJS22EC501)		
Unit	**Description**	**Duration**
1	**Basics of Communication System:** Block diagram, electromagnetic spectrum, signal bandwidth and power, types of Communication channels, Introduction to time and frequency domain; Types of noise, signal to noise ratio, noise figure and noise temperature.	04
2	**Amplitude Modulation and Demodulation:** Introduction, need for modulation. **DSBFC:** Mathematical analysis, modulation index, bandwidth, voltage distribution and power calculations. Low level and high level modulation, simple diode detector, practical diode detector. **DSBSC:** Mathematical analysis, modulation index, bandwidth, voltage distribution, power calculations, balanced modulator. **SSBSC**: Mathematical analysis, voltage distribution and power calculations.	11

	SSB generation: Filter method. **ISB**: Transmitter and receiver block diagram, applications. **VSB**: Application in television.	
3	**Angle Modulation and Demodulation:** Frequency modulation (FM): Introduction, mathematical analysis, time domain waveform, spectrum of FM wave, modulation index, bandwidth requirement, narrowband FM and wideband FM, Effect of noise, noise triangle, pre-emphasis and de-emphasis, FET reactance modulator, varactor diode modulator, frequency stabilized reactance modulator, indirect method of FM generation. Comparison between FM and PM, FM demodulation: Balance slope detector, Foster-Seely discriminator, ratio detector, amplitude limiting and thresholding.	**10**
4	**Radio Receivers:** Receiver parameters, TRF receiver, problems in TRF receiver, Super - heterodyne receiver, choice of IF, Comparison of FM receiver with AM receiver.	**04**
5	**Pulse Modulation & Demodulation:** Sampling theorem, Nyquist criteria, Sampling techniques, aliasing error and aperture effect PAM, PWM, PPM generation and detection, Quantization and its types, Pulse Code Modulation, delta modulation, adaptive delta modulation, principle, generation and detection. Applications of pulse communication.	**06**
6	**Multiplexing & De-multiplexing:** Frequency Division Multiplexing transmitter & receiver block diagram, Time Division Multiplexing transmitter & receiver block, Examples and applications of FDM and TDM.	**04**
	Total	**39**

Analog Communication Laboratory (DJS22EL501)	
Exp.	**Suggested Experiment List**
1.	Study of Amplitude Modulation.
2.	Study of Double Side Band Suppressed Carrier and Single Side Band Amplitude Modulation.
3.	Simulate of AM system and generate time and frequency domain output.
4.	To study different types of frequency modulators and Demodulators.
5.	Simulate Frequency Modulation system and generate time and frequency domain output.
6.	Implement Pre-emphasis and De-emphasis circuit required for FM and analyze the output.

7.	Study of Natural Sampling and its reconstruction.
8.	Study of Flat top sampling and its reconstruction.
9.	Study of Pulse Amplitude Modulation.
10.	Study of Pulse width Modulation.
11.	Study of Pulse Position Modulation.
12.	Study of PAM-TDM system.
13.	Study of FDM.

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. Kennedy and Devis, "*Electronic Communication System*", McGraw Hill Education Pvt. Ltd., 4th Edition, 2017.
2. Wayne Tomasi, "*Electronic Communication System*", Pearson, 5th Edition, 2012.

Reference books:

1. Toub Schilling and Shaha, "*Principles of Communication Systems*", Tata McGraw Hill, 4th Edition.
2. B. P. Lathi, Zhi Ding, "*Modern Digital and Analog Communication System*", Oxford University Press, 4th Edition.
3. Symon Haykin, Michal Moher, "*Introduction to Analog and Digital Communication*", Wiley, 4th Edition.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: V
Course: Radio Frequency Circuit Design	Course Code: DJS22EC502	
Course: Radio Frequency Circuit Design Laboratory	Course Code: DJS22EL502	

Pre-requisite:

1. Electromagnetics Wave Propagation (DJS22EC403)
2. Electrical Network Analysis and Synthesis (DJS22EL305)
3. Engineering Mathematics-III (DJS22EC301)

Objectives:

1. To develop the model for inductor, capacitor and resistor at high frequency.
2. To analyze transmission line using Smith Chart
3. To study application of smith chart for impedance matching
4. To synthesize filter for given specifications

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

1. Analyze the single and Multi-port network using parameters.
2. Apply their knowledge in analyzing inductor, capacitor and resistor at high frequency.
3. Calculate parameters of transmission line analytically and using Smith Chart.
4. Design matching network using Impedance matching techniques.
5. Design the filters for given specifications using insertion loss and image parameter method.

Radio Frequency Circuit Design (DJS22EC502)		
Unit	**Description**	**Duration**
1	**Single- and Multiport Networks:** **Basic Definitions** Interconnecting Networks, Series Connection of Networks, Parallel Connection of Networks, Cascading Networks. **The Scattering Matrix** Reciprocal Networks and Lossless Networks, A Shift in Reference Planes, Power Waves and Generalized Scattering Parameters, Practical Measurements of S-Parameters. **The Transmission (ABCD) Matrix**, Relation to Impedance Matrix and Scattering Matrix, Equivalent Circuits for Two-Port Networks	08
2	**Importance of Radio Frequency Design:** **RF behavior of Passive Components** High-Frequency Resistors, High-Frequency Capacitors, High-Frequency Inductors. **Chip Components and circuit Board Considerations** Chip Resistors, Chip Capacitors, Surface-Mounted Inductors. **SMD Assembly Process** Solders for SMD Applications, Fluxing and Cleaning, Types of Flux- Organic Soluble Fluxes, R Flux, RMS Flux, RA Flux, Water Soluble Fluxes and Types Flux Selection,	08

	Solder Applications, curing solder Paste, The Reflow Process, Assembly Methods, Adhesive Applications and Curing, Solder Creams.	
3	**Smith Chart:** **From Reflection Coefficient to Load Impedance** Reflection coefficient in Phasor Form, Normalized Impedance Equation, Parametric Reflection Coefficient Equation, Graphical Representation. **Impedance Transformation** Impedance Transformation for General Load, Standing Wave Ratio, Special Transformation Conditions. **Admittance Transformation** Parametric Admittance Equation, Additional Graphical Displays. **Z-Y Smith Chart** **Parallel and Series Connection of Lumped Elements and their analysis using Smith Chart** Parallel Connection of R and L, Parallel Connection of R and C, Series Connection of R and L, Series Connection of R and C, T and π Network.	**10**
4	**Impedance Matching and Tuning:** **Matching with Lumped Elements (L Networks)** Analytic Solutions, Smith Chart Solutions **Impedance Transformers** Single-Section Quarter-Wave Transformer, Multi-section Quarter-Wave Transformer, Transformers with Uniformly distributed section reflection coefficient, Binomial Multi-Section Matching Transformer, Chebyshev Multi-Section Matching Transformer.	**06**
5	**RF Filter Design:** **Basic Resonator and Filter configurations** Filter Types and Parameters, Low-Pass Filter, High-Pass Filter, Bandpass and Bandstop Filters, Insertion Loss. **Special Filter Realizations using Insertion Loss Method** Butterworth-Type Filters, Chebyshev-Type Filters, Denormalization of Standard Low- Pass Design. **Filter Implementation** Unit Elements, Kuroda's Identities, Microstrip Filter Design. **Filter Design by the Image Parameter Method** Image Impedances and Transfer Functions for Two-Port Networks, Constant-k Filter sections, m-derived Filter Sections, Composite Filters.	**07**
	Total	**39**

Radio Frequency Circuit Design Laboratory (DJS22EL502)	
Exp.	**Suggested Experiment List**
1	Characterization of resistor at high frequency.
2	Characterization of capacitor at high frequency.
3	Characterization of inductor at high frequency.

4	Analysis of Parallel and Series Connection of Lumped Elements and verification using Smith chart.
5	Filter Design by the Image Parameter Method.
6	Filter Design by the Insertion Loss Method.
7	Matching of Lumped Elements.
8	Design of quarter wave transformer.
9	Design of Binomial Multi-Section Matching Transformer.
10	Numerical from previous years GATE Examination paper.

Minimum eight tutorials based on syllabus will be conducted.

Books Recommended:

Text books:

1. Ludwig, Reinhold & Bretchko, Pavel, "*RF Circuit Design: Theory and Applications*", Prentice-Hall, 2nd Edition, 2011.
2. Pozar, David M, "*Microwave Engineering*", Hoboken, NJ: Wiley Publication, 2012.
3. Traister, John, "Design Guidelines for Surface Mount Technology", Elsevier, 2012.

Reference Books:

1. Guillermo Gonzalez, "*Microwave Transistor Amplifiers: Analysis and Design*", Prentice-Hall, 2nd Edition, 1996.
2. Matthew M. Radmanesh, "*Radio Frequency and Microwave Electronics Illustrated*", Prentice Hall PTR, 2001.

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Program: Third Year Electronic and Telecommunication Engineering	T.Y. B. Tech	Semester: V
Course: Microcontroller & Applications-II	Course Code: DJS22EC503	
Course: Microcontroller & Applications-II Laboratory	Course Code: DJS22EL503	

Pre-requisite: Knowledge of

1. Digital System Design (DJS22EC303)
2. Microcontroller & Applications – I (DJS22EC404)

Objectives:

1. To develop background knowledge and core expertise in advanced microcontroller.
2. To understand peripheral devices and their interfacing to advanced microcontroller.
3. To develop programming skill for microcontroller and their applications in Assembly and Embedded C language.

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

1. Explain the architecture and functionalities of the ARM 7 Processor.
2. Identify hardware components and select appropriate software tools for programming of LPC2148 based systems.
3. Develop assembly language and Embedded C programs for LPC2148 based systems.
4. Interface input/output devices with LPC2148 microcontroller for embedded applications.

Microcontroller & Applications-II (DJS22EC503)		
Unit	**Description**	**Duration**
1	**ARM7 Architecture:** Features of ARM core architecture, Data Flow Model, Pipeline, Registers, operating modes.	**05**
2	**Introduction to ARM Programming:** Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives- Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan.	**10**
3	**LPC2148 ARM CPU:** Salient features, Pin diagram, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control unit.	**10**

4	**LPC2148 Peripherals:** Registers, GPIOs, PLL-Features, PLL structure, Timers-Features, applications, Architecture of timer module, register description, Simple C programs for application using -GPIO, PLL, Timer.	**08**
5	**LPC2148 based Applications:** Design of system using GPIO's Blink a group of 8 LEDs with a delay, Stepper motor control, DC motor control, LCD interface, ADC, DAC, UART.	**06**
	Total	**39**

Microcontroller & Applications-II Laboratory (DJS22EL503)	
Exp.	**Suggested Experiment List**
1	To study ARM (LPC2148) Embedded Trainer kit and its software tools.
2	Write a program to generate LED sequence using ARM 7(LPC2148).
3	To display message on multiplexed four common anode7-segment display.
4	To read DIP switch status and display its position on 7-segment.
5	To display message on Alphanumeric LCD.
6	To verify LDR operation using on-chip ADC of LPC2148.
7	Waveforms generation using DAC.
8	To display room temperature on LCD using LM35 sensor.
9	Write a program to control DC motor speed using PWM.
10	Write a program for Interfacing keyboard and LCD.
11	Write a program for Interfacing EPROM and EEPROM.
12	Write a program for Interfacing stepper motor.
13	Write a program to transmit and receive data serially using UART.
14	Implementing ZIGBEE protocol with ARM.

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. Andrew N. Sloss, *"ARM System Developers Guide"*, Elsevier, 1st Edition, 2008.
2. Lyla Das, *"Embedded Systems: An Integrated Approach"*, Pearson Publication, 1st Edition, 2012.

Reference Books:

1. William Hohl, "*ARM Assembly Language – Fundamentals and Techniques*", CRC Press, 1st Edition, 2009.
2. Steve Furber, "*Arm System On Chip Architecture*", Pearson Publication, 1st Edition, 2012.
3. J.R. Gibson, "*ARM Assembly Language: An Introduction*", Cengage Learning, 1st Edition, 2010.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: V
Course: Digital Signal Processing	Course Code: DJS22EC504	
Course: Digital Signal Processing Laboratory	Course Code: DJS22EL504	

Pre-requisite: Signals and Systems (DJS22EC304)

Objectives:

1. To develop a thorough understanding of DFT and FFT and their applications.
2. To apply the design techniques and performance analysis of digital filters
3. To understand the effects of Poles and Zeros in the frequency response of digital filters.

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

1. Implement DFT and FFT algorithms in finding the response of the system.
2. Design IIR filter for given specifications.
3. Design FIR filter for given specifications.
4. Determine effects of Poles and Zeros in the frequency response of digital filters.

Digital Signal Processing (DJS22EC504)		
Unit	**Description**	**Duration**
1	**Discrete Fourier Transform & Fast Fourier Transform:** Definition and Properties of DFT, IDFT, Circular convolution of sequences using DFT and IDFT. Filtering of long data sequences: Overlap-Save and Overlap-Add Method for computation of DFT. Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT, composite Radix FFT N=2.3, N=3.2.	10
2	**IIR Digital Filters:** Types of IIR Filters (Low Pass, High Pass, Band Pass, Band Stop), Analog filter approximations: Butterworth, Chebyshev I. Mapping of S-plane to Z-plane, impulse invariance method, bilinear transformation method, Design of IIR digital filters (Butterworth and Chebyshev-I) from Analog filters with numerical examples. Effect of Poles and Zeros on the Frequency Response of IIR filters. Position of Poles and Zeros of Low Pass, High Pass, Band Pass, Band Stop, All Pass filters.	10
3	**FIR Digital Filters:** Characteristics of FIR digital filters, Minimum Phase, Maximum Phase, Mixed Phase and Linear Phase (Type 1 to Type 4) FIR Filters. Design of FIR filters using Window techniques (Rectangular, Hamming, Hanning, Blackman), Design of FIR filters using Frequency Sampling technique, Comparison of IIR and FIR filters.	07

4	**Poles, Zeros and Filters:** Effects of poles and zeros in the frequency response of IIR filters (LP, HP, BP, BR/Notch, All Pass filters). Placement of zeros and design of filters in Type1 to Type 4 Linear Phase FIR filters. **Finite Word Length effects in Digital Filters:** Quantization, truncation and rounding, Error due to truncation and rounding.	06
5	**DSP Processors:** Introduction to General Purpose and Special Purpose DSP processors, fixed point and floating-point DSP processor, Computer architecture for signal processing, Harvard Architecture, Pipelining, multiplier and accumulator (MAC), Special Instructions, Special purpose DSP hardware, Architecture of TMS320CX fixed and floating DSP processors.	06
	Total	**39**

Digital Signal Processing Laboratory (DJS22EL504)	
Exp.	**Suggested Experiment List**
1	Plot of Discrete Time Signals.
2	Frequency response of LTI systems by DTFT.
3	To perform Discrete Fourier Transform.
4	To implement Circular Convolution of two discrete time sequences.
5	To perform Overlap Add method of DFT for long data sequence.
6	To implement the algorithm of DIT-Fast Fourier Transform.
7	To plot the FFT of Sinusoids with noise.
8	Magnitude and phase response of FIR filter.
9	Design an Analog Butterworth filter with given specifications.
10	Design a Digital IIR Butterworth filter with given specifications.
11	Design an FIR filter by window method.
12	Removal of Noise by a designed filter.
13	Perform basic signal processing operations with DSP processor TMS 320C6713.
14	Generation of Sine Wave with Key Pressing in DSP processor TMS 320C6713.
15	Capturing a real time signal by the Processor and display on a DSO.
16	Implementation of Real time Low Pass filtering by DSP Processor.

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. Proakis J., Manolakis D., "*Digital Signal Processing*", Pearson Education, 4th Edition, 2007.
2. B. Venkata Ramani and M. Bhaskar, "*Digital Signal Processors, Architecture, Programming and Applications*", Tata McGraw Hill, 2nd Edition, 2004.

Reference Books:

1. Oppenheim A., Schafer R., Buck J., "*Discrete Time Signal Processing*", Pearson Education, 3rd Edition, 2021.
2. Sanjit K. Mitra, "*Digital Signal Processing – A Computer Based Approach*", McGraw Hill Education, 4th Edition, 2013.
3. Tarun Kumar Rawat, "*Digital Signal Processing*", Oxford University Press, 1st Edition, 2015.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: V
Course: Data Structures & Algorithms	Course Code: DJS22EC505	
Course: Data Structures & Algorithms Laboratory	Course Code: DJS22EL505	

Pre-requisite:

1. Structured programming using C (DJS22FEC12)

Objectives:

1. Understand and remember algorithms and its analysis procedure.
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. To design and implement various data structure algorithms.

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

1. Design and implement data structures such as arrays, linked lists, stacks, queues and trees.
2. Explain the operations of data structures.
3. Determine and analyze the complexity of given Algorithms.

Data Structures & Algorithms (DJS22EC505)		
Unit	**Description**	**Duration**
1	**Introduction to Data structures and Algorithms:** Introduction to Data structures, Types of Data structures: Linear and nonlinear data structures, Arrays, Stacks, Queue, Linked list and Tree, Recursion.	02
2	**Stack and Queue data structure:** Introduction to Stack, Operations on Stack Introduction to Queue, Queue as ADT, Operations on Queue, Linear representation of queue, Circular Queue.	03
3	**Linked List data structure:** Introduction to Linked List, Singly Linked list, Doubly Linked list, Operations on linked list, Linked representation of stack, Linked representation of Queue.	04
4	**Tree:** Introduction to Trees, Definitions & Tree terminologies, Binary tree representation, Operations on binary tree, Traversal of binary trees, Binary search tree.	04
	Total	13

Data Structures & Algorithms Laboratory (DJS22EL505)	
Exp.	**Suggested Experiment List**
1	To implement stack.
2	To implement parenthesis checking using stack.
3	Implementation of Infix to Postfix conversion.

4	To implement Implementation of prefix and postfix evaluation using menu driven approach.
5	To implement Linear queue.
6	To implement Circular queue.
7	To implement different operations on linked list –copy, concatenate, split, reverse, count no. of nodes.
8	To implement various operations on doubly linked list.
9	To implement Stack using Linked List.
10	To implement Queue using Linked List.
11	To create a binary tree and traverse it in Inorder, preorder and Post order.
12	To implement binary search tree.

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

Books Recommended:

Text books:

1. Tenenbaum, Langsam, Augenstein, "*Data Structures Using C*", Pearson Education, 1st Edition, 2019.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "*Fundamentals of Data Structures in C*", W. H. Freeman and Company, 2nd Edition, 2008.
3. Reema Thareja, "*Data Structures using C*", Oxford, 2nd Edition, 2017.

Reference Books:

1. Mark A. Weiss, "*Data Structures and Algorithm Analysis in C*", Pearson Education, 4th Edition, 2014.
2. M. T. Goodritch, R. Tamassia, D. Mount, "*Data Structures and Algorithms in C++*", Wiley, 2nd Edition, 2011.
3. Kruse, Leung, Tondo, "*Data Structures and Program Design in C*", Pearson Education, 2nd Edition, 2013.
4. Seymour Lipschutz, "*Data Structures*", Schaum's Outline Series, Tata McGraw-Hill, 1st Edition, 2014.

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Program: Common to all Programs	**T. Y. B. Tech**	**Semester: V**
Course: Environmental Studies	**Course Code: DJS22A3**	

Pre-requisite: Interest in Environment and its impact on Human.

Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarize environment related legislation.

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

1. Understand how human activities affect environment
2. Understand the various technology options that can make a difference.

Detailed Syllabus: Environmental Studies (DJS22A3)

Unit	Description	Duration
1	**Social Issues and Environment:** Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.	04
2	**Technological Growth for Sustainable Development:** Social, Economic and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.	04
3	**Green Technology:** History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.	05
	Total	13

Books Recommended:

Text books:

1. R. Rajagopalan, *"Environmental Studies: From Crisis to Cure"*, Oxford University Press, 2nd Edition, 2012.
2. Erach Bharucha, *"Textbook of Environmental Studies for Undergraduate Courses"*, Universities Press, 2nd Edition, 2013.
3. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, *"Green Information Technology: A Sustainable Approach"*, Morgan Kaufmann, 1st Edition, 2015.

Reference Books:

1. *Paulina Golinska*, Marek Fertsch, Jorge Marx-Gómez, *"Information Technologies in Environmental Engineering: New Trends and Challenges"*, Springer, 1st Edition, 2011.

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: V
Course: Innovative Product Development-III	Course Code: DJS22ILLL1	

Pre requisite:

1. Electronics Circuit Design (DJS22EC302)
2. Digital System Design (DJS22EC303)
3. Integrated Circuits (DJS22EC402)
4. Python Programming Laboratory(DJS22EL306)

Objectives:

1. To determine the goals, resource requirements of project and produce them in the form of documentation.
2. To learn effective utilization of time and project management skills.
3. To address the real-world projects, to connect theory with practice as per recent industrial trends.
4. To integrate knowledge and skills from various areas through more complex and multidisciplinary projects.

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

1. Define problem statement, formulation and solution by reviewing relevant literature
2. Identify alternate approaches to complete a project
3. Apply project management skills by interacting and dividing project work among team members
4. Develop technical, communication, and presentation skills

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

Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and Big data, Communication, Web and Application development, Robotics, AI and Machine learning, etc.
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' documentation and technical skills to find the cost effective solution of a problem. Guidelines are as follows:

1. The project work is to be carried out by a group of 4/5/6 students (2/3 second year and 2/3 third year students)
2. Each group is allotted a final year student as mentor and a faculty member as guide.
3. Project topics will be floated in various domains. Each group submits three project topic preferences, out of which one topic is allotted in discussion with faculty guide and faculty coordinators.
4. Each group will identify the hardware and software requirement for their problem statement.
5. Each group will be reviewed twice in a semester and marks will be allotted based on the rubrics mentioned in the evaluation scheme.
6. In the first review of the semester, each group is expected to complete the literature survey, budget plan and documentation based on project methodology.
7. In the second review of the semester, each group is expected to implement 30% of project.

8. Subsequent reviews will be carried out in sixth semester.

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 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. Objective and expected outcome
2. Long term social impact
3. Innovative ideas and motivation
4. Documentation
5. Simulation effectiveness
6. Literature survey and comparative research methodology
7. Project Progress/Implementation
8. Overall Presentation and team work

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