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)

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 (DJS23)

B. Tech.

In

(Semester VII/VIII)

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

Course Structure for Final Year Undergraduate Program in Electronics & Telecommunication Engineering : Semester VII (Autonomous)

(Academic Year 2026-2027)

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (SEE) - A						Continuous Assessment (CA) - 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 3 (TT3)	Term Test Total (TT1 + TT2 + TT3)	Term Work	CA Total (B)			
1	DJS23ECPC701	Mobile Communication System	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPC701	Mobile Communication System Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
2	DJS23ECPE711	Optical Fiber Communication	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE711	Optical Fiber Communication Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE712	Embedded Systems and Real-Time Firmware Design	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE712	Embedded Systems and Real-Time Firmware Design Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE713	Computer Vision	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE713	Computer Vision Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE714	Wireless Networks	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE714	Wireless Networks Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
3	DJS23ECPE721	Microwave System Design	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE721	Microwave System Design Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE722	Robotics and Industrial Automation	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE722	Robotics and Industrial Automation Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE723	Advanced Digital Signal Processing	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE723	Advanced Digital Signal Processing Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
	DJS23ECPE724	CMOS Analog VLSI Design	3	--	--	3	2	60	--	--	--	60	15	15	10	40	- -	40	100	3	4
	DJS23ELPE724	CMOS Analog VLSI Design Laboratory	--	2	--	1	--	--	--	--	--	--	- -	- -	- -	- -	25	25	25	1	
4	DJS23ECMD701	Natural Language Processing	2	--	--	2	2	60	--	--	--	60	15	15	10	40	--	40	100	2	3
	DJS23ELMD701	Natural Language Processing Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	--	25	25	25	1	
5	DJS23ITELX12	Research Ecosystem	--	--	2	2	--	--	--	--	--	--	- -	- -	- -	- -	50	50	50	2	2
6	DJS23IPELX13	Major Project	--	8	--	4	2	--	--	--	50	50	- -	- -	- -	- -	50	50	100	4	4
7	DJS23ECSC701	Generative AI and Large Language Models	1	--	--	1	--	--	--	--	--	--	15	15	10	40	--	40	40	1	1
8	DJS23ICHSX11	Disaster Management and Preparedness	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Total	**14**	**16**	**2**	**22**	**10**	**240**	**--**	**--**	**50**	**290**	**75**	**75**	**50**	**200**	**200**	**400**	**690**	**22**	**22**

Prepared by: Ms.Sheeja Nair Autonomy Committee	Checked by: Dr. Poonam Kadam Autonomy Committee	Dr. Amit Deshmukh Head of Department	Dr. Narendra Shekokar Vice Principal	Dr. Hari Vasudevan Principal

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Mobile Communication System	Course Code: DJS23ECPC701	
Course: Mobile Communication System Laboratory	Course Code: DJS23ELPC701	

Pre-requisite:

1. Analog & Digital Communication (DJS23ECPC503)
2. Computer Networks (DJS23ECPC601)

Objectives:

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

Outcomes: At the end of course, student 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. Understand the responsibilities of the data link layer and explain the datalink layer protocols.
4. Design network and subnetwork using commands and carry out investigations and troubleshooting.
5. Distinguish transport layer protocols based on application.

Mobile Communication System (DJS23ECPC701)		
Unit	**Description**	**Duration**
1	**Mobile Radio Propagation:** Large scale fading: Free space propagation model, the three basic propagation mechanisms, reflection, ground reflection (two-ray) model. Small scale fading: small scale multipath propagation, types of small-scale fading, Rayleigh and Rician distributions.	**06**
2	**Fundamentals of Mobile Communication:** The Cellular Concept System Design Fundamentals: Frequency Reuse, Handoff, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems Features of conventional multiple access techniques: Frequency division multiple access (FDMA), Time division multiple access (TDMA), OFDM	**06**
3	**Transition from 2G Networks to 3G UMTS Technology:** UMTS network architecture, Protocol Structure, Channel Structure, Frame slots and symbols, modulation, coding, multiple antenna techniques, WCDMA, Modulation, Handoff and Power Control.	**06**

4	**4G Network** LTE network: Architecture, Physical layer, Frames, slots, and symbols, modulation, coding, MIMO, LTE Radio Access, Radio-Interface Architecture, Physical Transmission Resources, Downlink and Uplink Physical-Layer Processing, Scheduling and Rate Adaptation.	**08**
5	**Advanced Wireless Communication Techniques**: Cognitive radio: Architecture, spectrum sensing Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals. SDR: Architecture, limitations, advantages, disadvantages.	**08**
6	**Road map towards 5G and Beyond:** 5G Network: Requirements and challenges, 5G NR Architecture, Standalone (SA) and Non-Standalone (NSA), Massive MIMO, Numerology and Subcarrier Spacing, Beamforming, mmWave Communication, Network Slicing, Edge Computing, Ultra-Reliable Low Latency Communication (URLLC), Enhanced Mobile Broadband (eMBB), Massive Machine Type Communication (mMTC) Introduction to 6G and Future Wireless Trends	**08**
	Total	**42**

Mobile Communication System Laboratory (DJS23ELPC701)	
Exp.	**Suggested Experiment List**
1	Study of frequency reuse using Matlab/Scilab.
2	To study performance evaluation of handover for absolute signal strength measurement.
3	Tutorial based on fundamentals of frequency reuse and capacity of cellular communication system.
4	Implementation of adaptive modulation for wireless environment.
5	Study of Rayleigh and Ricean fading distribution using Simulink and computation of link budget using Okumura model.
6	Tutorial based on emerging technologies of 4G.
7	Tutorial based on 3GPP LTE.
8	Scilab Based GSM, CDMA Implementations
9	Verify use of Orthogonal Walsh codes in CDMA environment
10	Tutorial based on Propagation Models
11	Study of frequency reuse using Matlab/Scilab
12	To study performance evaluation of handovers for absolute signal strength measurement
13	Modulation Techniques
14	MIMO OFDM

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. Vijay K. Garg, "*Wireless Communication and Networking*", Morgan Kaufmann Series in Networking, Elsevier, 2010.
2. Rappaport,T.S., "*Wireless Communications*",Pearson Education, 2nd Edition, 2010
3. T. L. Singal, "*Wireless Communications*", McGraw Hill Education, 2012.
4. Andreas F. Molisch, "*Wireless Communications*: *From Fundamentals to Beyond 5G"*, Wiley-IEEE Press, 3rd Edition, 2022.

Reference Books:

1. Upena Dalal, "*Wireless and Mobile Communications"*, Oxford University Press, 2016.
2. Vijay K. Garg, "*Wireless Communications and Networking"*, Morgan Kaufmann Series in Networking, Elsevier, 2007.
3. Young Kyun Kim and Ramjee Prasad, "*4 G Roadmap and Emerging Communication Technologies*", Artech house,3rd Edition, 2006.
4. Raj Pandya, "*Mobile And Personal Communications Systems And Services*", Prentice Hall,3rd Edition , 2000.

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Optical Fiber Communication	Course Code: DJS23ECPE711	
Course: Optical Fiber Communication Laboratory	Course Code: DJS23ELPE711	

Pre-requisite:

1. Applied Physics (DJS23FCBS102)
2. Wave Theory & Radio Frequency Design (DJS23ECPC502)
3. Analog & Digital Communication (DJS23ECPC503)

Objectives:

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

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

1. Describe the propagation of light in optical fibers for the ray theory and electromagnetic mode theory.
2. Analyze transmission characteristics (attenuation /dispersion/Nonlinearity) of an optical fiber using different techniques.
3. Compare and contrast working principle of optical sources, detectors and components.
4. Design optimal optical links by using Link budget and rise time budget and understand basic concepts of optical networks.

Optical Fiber Communication (DJS23ECPE711)		
Unit	**Description**	**Duration**
1	**Optical Fiber Fundamentals:** Motivations for light wave communications, General Optical system block diagram, advantages, disadvantages and applications of optical fiber communication, Loss and bandwidth window optical fiber waveguides, Types and classification of optical fibers.	**06**
2	**Transmission Characteristics of Optical Fiber and Optical Measurements:** Attenuation, absorption, linear and nonlinear scattering losses, bending losses, dispersion, Chromatic dispersion, Intermodal dispersion, over all dispersion in single mode and multimode fibers, dispersion shifted and dispersion flattened fibers, OTDR. Non-linear effects, scattering effects, Kerr effects, soliton. **Optical Measurements** Introduction to the Optical measurements, Fiber attenuation measurements , Fiber dispersion measurements , Fiber refractive index profile measurements , Fiber cutoff wavelength measurements , Fiber numerical aperture measurements , Fiber diameter measurements , Mode-field diameter for single-mode fiber , Reflectance and optical return loss , Field measurements	**12**

3	**Optical Sources and Detectors:** Working principle and characteristics of sources (LED, LASER), Tunable lasers, Quantum well lasers, Charge capture in Quantum well lasers, Multi Quantum well Laser diodes, Surface Emitting Lasers: Vertical cavity Surface Emitting Lasers. Working principle and characteristics of detectors (PIN, APD), Resonant cavity enhancement (RCE) Photo Detector, receiver structure, bit error rate of optical receivers and receiver performance. Optical instrumentation, Integrated optics, Fiber optic sensors	**08**
4	**Optical Communication Components:** Fiber joints, fiber connectors, splices Couplers, Isolators, multiplexers, filters, fiber gratings, Fabry Perot filters, switches and wavelength converters, Optical amplifiers, basic applications and types (EDFA and SOA).	**06**
5	**Optical Networks and Free Space:** Optics Point-to-Point Links, System Considerations, Link Power Budget, Rise time budget, SONET/SDH optical networks, WDM and DWDM optical networks. Introduction to FSO, Applications, coherent optical space communication, Drawback and problems of realization, system description and design, Telecommunications technology	**08**
	Total	**42**

Optical Fiber Communication Laboratory (DJS23ELPE711)	
Exp.	**Suggested Experiment List**
1	Calculation of Numerical aperture.
2	Analysis of various Transmission Characteristics of Optical Fiber cable.
3	Performance analysis of Single mode fiber.
4	Performance analysis of Graded Index fiber and Multimode Fiber.
5	Study of Optical Analog communication link.
6	Study of Optical Digital communication link.
7	Performance Analysis of Optical Link with Different Sources and detectors.
8	Power budget and Rise Time Budget Analysis for Optical Link (Eye Diagram)
9	Performance Analysis of Optical Amplifier.
10	Calculation of link Loss for given link with nonlinearities.
11	Case Study: Power budget and Rise Time Budget Analysis for Optical Link.
12	Case Study: FSO Link and its Analysis.

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. John M. Senior, "*Optical Fiber Communications"*, 3rd Edition, 1998, Pearson Education.
2. Gerd Keiser, "*Optical Fiber Communication"*, 4th Edition, 2003, Mc Graw Hill.
3. JH Franz, VK Jain, *"Optical Communications Components and Systems"*, 2nd Edition, 2013.

Reference Books:

1. Harold Kolimbiris, "*Fiber optics communications"*,2007, Pearson Education
2. Rajiv Ramaswami and Kumar N. Sivarajan, "*Optical Networks: A Practical Perspective"*, 3rd, Edition, Elsevier India Pvt. Ltd.
3. Ghatak and K. Thyagrajan, "*An introduction to fiber optics"*, 2010, Cambridge Univ Press. 4. Joseph C Palais, "*Fiber Optic Communication"*, 4th Edition, Pearson Education.

Program: Electronics and Telecommunication Engineering	**B. Tech**	**Semester: VII**
Course: Embedded Systems and Real-Time Firmware Design	**Course Code: DJS23ECPE712**	
Course: Embedded Systems and Real-Time Firmware Design Laboratory	**Course Code: DJS23ELPE712**	

Pre-requisite:

1. Digital System Design (DJS23ECPC303)
2. Microcontroller and Applications (DJS23ECPC403)

Objectives:

To develop the ability to design, implement and debug modern real-time embedded systems using ARM Cortex-M based platforms, embedded firmware methodologies, peripheral interfacing techniques and RTOS concepts for practical engineering applications while exposing learners to emerging trends in connected and intelligent embedded systems.

Outcomes: At the end of course, students will be able to:

1. Explain the architecture, design methodology and operational characteristics of modern embedded systems and ARM Cortex-M based microcontrollers.
2. Demonstrate the ability to analyze ARM Cortex-M3 architecture and develop embedded firmware utilizing memory organization, interrupt handling, low-power operation and system reliability features in real-time embedded systems.
3. Implement embedded communication and sensor interfacing solutions using standard protocols such as UART, SPI and I2C**.**
4. Analyse and design multitasking real-time embedded applications using RTOS concepts including scheduling, synchronization and inter-task communication.
5. Analyse, debug and evaluate embedded firmware systems while demonstrating awareness of modern embedded engineering practices, low-power systems and emerging embedded technologies.

Embedded Systems and Real-Time Firmware Design (DJS23ECPE712)		
Unit	**Description**	**Duration**
1	**Modern Embedded Systems Overview:** Evolution of embedded systems, Characteristics and classification of embedded systems, MCU vs MPU vs SoC, Applications of embedded systems in – automotive, industrial automation, medical electronics, IoT, robotics, wearables, consumer electronics. Real-time constraints and design metrics – Power, cost, reliability and latency tradeoffs, Embedded system design lifecycle, Hardware-software co-design; Firmware architecture concepts, Bare-metal vs RTOS based system.	**06**
2	**ARM Cortex-M Architecture and Embedded Firmware:** Comparison of CISC & RISC architectures, overview of ARM family, ARM Cortex-M3 architecture, Programmer's model – Operation Modes and States, Registers, special registers; Application Program Status Register – Integer status flags, Q status flag, GE bits. Memory system – Features and memory map, Exceptions and Interrupts, Nested vectored interrupt controller (NVIC); Low power design, Cortex – M low power features, Developing low power applications. Polling versus interrupts, Interrupt response time and interrupt service routines, Watchdog Timer and Brownout Detection.	**12**
3	**Embedded Communication:** Communication Protocols – UART, SPI, I2C, CAN, USB. Wireless	**8**

	communication protocol – WiFi , Bluetooth, Bluetooth low energy, Zigbee, LoRaWAN; Industrial Ethernet Protocol - EtherCAT; MQTT concepts.	
4	**Real-Time Operating Systems and Firmware Architecture:** Introduction to real-time systems, Hard and soft real-time systems. Need for RTOS, RTOS architecture and kernel concepts, Processes, tasks and threads, Task states and context switching. Scheduling Techniques – Round robin scheduling, Cooperative scheduling, Preemptive scheduling, Rate Monotonic Scheduling, Earliest Deadline First; Synchronization and Communication – Semaphores, Mutex, Queues, Event groups, Software timers, Mailboxes. RTOS Issues – Deadlock, Starvation, Priority inversion, Determinism. RTOS Platforms – FreeRTOS overview.	**12**
5	**Modern Embedded Engineering Practices and Emerging Trend:** Embedded debugging methodologies – printf, & JTAG; Logic analyzer and oscilloscope usage, Embedded testing concepts, Bootloader and OTA update concept, Low-power firmware design basics.	**4**
	Total	**42**

Embedded Systems and Real-Time Firmware Design (DJS23ELPE712)	
Exp.	**Suggested Experiment List**
1	Study of STM32 Nucleo board architecture and STM32CubeIDE environment.
2	GPIO interfacing and push button interrupt programming.
3	Timer programming and PWM generation.
4	ADC interfacing for analog sensor acquisition.
5	UART communication and serial debugging.
6	SPI or I2C interfacing with external peripherals.
7	Interrupt driven data acquisition system.
8	Circular buffer implementation for serial communication.
9	Watchdog timer implementation.
10	DMA based peripheral data transfer.
11	Task creation and scheduling using FreeRTOS.
12	Inter-task communication using queues.
13	Semaphore and mutex implementation.
14	Producer-consumer implementation using RTOS.
15	Multi-task sensor monitoring system using FreeRTOS.
16	Low-power mode implementation and analysis.
17	CAN/BLE communication demonstration.
18	State-machine based firmware implementation.
19	Embedded logging and debugging exercise.
20	Mini-project implementation based on integrated real-time embedded application.

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. Shibu K. V., Introduction to Embedded Systems, 2nd ed. New Delhi, India: McGraw Hill Education, 2017.
2. K. V. K. K. Prasad, Embedded/Real-Time Systems: Concepts, Design and Programming, New Delhi, India: DreamTech Press, 2005.
3. J. Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 3rd ed. Oxford, U.K.: Newnes/Elsevier, 2014.

Reference Books

1. S. R. Iyer and P. Gupta, Embedded Real-Time Systems Programming, New Delhi, India: Tata McGraw-Hill Education, 2004.
2. D. E. Simon, An Embedded Software Primer, Boston, MA, USA: Pearson Education, 1999.
3. R. Kamal, Embedded Systems: Architecture, Programming and Design, 3rd ed. New Delhi, India: McGraw Hill Education, 2017.
4. R. Barry, Mastering the FreeRTOS Real Time Kernel: A Hands-On Tutorial Guide, Real Time Engineers Ltd., 2016.
5. E. White, Making Embedded Systems: Design Patterns for Great Software, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, 2024.

Web Resources:

1. https://www.youtube.com/watch?v=dnfuNT1dPiM – Robert Feranec guides a step-by-step tutorial using STM32CubeIDE to program a Nucleo-F401RE board.
2. https://wiki.st.com/stm32mcu/wiki/STM32StepByStep:Getting_started_with_STM32_:_STM32_step_by_step – Getting started with STM32: STM32 step-by-step

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	B. Tech.	Semester: VII
Course: Computer Vision	Course Code: DJS23ECPE713	
Course: Computer Vision Laboratory	Course Code: DJS23ELPE713	

Pre-requisite:

1. Python Programming Laboratory (DJS23EMD201)
2. Digital Signal Processing (DJS23ECPC501 and DJS23ELPC501)
3. Image Processing (DJS23ECPC602 and DJS23ELPC602)

Objectives:

1. To understand the fundamentals of digital image processing, image formation, camera geometry, and geometric transformations used in computer vision systems.
2. To develop knowledge of feature detection, feature extraction, descriptors, and feature matching techniques for image analysis and recognition.
3. To analyze and implement deep learning techniques for image classification, object detection, segmentation, and visual understanding tasks.
4. To study motion analysis methods including optical flow, motion detection, object tracking, and structure from motion for video-based computer vision applications.

Outcomes: After successful completion of the course, the students will be able to:

1. Apply concepts of image formation, camera models, image enhancement, filtering, and geometric transformations for preprocessing and analysis of digital images.
2. Analyze and implement edge, corner, interest point detection, and feature extraction and matching techniques for object representation and recognition tasks.
3. Develop deep learning-based computer vision solutions using CNN architectures, transfer learning, object detection, and segmentation models.
4. Evaluate motion analysis and tracking techniques including optical flow, background subtraction, object tracking, and structure-from-motion for dynamic scene understanding.

Computer Vision (DJS23ECPE713)		
Unit	**Description**	**Duration**
1	**Image Formation and Camera Geometry:** Review of digital image fundamentals: Fourier Transform, Convolution and Filtering, Image Enhancement, Histogram Processing Pinhole camera model. Coordinate systems: World coordinates, Camera coordinates, Image coordinates. Perspective projection, Orthographic projection, Camera modeling and calibration concepts **Geometric transformations:** Translation, Rotation, Scaling, Affine transformation, Projective transformation, Perspective transformation, Stereo vision basics, Epipolar geometry (introductory level)	08
2	**Edge, Corner and Interest Point Detection:** **Gradient operators**: Roberts, Prewitt, Sobel, Laplacian Canny edge detector, Scale-space representation, Laplacian of Gaussian (LOG) and Difference of Gaussian (DoG), **Corner detection**: Harris corner detector, Hessian corner detection **Hough transform:** Line detection, Circle detection Interest point detection concepts, Non-maximum suppression.	08

3	**Feature Extraction, descriptors and matching:** **Feature Extraction:** Local vs global features, Texture descriptors, Histogram of oriented gradients (HoG), GLOH **Feature Descriptors:** Scale invariant feature transform (SIFT), Speeded-up robust features (SURF), Oriented FAST and Rotated BRIEF (ORB). **Feature matching:** Brute-force matching, Fast Library for Approximate Nearest Neighbors (FLANN) matcher, Random Sample Consensus (RANSAC) algorithm	10
4	**Deep Learning for Computer Vision:** Introduction to Convolutional Neural Networks (CNNs), image classification models (VGG, ResNet, MobileNet) through transfer learning, Attention Mechanism in Computer Vision. **Object Detection using deep learning**: One-stage detectors- YOLO (You Only Look Once), SSD (Single Shot MultiBox Detector), Two-Stage Detectors - R-CNN family (Regions with CNN features) **Object Segmentation with deep learning:** UNet and Mask R-CNN	10
5	**Motion Analysis:** Motion models, Optical flow: Lucas-Kanade method, Horn-Schunck method, Shape from optical flow, Background subtraction, Motion detection in videos, Object tracking: Kalman filter basics, Mean-shift tracking, Structure from Motion (SfM)	06
	Total	**42**

Computer Vision Laboratory (DJS23ELPE713)	
Exp.	**Suggested Experiment List**
1	Basic Image Operations and Image Representation.
2	Camera Geometry and Geometric Transformations
3	Edge Detection Techniques
4	Scale Space and Corner Detection: Harris and Hessian, Blob detection
5	Hough Transform for Shape Detection
6	Feature Extraction using HoG and Texture Descriptors
7	Feature Descriptors and Feature Matching: SIFT, SURF, or ORB.
8	CNN-based Image Classification using Transfer Learning
9	Object Detection using Deep Learning: YOLO or SSD
10	Implement semantic segmentation using UNet or Mask R-CNN.
11	Optical Flow and Motion Detection.
12	Object Tracking and Structure from Motion
13	Use stereo image pairs to estimate depth using disparity maps.
14	Apply object tracking algorithms such as Mean-shift, Camshift, or KLT tracker.
15	Implement HOG with SVM for any classification problem

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. Application specific mini-projects can be implemented

Books Recommended:

Textbooks:

1. Richard Szeliski, "*Computer Vision: Algorithms and Applications*", Springer, 2nd Edition, 2022.
2. David A. Forsyth and Jean Ponce, "*Computer Vision – A Modern Approach*", PHI Learning, 2nd Edition, 2009.
3. Richard Hartley, Andrew Zisserman, "*Multiple View Geometry in Computer Vision*," Cambridge University Press, Second Edition, 2003

Reference Books:

1. Adrian Rosebrock, "*Deep Learning for Computer Vision with Python*", 1st Edition, 2017.
2. Jan Erik Solem, "*Programming Computer Vision with Python"*, O'Reilly Media, First Edition, 2012
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "*Deep Learning",* MIT Press, First Edition, 2016.

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Wireless Networks	Course Code: DJS23ECPE714	
Course: Wireless Networks Laboratory	Course Code: DJS23ELPE714	

Pre-requisite:

1. Analog & Digital Communication (DJS23ECPC503)
2. Computer Networks (DJS23ECPC601)

Objectives:

1. To understand concept of wireless transmission and spectrum requirement.
2. To understand the concepts of WPAN.
3. To understand the concepts of WLAN.
4. To understand the concepts of WSN and range of category 1 and category 2 applications.

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

1. Analyze the fundamentals, standards, architectures, and spectrum requirements of various wireless communication networks.
2. Evaluate the operation, protocol stack, topologies, security features, and applications of WPAN technologies.
3. Analyze IEEE 802.11 WLAN and IEEE 802.16 WiMAX technologies.
4. Design Wireless Sensor Network (WSN) and Wireless Body Area Network (WBAN) solutions for WSN applications using appropriate middleware concepts.

Wireless Networks (DJS23ECPE714)		
Unit	**Description**	**Duration**
1	**Basics of Wireless Networks:** Introduction to Wireless Network, Classifications of wireless networks, Wireless Standards, Spectrum requirement for various wireless systems.	03
2	**Wireless Personal Area Networks:** Bluetooth (802.15.1): Radio Specifications, Protocol Stack, Link Types, Security, Topologies, Connection establishment, Applications. Zigbee (802.15.4): Radio Specifications, Components, Topologies, Protocol Stack, Applications. RFID: Radio Specifications, Architecture & Types, Applications. Near Field Communication UWB: Introduction to UWB and its characteristics, Spectrum and pulse-based communication, IEEE 802.15.3a standard for high-speed WPAN, IEEE 802.15.4a standard for low-power communication and localization IEEE 802.15.4z standard for secure and accurate ranging UWB ranging and localization concepts	12

	Applications of UWB in indoor positioning, IoT, asset tracking, and smart devices, Advantages and limitations of UWB	
3	**Wireless Local Area Network and Wireless Metropolitan Area Networks:** Introduction and features of IEEE802.11a, b, I, g and n Equipment, Topologies, Technologies, Applications, IEEE802.11 WLAN Joining an existing Basic Service Set, Security and Power Management, Radio Link and Coverage Planning for IEEE 802.11 WLAN Introduction to WiMAX, WiMAX architecture and working principle, IEEE 802.16 standards and evolution, Advantages and limitations of WiMAX. **Case Study:** Campus Wi-Fi installation.	10
4	**Wireless Sensor Network:** Background of sensor network technology, sensor network architectural elements, historical survey of sensor networks, Technologies for wireless sensor network, sensor node technology, hardware and software, sensor taxonomy, operating environment, wireless network trends, transmission technology, Applications of wireless sensor network: examples of category 1 and 2	8
5	**Wireless Body Area Network (WBAN):** Introduction to WBAN and its characteristics, Network Architecture, Network Components, Applications of WBAN in healthcare, fitness, and remote monitoring, Security and power management issues in WBAN, Advantages and limitations of WBAN.	5
6	**Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.	4
	Total	**42**

Wireless Networks Laboratory (DJS23ELPC714)	
Exp.	**Suggested Experiment List**
1	Installation and study of network simulation tool such as NS2/ NS3.
2	Creating Wireless nodes for WLAN/ WSN
3	Creating various topologies for wireless networks using simulation tool like NS2/NS3.
4	Creating sensor nodes with reference to their communication range using NS2/NS3.
5	Analysis of Wi-Fi network.
6	Data transfer using Bluetooth.
7	Data transfer using Zigbee.
8	Data transfer using RFID.

9	Case study on WSN Application
10	Case Study on campus WiFi installation

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

Books Recommended:

Text books:

1. Vijay K. Garg, "*Wireless Communication and Networking"*, Morgan, Kaufmann Series in Networking, Elsevier, First edition, 2007.
2. Kazem Sohraby, Daniel Minoli, and Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, and Applications*, First edition, 2007, John Wiley &Sons.

Reference Books:

1. Upena Dalal, "*Wireless and Mobile Communications"*, First edition, 2015, Oxford University Press.
2. Theodore S. Rappaport, "*Wireless Communications Principles and Practice"*, 2nd Edition, 2010, Pearson Publication.
3. Sunil Kumar, S. Manvi, and Mahabaleshwar S. Kakkasageri, "*Wireless and Mobile Networks Concepts and Protocol"*, 2nd Edition, 2010, Wiley Publication.
4. Raj Kamal, "*Internet of Things Architecture & Design Principles"*, 4th Edition, 2017, McGraw Hill.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Microwave System Design	Course Code: DJS23ECPE712	
Course: : Microwave System Design Laboratory	Course Code: : DJS23ELPE712	

Pre-requisite:

1. Electronics and Devices and Circuits (DJS23EPC202)
2. Wave Theory & Radio Frequency Design (DJS23ECPC502)
3. Analog & Digital Communication (DJS23ECPC503)
4. Radiating Systems (DJS23ECPC603)

Objectives:

1. To Understand the fundamentals of microwave engineering and its applications.
2. Analyze of microwave components and design of microwave amplifier.

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

1. Understand microwave frequency bands, propagation characteristics, microwave communication systems, and measurement techniques used in microwave engineering.
2. Analyze Microwave characteristics of microwave generation and amplification using active and passive devices.
3. Apply transmission line theory and waveguide concepts for the analysis and design of microwave transmission structures including stripline and microstrip circuits.
4. Design of small and large signal amplifier with maximum and unilateral gain amplifier design.
5. Understand various microwave applications and effects on electromagnetic signals.

Microwave System Design (DJS23ECPE712)		
Unit	**Description**	**Duration**
1	**Microwave Communication Systems and Measurements** **Introduction to Microwave Communication** Microwave Frequency Bands in Radio Spectrum, Characteristics, Advantages and Applications of Microwaves. **Microwave Measurements** VSWR, Frequency, Power, Impedance, Attenuation, Dielectric Constant.	**04**
2	**Waveguide and Planar Transmission Lines** Parallel plate waveguide, rectangular waveguide, circular waveguide, Microstrip line and Strip line: Analysis and Design, Even-odd mode analysis.	**10**
3	**Microwave Generation and Amplification** Two Cavity Klystron and Reflex Klystron, Helix Travelling Wave Tube and Backward Wave Oscillator, Cylindrical Magnetron.	**06**
4	**Microwave Devices and Components** Tees, Directional couplers, Phase shifters, Terminations, Attenuators and Ferrite devices such as Gyrator, Isolator, Circulator. Diodes: Varactor diode, PIN diode, Tunnel, Gunn, IMPATT, Application of Tunnel, Gunn and IMPATT diode as a Microwave Oscillator, *(construction, working, equivalent circuit and performance characteristics).*	**08**
5	**Microwave Amplifier Design** Two-Port Power Gains, Stability Circles, Single-Stage Amplifier Design: Design for Maximum Gain (Conjugate Matching), Constant-Gain Circles and Design for Specified	**10**

	Gain, Low-Noise Amplifier Design, Large-Signal Characterization of Transistors, Design of Class A Power Amplifiers.	
6	**Microwave Applications and Hazards** Medical (Microwave Imagining, Microwave Diathermy) and Civil applications (Microwave heating, Instrumentation Landing Systems) Microwave hazards, Biological Effects and Safety.	**04**
	Total	**42**

Microwave Systems Design Laboratory (DJS23ELPE712)	
Exp.	**Suggested Experiment List**
1	Study of Microwave Components.
2	Measurement of Microwave frequency using Microwave Bench Setup.
3	Measurement of Attenuation using Microwave Bench Set-up.
4	Study of Various Modes of Reflex Klystron
5	Amplifier design using smith chart
6	Study of Microwave Hazards.
7	Measurement of Wavelength, VSWR and Unknown load using Microwave Bench Set-up.
8	Measurement of S-parameters for various microwave components.
9	Design and Simulation of Branch line coupler.
10	Mode Pattern Analysis for Rectangle Waveguide
11	CST based Simulation for Microwave Components

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. *Samuel Liao, "Microwave Devices and Circuits",* Prentice Hall.
2. *M. Kulkarni, "Microwave and Radar Engineering,"* 3rd Edition, Umesh Publication.
3. D. M. Pozar, "*Microwave Engineering*" 4th Edition, Wiley Publications, 2012.

Reference Books:

1. Annapurna Das, Sisir K. Das, "*Microwave engineering*", TMH, 5th Edition, 2021.
2. Peter A. Rizzi, "*Microwave Engineering: Passive Circuits*" Prentice Hall, 2nd Edition, 1998.

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Robotics and Industrial Automation	Course Code: DJS23ECPE722	
Course: Robotics and Industrial Automation Laboratory	Course Code: DJS23ELPE722	

Pre-requisite:

1. Mathematics for Telecommunication Engineering (DJS23EPC201)
2. Integrated Circuits (DJS23EPC252)
3. Control System (DJS23ECPE513)

Objectives:

1. To understand the anatomy of Robots and kinematics for industrial applications.
2. To cover various path planning methodologies for robotic navigation and task execution.
3. To understand various types of controllers used in process and their tuning for different applications.

Outcomes: At the end of course, students will be able to:

1. Understand basic concepts of robotics.
2. Understand the principle of direct and inverse kinematics in robotic operation.
3. Analyze the controller parameters for discrete or continuous type.
4. Design the process controller (electronic) for a given process or application.

Robotics and Industrial Automation (DJS23ECPE722)		
Unit	**Description**	**Duration**
1	**Fundamentals of Robotics:** Robot Classification, Robot Components, Robot Specification, Joints, Coordinates, Coordinate frames, Workspace, Applications.	04
2	**Kinematics of Robots:** Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations – position and orientation. Denavit - Hartenberg representation of forward kinematics, Forward and inverse kinematic solutions of SCARA robot.	08
3	**Trajectory planning:** Basics of Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories.	04
4	**Analog & digital signal conditioning and Instrumentation Circuits:** Signal level & bias change, linearization, conversion, filtering & impedance matching, concept of loading, comparators & converters. Design of operational amplifier-based circuits in instrumentation – analysis of voltage divider circuits, bridge circuits, inverting & non-inverting amplifier, instrumentation amplifier, V to I & I to V converter, integrator, differentiator & linearization. Transmitters – Introduction to telemetry & its basic block diagram, 2 wire, 3 wire & 4 wire transmitters, 4 mA to 20 mA current transmitter, current to pressure (I to P) & pressure to current (P to I) converters.	10

5	**Controllers Discontinuous & Continuous and Tuning:** Two position discontinuous control mode. Continuous control mode – single mode (P, I & D) & composite mode (PD, PI & PID), selection criterion of controller for a process mode Tuning of PID controller – open loop transient response method, Ziegler – Nichols tuning method, frequency response method.	08
6	**Discrete state process controller:** Discrete state process variables, specifications & event sequence description Relay controller, ladder diagram logic, ladder diagram elements & ladder diagram programming examples PLC – relay sequencers, programmable logic controller design, PLC operation, programming the PLC. HMI and SCADA.	08
	Total	**42**

Robotics and Industrial Automation Laboratory (DJS23ELPE722)	
Exp.	**Suggested Experiment List**
1	Forward kinematics
2	Inverse kinematic
3	Dynamic analysis
4	Joint-space trajectory
5	Cartesian-space trajectory
6	Design of stepper motor interface & controller
7	Design of instrumentation amplifier for variable voltage gain
8	Design of signal conditioning circuits for LDR / thermistor / RTD / strain gauge
9	Tuning of P+I+D controller using MATLAB / Simulink
10	Implementation of PLC ladder diagram for given application

Seminars on Actuators – Electrical, Pneumatic and Hydraulic on the following content:

S.1 Electrical actuators – relays, solenoids & electrical motors (DC, AC & stepper motor)

S.2 Pneumatic actuators – basic pneumatic system, pneumatic compressors (piston, vane, screw) flapper nozzle, single & double acting cylinder, rotary actuator, filter-regulator-lubricator (FRL)

S.3 Hydraulic actuator – hydraulic pumps, control valves types (globe, ball, needle, butterfly, gate, diaphragm & pinch), cavitation & flashing with their remedies, pressure drop across valve & leakage, valve noise, flow characteristics on load changes, control valves parameters, control valves sizing, valve calibration, digital control valves, selecting control valves & applications

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. Robert Shilling, "*Fundamentals of Robotics - Analysis and control*", Prentice Hall of India, 2009.
2. Saeed Benjamin Niku, "*Introduction to Robotics – Analysis, Control, Applications*", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. Curtis D. Johnson, "*Process Control Instrumentation Technology"*, 7th Edition, PHI

Reference Books:

1. John J. Craig, "*Introduction to Robotics – Mechanics & Control*", Third Edition, Pearson Education, India, 2009.
2. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, "*Robot Modeling & Control*", Wiley India Pvt. Ltd., 2006.
3. S. K. Singh, "*Industrial Instrumentation & Control"*, 3rd Edition, McGraw Hill.
4. B.C. Nakra & K. K. Chaudhary, "*Instrumentation Measurement & Analysis"*, 3rd Edition, McGraw Hill.
5. Andrew Parr, "*Pneumatics & Hydraulics"*, 2nd Edition, Jaico Publishing Co.
6. G. Liptak, "*Handbook of Process Control & Instrumentation"*, 4th Edition, CRC Press

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	**B. Tech**	**Semester: VII**
Course: Advanced Digital Signal Processing	**Course Code: DJS23ECPE723**	
Course: Advanced Digital Signal Processing Laboratory	**Course Code: DJS23ELPE723**	

Pre-requisite:

1. Digital Signal Processing (DJS23ECPC501)

Objectives:

1. To introduce the fundamentals of multirate digital signal processing and sampling rate conversion techniques used in modern signal processing systems.
2. To develop understanding of adaptive systems and adaptive filtering algorithms for solving real-time signal processing problems.
3. To familiarize students with linear prediction methods, optimum linear filters, and lattice filter structures for signal modeling and estimation.
4. To impart knowledge of wavelet transforms and multiresolution analysis for advanced applications such as denoising, compression, and time-frequency analysis.

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

1. Explain the concepts of multirate digital signal processing including decimation, interpolation, and sampling rate conversion techniques used in speech and signal processing applications.
2. Analyze adaptive systems and implement adaptive filtering algorithms such as LMS and RLS for applications including system identification, channel equalization, echo cancellation, and noise cancellation.
3. Apply linear prediction and optimum linear filtering techniques for signal modeling, prediction, and filter realization using lattice and Wiener filter structures.
4. Apply wavelet transform techniques and multiresolution analysis for signal denoising, compression, speckle removal, and time-frequency analysis applications.

Advanced Digital Signal Processing (DJS23ECPE723)		
Unit	**Description**	**Duration**
1	**Multirate DSP:** Introduction and concept of Multirate Processing, Block Diagram of Decimator and Interpolator, Decimation and Interpolation by Integer Numbers, Spectra after decimation and Interpolation, Sampling Rate conversion by a Rational Factor I/D. Application: Subband coding of Speech Signals.	08
2	**Introduction to Adaptive systems** Introduction, Characteristics, Examples of Adaptive systems, Adaptive linear combiner-Description, Weight vectors, desired response and error, performance function, Gradient and minimum mean square error, Decorrelation of errors and Input Components.	06
3	**Adaptive Algorithms and Applications** Adaptive Direct Form FIR Filters based on steepest descent method, Widrow Hoff LMS Adaptive algorithm, RLS algorithms. Applications: System Identification, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation.	08
4	**Linear Prediction and Optimum Linear Filters:** Forward and Backward Linear Prediction, Solution of Normal Equation (Levinson-Durbin and Schur Algorithm), AR Lattice and ARMA Lattice Ladder Filters, Weiner Filters for Filtering and Prediction.	12

5	**Wavelet Theory** Fourier Transform and its Limitations, Short Time Fourier Transform, Introduction to time frequency analysis, Continuous Wavelet Transform, Discrete Time Wavelet Transform, Multi-resolution analysis, Haar Wavelet, Daubechies Wavelet, Filter bank theory. Application of wavelet theory to signal denoising, speckle removal, and signal compression.	08
	Total	**42**

Advanced Digital Signal Processing (DJS23ELPE723)	
Exp.	**Suggested Experiment List**
1	To perform up sampling & down sampling by integer factors.
2	Convert a signal's sampling rate by a non-integer ratio (e.g.3/2).
3	Two-Channel Subband Coding of a Speech/Audio Signal
4	To perform Adaptive channel equalization,
5	To perform Adaptive echo cancellation
6	Unknown Channel Identification using LMS Algorithm
7	To Perform Noise Cancellation Using LMS Algorithm
8	Denoising a signal using Wavelet Transform
9	STFT vs. FT for Non-Stationary Signals(Speech Signals)
10	Speckle removal by Wavelet Transform
11	Signal compression by Wavelet Transform
12	Noise removal from ECG signal Using Digital Filter

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. John G. Proakis and Dimitris G. Manolakis, "*Digital Signal Processing*", PHI, 2014.
2. Bernard Widrow and Samuel D.Strearns, "*Adaptive Signal Processing*", Pearson Edu Asia 2002.
3. Raghuveer. M. Rao and Ajit S.Bopardikar, "*Wavelet Transforms -Introduction to theory and applications*, Pearson Education, Asia, 2000.

Reference Books:

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "*Digital Signal Processing- A Practical Approach*," Pearson Education, 2nd Edition, 2002
2. Simon Haykin, "*Adaptive Filter Theory*," Pearson Education, 5th Edition, 2014.

Program: Electronics and Telecommunication Engineering	B. Tech.	Semester: VII
Course : CMOS Analog VLSI Design	Course Code: DJS23ECPE724	
Course : CMOS Analog VLSI Design Laboratory	Course Code: DJS23ELPE724	

Pre-requisite:

1. Electronics Devices & Circuits (DJS23ECPC302)
2. Integrated Circuits (DJS23ECPC402)
3. Digital VLSI Design (DJS23ECPE612)

Objectives:

1. To highlight the circuit design issues in the context of Analog VLSI technology
2. To provide the understanding of different design styles.
3. To provide an exposure to drawing layout of circuits.

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

1. Describe MOSFET operation and analyze small signal MOS models
2. Design single stage amplifier based on MOSFET.
3. Design differential amplifier based on MOSFET.
4. Design the MOSFET-based operational amplifier.
5. Describe the techniques of layout for analog circuits.

CMOS Analog VLSI Design (DJS23ECPE724)		
Unit	**Description**	**Duration**
1	**CMOS Analog building blocks** **MOS Models**: Necessity of CMOS Analog Design, Review of Characteristics of MOS Device, MOS Small Signal Model, MOS SPICE Models. **Passive and Active Current Mirrors**: Basic Current Mirrors, Cascode Current Mirrors and Active Current Mirrors. **Band Gap References**: General Considerations, Supply-Independent Biasing, Temperature-Independent References, PTAT Current Generation and Constant-Gm Biasing.	**10**
2	**Single Stage Amplifiers Configurations**: Basic concepts, Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Active Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Common-Source amplifier using Source follower, Common-Gate stage, Cascade stage.	**12**

	Frequency Response and Noise: General Considerations, Common-Source stage, Source followers, Common-Gate stage, Cascode stage and Noise in Single Stage Amplifier.	
3	**Differential Amplifiers** **Configurations**: Resistive load differential amplifier, Single-Ended and Differential Operation, Basic Differential Pair, Common-Mode Response, Differential Pair with MOS Loads. **Frequency response and noise in differential Amplifiers:** Differential pair with Passive Loads, Differential Pair with Active Loads.	**08**
4	**MOS Operational Amplifiers** **Op-amp Design**: General Considerations, Performance parameters, One-stage op-amps, Two-stage op-amps, Gain Boosting, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection, Noise in op-amps.	**08**
5	**Analog Layout and other concepts** **Analog Layout Techniques:** Antenna Effect, Resistor Matching, Capacitor Matching, Active Device Design, Current Mirror Matching, Floor Planning, Shielding and Guard Rings.	**04**
	Total	**42**

CMOS Analog VLSI Design-Laboratory (DJS23ELPE724)	
Exp.	**Suggested Experiment List**
1	To study trans-conductance plots of MOSFET device (voltage bias, current bias and technology bias).
2	To design basic amplifier using MOSFETs
3	To design cascode amplifier
4	To design basic current sink
5	To design current sink by using negative feedback resistor
6	To design cascode current sink.
7	To design of positive feedback boot strap current sink
8	To design of regulated cascode current sink
9	To design of simple current mirror
10	To design Wilson current mirror

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:

Textbooks:

1. B. Razavi, "*Design of Analog CMOS Integrated Circuits*", Tata McGraw Hill, 2nd Edition, 2017.
2. R. Jacob Baker, Harry W. Li, David E. Boyce, "*CMOS Circuit Design, Layout, and Stimulation*", Wiley, 3rd Edition, 2010.
3. P. E. Allen and D. R. Holberg, "*CMOS Analog Circuit Design*", Oxford University Press, 3rd Edition, 2012.

Reference Books/online courses:

1. Mohammed Ismail and Terri Faiz, "*Analog VLSI Signal and Information Process"*, McGraw-Hill Book company,1994.
2. John P. Uyemura,"*CMOS Logic Circuit Design* ", Springer US, 2001.
3. Gray, Meyer, Lewis, Hurst, "*Analysis and design of Analog Integrated Circuits*", Willey, 6th Edition, 2024.
4. nptel.ac.in/courses/108104193 (Prof. Imon Mondal, IITK)
5. nptel.ac.in/courses/117101105 (Prof. A. N. Chandorkar, IITB)

Program: Electronics and Telecommunication Engineering	B. Tech	Semester: VII
Course: Natural Language Processing	Course Code: DJS23ECMD701	
Course: Natural Language Processing Laboratory	Course Code: DJS23ELMD701	

Pre-requisite:

1. Machine Learning & Applications (DJS23ECMD601)

Objectives:

1. Understand the fundamental concepts, evolution, and architecture of Natural Language Processing systems.
2. Apply text preprocessing and syntactic analysis techniques for processing natural language data.
3. Analyze semantic and discourse level structures to interpret meaning and context in natural language.
4. Evaluate and apply NLP techniques for solving real-world problems and emerging applications in IoT, Cybersecurity, and Blockchain.

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

1. Explain the concepts, evolution, architecture, and challenges of Natural Language Processing systems.
2. Apply text processing techniques to preprocess textual data.
3. Analyze syntactic structures and sequence models for language modeling tasks.
4. Evaluate semantic analysis techniques for interpreting meaning in text.
5. Analyze Pragmatic and discourse structures and coreference resolution techniques in Natural Language Processing.

Natural Language Processing (DJS23ECMD701)		
Unit	**Description**	**Duration**
1	**Introduction to Natural Language Processing (NLP):** Definition and scope of NLP, Evolution of NLP (Rule-based → Statistical → Neural → LLMs), Traditional NLP vs LLM-based systems, Architecture / pipeline of NLP system, Levels of language processing, Ambiguity, challenges and limitations of NLP. Applications of NLP in Emerging Technologies.	04
2	**Text Processing and Word Level Analysis:** Words and tokens, Word types and word instances, Corpora and vocabulary. Regular expressions for text processing, Minimum edit distance (for spelling correction), N-grams: Unigram, Bigram, Trigram, N-gram language model (basic concept), Applications of N-grams: Text prediction, Spelling correction.	04
3	**Syntactic Analysis and Sequence Modeling:** Part-of-speech tagging and tag sets, rule-based POS tagging, stochastic POS tagging, issues in POS tagging (multiple tags and unknown words), context-free grammar, sequence labeling using Hidden Markov Models, Maximum Entropy models and Conditional Random Fields.	07
4	**Semantic Analysis:** Lexical semantics, word senses and semantic relations, homonymy, polysemy, synonymy and hyponymy, lexical resources such as WordNet, word sense disambiguation techniques (WSD), semantic role labeling and semantic	08

	representation in natural language processing. Knowledge based approach (Lesk's Algorithm), Supervised (Naïve Bayes, Decision List).	
5	**Pragmatics and Discourse Processing:** Pragmatics in natural language processing, discourse analysis, reference resolution, reference phenomena in discourse, syntactic and semantic constraints on coreference, coreference resolution techniques, applications of discourse processing in NLP. Anaphora Resolution using Hobbs and Centering Algorithm. Characteristics and challenges of Indian languages: • Morphological richness • Free word order • Script diversity (Devanagari, Bengali, Tamil, Telugu, Gujarati, etc.) • Code-mixing and code-switching (e.g., Hinglish)	05
	Total	28

Natural Language Processing Laboratory (DJS23ELMD701)	
Exp.	**Suggested Experiment List**
1	To Perform Text Preprocessing in NLP: Tokenization, stop word Removal, Lemmatization, stemming using NLTK and SPACY
2	To Implement Named Entity Recognition for any given text:
3	To Perform Part-of-Speech Tagging
4	To Perform Chunking and Named Entity Recognition:
5	To Implement regular expressions for text processing.
6	To Implement N-gram Language Model
7	To Implement Minimum, Edit Distance
8	To Perform Word Sense Disambiguation
9	To Perform Sentiment Analysis
10	Mini Project (A mini project to be undertaken by a group of 4–5 students, focusing on topics related to the subject. Any application of NLP: Spell Check, Autocorrect, plagiarism detection, sentiment analysis, sarcasm detection or text analytics in any domain.)

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. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O'Reilly Media, 1st Edition, 2009.
2. Speech and Language Processing – Daniel Jurafsky & James H. Martin, 3rd Edition, Stanford University, 2023

Reference Books:

1. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 1st Edition, 1999.
2. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 1st Edition, 2019.
3. Lewis Tunstall, Leandro von Werra and Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 1st Edition, 2022.

Online References:

1. Natural language toolkit- https://www.nltk.org/
2. Natural language Processing: https://www.deeplearning.ai/resources/natural-language-processing/
3. Speech and Language Processing book: https://web.stanford.edu/~jurafsky/slp3/?utm_source=chatgpt.com

Online Courses: NPTEL / Swayam:

1. Natural Language Processing by Prof. Pawan Goyal, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc21_cs102/preview
2. Applied Natural Language Processing, By Prof. Ramaseshan R, CMI, https://onlinecourses.nptel.ac.in/noc20_cs87/preview

3. Cousera: https://www.coursera.org/specializations/natural-language-processing

4. Udemy: https://www.udemy.com/course/nlp-natural-language-processing-with-python/

Prepared by Checked by Head of the Department Principal

Program: All programs	Final Year B. Tech.	Semester: VII/VIII
Course: Research Ecosystem (DJS23ITELX12)		

Pre-requisites:

1. Basic understanding of Engineering concepts and problem-solving techniques.
2. Fundamental knowledge of project-based learning, data analysis, and domain-specific tools.
3. Basic exposure to project development, technical report writing, and emerging technologies.

Objectives:

1. To understand and identify complex engineering, societal, and industrial problems suitable for research through structured analysis of literature, patents, and real-world needs.
2. To learn and apply advanced research methodologies—including experimental, simulation-based, and data-driven approaches—for designing and validating engineering solutions.
3. To gain proficiency in selecting and using appropriate tools, software, and platforms (AI/ML, simulation, CAD, IoT, etc.) for experiment design, data acquisition, and performance evaluation.
4. To transform research insights into innovative prototypes, products, or startup concepts by engaging with innovation ecosystems, TRLs, and funding mechanisms.
5. To analyze socio-technical systems, ethics, and sustainability implications of engineering solutions, ensuring responsible and impactful outcomes.
6. To integrate systems thinking, multidisciplinary perspectives, policy awareness, future technology trends, and technical documentation skills to develop comprehensive research proposals and outputs (papers, patents, reports).

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

1. Analyze complex engineering and societal problems to evaluate literature and patents and formulate clear research gaps.
2. Design and apply advanced research methods and tools to acquire data and evaluate solution performance.
3. Transform research insights into prototypes or startup concepts using innovation frameworks and Technology Readiness Levels.
4. Evaluate ethical, socio-technical, and sustainability issues and create responsible engineering solutions.
5. Synthesize multidisciplinary knowledge to create research proposals and scalable, future-ready solutions.

Research Ecosystem (DJS23ITELX12)		
Unit	**Description**	**Duration**
1	**Research Gap Identification & Advanced Problem Formulation** • Identifying high-impact problems from: ▪ Industry and Society ▪ Emerging technologies (AI, IoT, Blockchain, EV, etc.) • Research gap identification techniques: ▪ Systematic Literature Review (SLR) ▪ Patent analysis	**6**

	• Defining objectives, scope, constraints, and feasibility of the identified problem • Writing problem statement for: ▪ Research paper ▪ Product/Startup idea **Activities:** • Convert Industry/ Societal problem into research problem. • Analyze research articles and extract research gaps.	
2	**Experimental Design, Tools & Validation Techniques** • Advanced research methodologies: ▪ Experimental, simulation, data-driven, design thinking • Tool selection: ▪ Computational tools and software, simulation and analysis platforms, system prototyping and testing platforms • Data acquisition: ▪ Data collection interfaces, Principles of data cleaning and organization (primary / secondary data) • Validation techniques: ▪ Accuracy and performance metrics ▪ Benchmarking with existing solutions • Result interpretation & visualization **Activities:** • Selection of Research Design for final year project. • Apply evaluation metrics (e.g., ML model accuracy, system efficiency).	**6**
3	**Research to Innovation, Product & Startup Ecosystem** • Research → Prototype → Product → Startup lifecycle • Intellectual Property Rights (IPR), patents, copyrights • Technology readiness levels (TRL) • Case studies: ▪ AI startups, EV ecosystem, Smart Cities • Industry-academia collaboration models • Funding opportunities (grants, incubation, government schemes - Anusandhan National Research Foundation (ANRF)) **Activities:** • Convert project into startup idea or product pitch. • Analyze failure of a technology/product.	**6**
4	**Socio-Technical Systems, Ethics & Sustainability** • Socio-technical systems: Interaction of people, technology and environment • Ethical issues: ▪ Plagiarism, AI bias, data privacy • Sustainability in Engineering: ▪ Green practices, resource optimization and lifecycle considerations • Impact assessment: ▪ Social, economic, environmental • Policies and governance (data protection laws, standards and compliance requirements) **Activities:** • Case study: Facial recognition ethics / smart surveillance. • Impact analysis of student's own project.	**6**
5	**Integrated Research, Policy and Future Engineering Challenges** • Systems thinking and holistic analysis • Multidisciplinary problem solving: ▪ Healthcare tech, climate tech, smart mobility	**6**

	• Writing research proposals: ▪ Problem → Methodology → Expected outcomes • Future trends: ▪ AI ethics, Quantum computing, Industry 5.0 / 6.0 • Scaling solutions from lab to society **Activities:** • *Capstone Task:* ▪ Identify real-world problem. ▪ Apply research methodology. ▪ Propose: o Technical solution o Societal impact o Possible commercialization	
	Total	**30**

Term Work Guidelines:

The Term Work (TW) shall consist of continuous assessment based on tutorials activities and a final group presentation.

a) **Part A (25 Marks):**
Each student shall complete a minimum of five tutorials based on the syllabus topics during the semester. The tutorials may include activities such as research gap identification, literature survey, case study analysis, tool-based experimentation, impact analysis, technical report writing, and innovation-oriented problem solving.

b) **Part B (25 Marks):**
Students shall work in groups and select a project/research topic based on emerging engineering, industrial, or societal challenges. The group presentation shall include:

i. Identification of a real-world problem
ii. Application of appropriate research methodology
iii. Proposed technical solution
iv. Analysis of societal impact
v. Possible commercialization/startup opportunities

Books Recommended:

Reference Books:

- Kothari, C. R., Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi, 2023.
- Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & FitzGerald, W. T., The Craft of Research, University of Chicago Press, Chicago, 2024.
- Montgomery, D. C., Design and Analysis of Experiments, Wiley, New York, 2020.
- Singh, Pooja, Katiyar, Aman, Rawat, Shalini, Dhuri, Archana, Research Methodology and IPR, RK Publications, India, 2025.
- Blok, Vincent (Ed.), Putting Responsible Research and Innovation into Practice: A Multi-Stakeholder Approach, Springer Cham, Switzerland, 2022.

Web References:

- Research Methodology: Quantitative Methods and Computer Application (https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_ma02)

- Research Methodology and IPR (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28)
- Research and Publication Ethics (https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge46)
- Research Ethics and Plagiarism (https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge26)
- Quantitative and Mixed Methods Research for Management (https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg21)
- Doing Qualitative Research (https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge61)

Program: B. Tech. (Common to all Programmes)	B. Tech.	Semester: VII/VIII
Course: Major Project	Course Code: DJS23IPELX13	

Objectives

The primary purpose of the Major Project is to enable students to apply the knowledge and skills acquired across the programme to conceive, design, implement, and evaluate a comprehensive solution to a real-world problem. The project strengthens technical competence, communication, and teamwork by integrating design, development, technical writing, presentation, and collaborative work. It emphasises professional engineering practice and addresses a range of non-technical considerations such as economic factors, safety, reliability, ethics, sustainability, and environmental and societal impact.

Course Outcomes (CO)

On successful completion of the Major Project, the student will be able to:

CO1: Apply technical knowledge gained from previous courses to identify real-life, industry, or societal problems and design appropriate solutions.

CO2: Demonstrate the technical skills required to design, develop, build, and test engineering systems, products, software, or hardware using modern engineering and IT tools.

CO3: Apply project-management skills — scheduling work, procuring resources/components, budgeting, documenting technical and non-technical details, and working within defined deadlines as an effective team.

CO4: Develop and demonstrate the ability to test, validate, debug, and troubleshoot engineering systems (including software, hardware, and process components) and analyse the results.

CO5: Create technical reports and research papers in the prescribed format and effectively communicate and present the work to evaluators.

Scope and Nature of the Project Work

Final-year students have already undertaken project assignments in their pre-final year through Innovative Product Design / Mini Project work. In the final year, a group of a maximum of four students completes a comprehensive project based on the courses studied. The project work may be internally assigned or externally assigned by research institutes, industry, or similar organisations. Each group is assigned one faculty member as supervisor. The final-year project may be an extension of the Mini Project carried out in the pre-final year.

The main intention of the project work is to enable students to apply the knowledge and skills learnt across the programme to solve or implement a well-defined practical problem. The work may go beyond the scope of the curriculum or build upon courses studied, but the thrust should be on:

- Learning additional skills relevant to the chosen domain;
- Developing the ability to define, design, analyse, and implement a problem and carry it through to completion with proper planning;
- Learning behavioural science and professional ethics by working effectively in a group;
- Selecting a project area aligned with the student's intended higher education, employment, or self-employment goals;
- Choosing a topic that differs from, or meaningfully advances, the Mini Project topic;

- Using the opportunity to learn modern computational techniques, tools, and model development through an appropriate choice of project.

Continuous Assessment and Term Work

The department maintains a proper record of the progress of each project throughout the semester. At the end of the semester, the work is assessed for the award of Term Work (TW) marks by an approved internal faculty member appointed by the Head of the Institute, on the basis of:

- Scope and objectives of the project work;
- Extent and quality of the literature survey;
- Progress of the work (continuous assessment across reviews);
- Design, implementation, and analysis of the project work;
- Results, conclusions, and future scope;
- Report prepared in the prescribed University / institutional format.

Oral / Practical Examination: An approved external examiner together with an internal examiner appointed by the Head of the Institute assesses the project during the oral examination. The oral examination consists of a presentation by the group along with a demonstration of the work done. Each student is assessed individually for their contribution, understanding, and the knowledge gained.

Project Guide / Topic Allocation Policy

The project guide and topic-allocation policy is explained to students during the Orientation held in Semester VI. Each faculty member is allocated a minimum of one and a maximum of four project groups. As per the timeline in the academic calendar, the list of project topics and areas offered by each faculty member — three topics per faculty member — is displayed on the notice board. Allocation is carried out over successive rounds, and in each round students submit their preferences against the available topics and guides.

If a topic is preferred by only one group, that group is allocated to the corresponding guide and topic. If a topic is preferred by more than one group, the concerned faculty member reviews the applications and selects one group; the remaining groups carry forward to the next round. After each round, the list of groups and guides allotted so far is displayed, along with the topics and guides that remain available. Unallotted groups then submit fresh preferences from the available list. This process continues over successive rounds until every group has been allotted a guide, ensuring a uniform distribution of project groups among the faculty members.

Assessment Scheme

The Major Project carries a total of 100 marks — **Term Work (50)** assessed internally through continuous evaluation, and **Oral / Practical Examination (50)** assessed jointly by internal and external examiners. Each criterion is scored against three performance levels — Excellent, Satisfactory, and Below Expectation — as detailed below.

Rubric for Term Work (50 Marks)

Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Problem Definition, Objectives & Literature Survey (CO1)	**10**	8–10	5–7	0–4

Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Design, Methodology & Implementation Progress – Continuous Assessment (CO2)	**10**	8–10	5–7	0–4
Project Management & Teamwork (CO3)	**10**	8–10	5–7	0–4
Report / Thesis Writing – Written Communication (CO5)	**10**	8–10	5–7	0–4
Research Paper Writing / IPR – Patent or Copyright (CO5)	**10**	8–10	5–7	0–4
TOTAL	**50**			

Rubric for Oral / Practical / Presentation / Demonstration (50 Marks)

Assessment Criteria (mapped CO)	Max	Excellent	Satisfactory	Below Exp.
Concept & Problem Definition (CO1)	**5**	4–5	3	0–2
Design, Methodology & Implementation (CO2)	**15**	12–15	7–11	0–6
Project Management Skills (CO3)	**5**	4–5	3	0–2
Demonstration, Testing & Result Analysis (CO4)	**15**	12–15	7–11	0–6
Presentation & Oral Communication (CO5)	**10**	8–10	5–7	0–4
TOTAL	**50**			

Descriptive Assessment Rubric (Performance-Level Descriptors)

The following descriptors define each performance level and are applied consistently across all programmes. Examiners map a student's performance to the most appropriate level for each criterion before awarding the corresponding marks from the tables above.

Criteria	Excellent	Satisfactory	Below Expectation
Concept & Problem Definition	All major and minor objectives are identified and correctly prioritised. The problem statement is precise, relevant and well-scoped. All relevant information is gathered from valid sources and the proposed solution is well justified.	Major objectives identified but one or two minor ones missing or priorities not fully set. Problem statement mostly clear. Sufficient information from largely valid sources; solution mostly justified.	Several major objectives not identified. Problem statement vague or too broad. Insufficient information and/or invalid sources; proposed solution not justified.
Literature Survey	Comprehensive, current and well-organised survey of journals, standards, patents and existing products/systems. Research gap / novelty clearly identified and the	Adequate survey covering most key sources. Gap / novelty identified but only partially justified.	Sparse or outdated survey. Little or no identification of the gap; chosen approach not justified.

Criteria	Excellent	Satisfactory	Below Expectation
	chosen approach is well justified.		
Design, Methodology & Implementation	Design is based on stated criteria, sound analysis and realistic constraints. Methodology is appropriate and well justified. Implementation is complete and robust and makes effective use of modern engineering / software tools.	Design is reasonable and methodology mostly appropriate. Implementation is largely complete; deeper analysis of alternatives or constraints could improve the outcome.	Only one solution considered or alternatives ignored. Weak methodology and incomplete implementation. Many constraints and criteria ignored.
Project Management & Teamwork	Responsibilities delegated fairly and every member contributes valuably. All members attend meetings and meet deliverable deadlines. Schedule, resources and budget are well managed.	Minor inequities in delegation; some members contribute more than others but all meet their responsibilities. Meetings mostly attended and deadlines mostly met.	Major inequities in delegation, with free-riders or dominating members. Meetings and deadlines frequently missed; poor planning of schedule and resources.
Demonstration, Testing & Result Analysis	Develops and follows logical testing / validation / experimental procedures. Selects appropriate tools, equipment, platforms or datasets and operates them confidently. Aware of errors / limitations, accounts for them, and interprets and relates the results to the objectives and underlying theory.	Procedures mostly followed with occasional oversight. Needs some guidance in selecting tools / equipment and is tentative in operating them. Aware of errors but accounts for them only minimally.	Does not follow a proper procedure. Cannot select appropriate tools / equipment or operates them incorrectly, needing frequent supervision. Makes no attempt to relate results to objectives.
Report / Thesis Writing (Written Communication)	Report is well organised and clearly written; the logic is easy to follow. Wording is precise; figures, tables and analyses enhance understanding. Grammatically correct, free of spelling errors, properly cited and free of plagiarism.	Report is mostly organised and clear; a few sections are harder to follow. Wording is good with minor exceptions; figures are consistent. Few grammatical / spelling errors that do not hinder the reader; some sources not fully cited.	Report lacks organisation and the logic is hard to follow. Figures absent or inconsistent. Grammatical and spelling errors hinder reading. Evidence of plagiarism or inadequate citation.
Research Paper Writing / IPR (Patent or Copyright)	A research / technical paper is drafted to publication standard in the required format, or a patent / copyright application is prepared and filed. Novelty and	A paper draft or IPR document is prepared and largely follows the required format. Novelty and contribution are stated but only partially developed, with minor	No paper / IPR document, or a weak draft that does not follow the required format. Novelty or contribution is unclear or unsupported, with

Criteria	Excellent	Satisfactory	Below Expectation
	contribution are clearly articulated, claims and results are well supported, and the work is original with proper citations and no plagiarism.	gaps in supporting evidence or formatting.	evidence of plagiarism or inadequate citation.
Presentation & Oral Communication	Slides are error-free and logically present the work and findings; they are readable and the graphics support the main ideas. Speakers are audible and fluent, do not rely on notes and answer questions accurately. Confident body language and eye contact convey strong engagement.	Slides are error-free and logical and mostly readable. Speakers are mostly fluent with minimal reliance on notes and answer most questions well. Slight discomfort or occasional distracting gestures.	Slides contain errors and lack logical flow; key aspects are absent and graphics confuse the audience. Speakers are inaudible or hesitant and rely heavily on notes, with difficulty answering questions. Body language conveys discomfort.

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

<table>
<tr><td colspan="6">Program: Final Year</td><td colspan="4">Semester: VIII</td></tr>
<tr><td colspan="6">Course: Disaster Management and Preparedness</td><td colspan="4">Course Code:</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="3">Total Marks = (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3" rowspan="2">Theory</td><td>Term Test 1</td><td>Term Test 1I / presentation / assignment / course project / group discussion / any other.</td><td>AVG</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="2">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">-</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Objectives:

1. To provide basic understanding of hazards, disasters and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organizations during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

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

1. Apply disaster management principles & guidelines.
2. Conduct risk assessments.
3. Develop community awareness & participation.
4. Utilize Science & Technology tools (GIS, GPS).
5. Prepare disaster management plans.

Detailed Syllabus: (unit-wise)		
Unit	**Description**	**Duration**
1	**Understanding Disasters & Hazards:** • **Definition and types of disasters**: Natural, Man-made and hybrid disasters, **Study of Natural disasters**: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. **Study of Human/Technology Induced Disasters**: Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, • Hazard & Vulnerability profiles of India (seismic zones, flood-prone areas). • India's vulnerability to disasters, and the impact of disasters on National development.	**06**
2	**Disaster Risk Reduction (DRR) & Mitigation:** • **Disaster Management Cycle**: Prevention, Mitigation, Preparedness, Response, Recovery. Need for disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. • Risk Assessment & Vulnerability Analysis. • **Science & Technology**: Use of information management, Geo informatics like RS, GIS, GPS and remote sensing mitigation measure.	**06**
3	**Disaster Preparedness & Response:** • Preparedness Planning, Early Warning Systems (EWS), & Communication. • Emergency Response: Search & Rescue, Logistics, Medical Aid. • Psychological Response & Management (Trauma, Stress). • Role of IT, Media, Govt., NGOs, & Community.	**04**
4	**Recovery, Rehabilitation & Reconstruction:** • Post-disaster damage assessment. • Rehabilitation, Reconstruction, & Livelihood Restoration. • Sanitation, Hygiene, & Waste Management.	**04**
5	**Policy, Governance & Capacity Building:** • National Disaster Management Authority (NDMA) & Legislation. • Institutional Mechanisms & Community Mobilization. Non-Structural Mitigation: Community based disaster preparedness, capacity development and training, awareness and education, contingency plans.	**04**
6	**Case studies on disaster (National /International):** • Case study discussion of National Disasters: Tsunami (2004), Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, 26th July 2005 Mumbai flood • Case study discussion of International Disasters: Hiroshima – Nagasaki (Japan), Cyclone Phailin (2013), Fukushima, Daiichi nuclear disaster (2011), Chernobyl meltdown	**04**
	Total Number of Hours	**28**

Books Recommended:

Reference Books and Reports:

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O. S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites.)