INSTITUTE OF ENGINEERING & MANAGEMENT

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DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

4th YEAR- 7th SEMESTER

Syllabus for B. Tech Admission Batch 2022

Semester VII [Fourth year]
Branch/Course: Electrical Engineering

Sl No	Type of Course	Course Code	Course Name	L	T	P	S	Total Contact Hours	Credit Points
Theory									
1	Professional Elective Courses	PEC-EE 701	A. Digital Signal Processing B. Digital Control System C. Electric Drives	3	0	0		3	3
2	Open Elective Courses	OEC-EE 701	A. Embedded system B. VLSI Circuits	3	0	0		3	2
3	Open Elective Courses	OEC-EE 702	A. Big Data Analysis B. Computer Network	2	0	0		2	2
4	Humanities and social sciences including Management	HSMC-701	Human Resource Development & Organisational Behaviour	3	0	0		2	2
5	Humanities and social sciences including Management	ESPEE 701	Essential Studies for Professionals VII	2	0	0		2	0.5
SESSIONAL									
6	Project. Seminar and Industrial Training	PI-EE 781	Industrial Training/Internship				12w	-	4
7	Humanities and social sciences including Management	SDP 781	Skill Development for Professionals VII				2	2	0.5
8	Project. Seminar and Industrial Training	PWEE781	Project (Phase I)				6	6	3
Value Added Courses									
9	Massive Open Online Courses (MOOCs)	MOOCs	Massive Open Online Courses (MOOCs)						
10	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
11	Mandatory Additional Requirements (MAR)	MAR781	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**13**	**0**	**0**	**8**	**21**	**17**

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Syllabus and Lesson Plan for B.Tech Admission Batch 2022

Subject Name: Digital Signal Processing **Credit: 3** **Lecture Hours: 35**

Subject Code: PEC-EE 701 A

Pre-requisite: Basic knowledge of signals and systems, Fundamentals of Fourier and Laplace transforms, Basic calculus and linear algebra

Course Objective: To impart a solid foundation in discrete-time signal processing including the analysis and design of LTI systems, understanding Z-transforms, DFTs, FFTs, and digital filter design, along with exposure to DSP hardware and FPGA implementation.

Course Outcome: Upon successful completion of this course, students will be able to:

1. Analyze and classify discrete-time signals and systems.
2. Apply Z-transform and convolution for system analysis.
3. Understand and implement DFT/FFT algorithms.
4. Design digital IIR and FIR filters.
5. Familiarize with DSP processors and FPGA implementation of DSP algorithms.

Relevant Links:

Study Material 1 Study material 2	NPTEL	**coursera**	linkedin Learning

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Discrete-time signals and systems** Discrete time signals and systems: Sequences; representation of signals onorthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals -aliasing; Sampling theorem and Nyquistrate.	Aligns with signal processing in communication and control systems, foundational in courses by MIT, Coursera	9	Signal generation, convolution (manual and MATLAB), LTI system verification	Oppenheim & Schafer / Proakis & Manolakis	Ch. 1, 2
2	**Z-transform** z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	Used in DSP chip design, MATLAB DSP toolbox, IEEE courses on Z-transform and FFT	8	Z-transform and DFT computation, circular convolution, FFT with signal samples	Proakis & Manolakis	Ch. 3, 4, 5
3	**Discrete Fourier Transform** Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals,Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems	Industry filter design tools (e.g., FDA Tool in MATLAB), used in audio/image systems	5	FIR/IIR filter design using MATLAB, verification of frequency response	Proakis & Manolakis	Ch. 6, 7
4	**Design of Digital filters** Design of FIR Digital filters:Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	Matches Texas Instruments' DSP courses, Xilinx FPGA design flows	7	Writing basic code for DSP operations, mapping simple algorithms on FPGA	TMS320C54xx Docs / FPGA Literature	Manuals + Supplement Notes

5	**Applications of Digital Signal Processing** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.		6			

Lesson Plan:

Module 1: Discrete-Time Signals and LTI Systems

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction to discrete-time signals, sampling and reconstruction concepts
2	Periodic, energy, power signals; basic sequences (unit-step, ramp, etc.)
3	Arithmetic operations on sequences
4	Introduction to LTI systems and impulse response
5	Convolution concepts: graphical, analytical, overlap-add methods
6	Properties of convolution and interconnections of LTI systems
7	Stability and causality in LTI systems
8	Recursive and non-recursive systems

Module 2: Z-Transform, DFT, FFT

WORKING DAY	LESSON PLAN – DESCRIPTION
9	Definition of Z-transform, s-plane/z-plane mapping, ROC
10	Properties of Z-transform with examples
11	Inverse Z-transform: power series, contour, partial fractions
12	Convolution and correlation via Z-transform
13	DFT and IDFT definitions, twiddle factors, matrix form
14	Circular convolution: graphical and matrix methods
15	Linear filtering using DFT, aliasing error
16	Overlap-Save and Overlap-Add methods

17	FFT: Introduction, Radix-2 DIT and DIF algorithms
18	FFT butterflies, signal flow, bit reversal examples

Module 3: Filter Design

WORKING DAY	LESSON PLAN – DESCRIPTION
19	IIR vs FIR filters, system functions, difference equations
20	IIR filter design using impulse invariant and bilinear transforms
21	FIR filter design – linear phase concepts, number of taps
22	FIR filter design using rectangular and Hamming windows
23	FIR design using Blackman window; practical filter specification

Module 4: DSP Processor and FPGA

WORKING DAY	LESSON PLAN – DESCRIPTION
24	Architecture of TMS320C5416/6713 DSP processor
25	Instruction set and writing basic assembly programs
26	Introduction to FPGA architecture and design flow
27	Sub-systems and algorithm mapping on FPGA
28	Case study and design example on FPGA-DSP integration
29	Revision and Q&A

Text Books:

1. **John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 4th Edition, Pearson Education.**
2. **Sanjit K. Mitra, *Digital Signal Processing: A Computer-Based Approach*, 4th Edition, McGraw-Hill.**

Reference Books:

1. **Alan V. Oppenheim and Ronald W. Schafer, Discrete-Time Signal Processing, 3rd Edition, Pearson Education.**

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Syllabus and Lesson Plan for B.Tech Admission Batch 2022

Subject Name: Digital Control System **Credit: 3** **Lecture Hours: 40**

Subject Code: PEEE701B

Pre-requisite: control systems, discrete-time signals and systems, and Laplace/Z-transform techniques.

Course Objective: To introduce the principles and design techniques of digital control systems, with emphasis on discrete-time modeling, stability analysis, and controller design in the z-domain.

Course Outcome: Upon completion, students will be able to:

1. Model and analyze discrete-time control systems.
2. Design digital controllers using pole placement and frequency-domain techniques.
3. Evaluate system stability and performance in the z-domain.
4. Implement digital control strategies in real-time systems.

Relevant Links:

Study Material 1 Study Material 2	**nptel**	coursera	linkedin learning

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Discrete Representation of Continuous Systems:** Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.	Aligned with industrial automation and embedded digital controllers	6	Sample-and-hold modeling, quantization, and ZOH in MATLAB	Ogata, Kuo	Ogata Ch. 1, Kuo Ch. 2
2	**Discrete System Analysis:** Z Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z-plane. Solution of Discrete time systems. Time response of discrete time system.	Matches with modeling and analysis of discrete-time systems in DSP applications	6	Z-transform and inverse operations, pulse transfer functions	Ogata, Kuo	Ogata Ch. 2–3
3	**Stability of Discrete Time System** Stability analysis by Jury test.Stability analysis using bilinear transformation. Design of digital control system with deadbeat response. Practical issues with deadbeat response design.	Used in control systems for aerospace and robotics; Jury's test widely adopted	4	Jury test implementation and stability check using MATLAB	Ogata	Ch. 4
4	**State Space Approach for discrete time systems** State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.	Related to modern control theory and model-based design in Mechatronics	10	Controllability and observability verification using MATLAB	Kuo, Ogata	Kuo Ch. 5, Ogata Ch. 5
5	**Design of Digital Control System** Design of Discrete PID Controller, Design of discrete statefeedback controller. Design	Widely used in PLC, embedded, and	8	PID tuning, state feedback design, observer simulation	Ogata	Ch. 6

	of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.	motion control design platforms				
6	**Discrete output feedback control** Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems	Reflects current research in fast output sampling, periodic feedback in smart grids	8	FOS-based controller and output feedback design in simulation tools	Research articles + Kuo supplementary	Supplementary Notes

Lesson Plan:

Module1 : Introduction to Digital Control Systems

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction to digital control and discrete-time systems
2	Sample and Hold circuit – structure and working
3	Quantization and sampling frequency effects
4	Mathematical modeling of S/H circuit and ZOH equivalent
5	Recap and simulation assignment discussion
WORKING DAY	**LESSON PLAN – DESCRIPTION**
6	Z-transform definition and properties
7	Inverse Z-transform techniques and examples
8	Pulse transfer function derivation
9	Mapping from s-plane to z-plane
10	Discrete-time system response computation
11	Closed-loop system representation and analysis
WORKING DAY	**LESSON PLAN – DESCRIPTION**
12	Jury stability test – introduction and algorithm
13	Stability analysis using Jury's test – examples
14	Bilinear transformation and its use in stability testing
15	Deadbeat controller – design steps

WORKING DAY	LESSON PLAN – DESCRIPTION
16	Introduction to state-space models of discrete systems
17	Time-domain analysis using state-space
18	Controllability and reachability criteria
19	Observability and reconstructibility
20	Lyapunov stability theory for discrete systems
21	Effect of pole-zero cancellation on control properties
22	Simulation and design exercise
WORKING DAY	**LESSON PLAN – DESCRIPTION**
23	Design of discrete PID controllers
24	Discrete state-feedback controller design
25	Design of set-point tracker and its advantages
26	Observer design in discrete domain
27	Discrete compensator design and tuning
23	Design of discrete PID controllers
24	Discrete state-feedback controller design
25	Design of set-point tracker and its advantages
26	Observer design in discrete domain
27	Discrete compensator design and tuning

Text Book:

- **K. Ogata, *Discrete-Time Control Systems*, Pearson Education, 2nd Edition**
- **B.C. Kuo, *Digital Control Systems*, Oxford University Press**

Reference Books:

G.F. Franklin, J.D. Powell, M. Workman, *Digital Control of Dynamic Systems*, Pearson

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Syllabus and Lesson Plan for B.Tech Admission Batch 2022 **Subject**

Name: Electrical Drives **Credit: 3** **Lecture Hours: 35**

Subject Code: PEC-EE 701C

Pre-requisite: Electrical Machines, Power Electronics

Course Objective:

1. To understand basic concept, classification and principle of operation of Electric Drive.
2. To understand methods of starting and braking of Electric Drive.
3. To understand methods of control of speed of DC and AC machines
4. To solve problem related to Electric Drive

Course Outcome:

CO1. Understand the fundamental principles of electric drives and their applications in various industries and systems.

CO2. Understand the performance and characteristics of various electric machines and their associated drives.

CO3. Understand the principles and operation of different power electronic converters used in electric drives and apply this knowledge to select and design suitable converters for specific applications.

CO4. Analyze and solve problems related to Electric Drives

Relevant Links:

Study Material	nptel	coursera	linkedin

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**DC motor characteristics** Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB, PSIM	3	Not applicable	Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**1, 2**

2	**Chopper fed DC drive** Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB, PSIM	**4**	Not applicable	Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**4**
3	**Multi-quadrant DC drive** Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB, PSIM	6	1.Model and simulate the speed control of a DC motor using a chopper-controlled drive in electric vehicles. Focus on how speed is controlled in response to varying loads and terrain	Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**5**

4	**Closed-loop control of DC Drive** Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric- machines-fall-2013/ **Industry:** MATLAB, PSIM	**6**	1.Simulat e the speed control of an induction motor by adding external resistance in the rotor circuit using a chopper. This is used in variable-speed drive systems, such as those in rolling mills, crushers, or conveyors.	Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**6**
5	**Induction motor characteristics** Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB, PSIM	6	1.Model and simulate the performance of a brushless DC motor in an electric vehicle or a high- efficiency fan.	Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**7, 8, 9**
6	**Scalar control or constant V/f control of induction motor** Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB,	5		Electric Drives Concepts and Applications, Vedam Subrahmanyam, 2nd Edition, TMH.	**7**

7	**Control of slip ring induction motor** Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/ **Industry:** MATLAB,	**5**		Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.	**7, 8, 9**

Lesson Plan:

Module 1: Electric Drive

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Concept, classification, parts and advantages of electrical dives.
2	Types of Loads, Components of load toques, Fundamental torque equations
3	Equivalent value of drive parameters for loads with rotational and translational motion.
4	Determination of moment of inertia, Steady state stability,

	Transient stability.
5	Multi quadrant operation of drives. Load equalization.

Module 2: Motor power rating

WORKING DAY	LESSON PLAN – DESCRIPTION
6	Thermal model of motor for heating and cooling,
7	Classes of motor duty, determination of motor rating
8	Torque and power methods of determination of rating for fluctuating and intermittent loads.
9	Effect of load inertia & environmental factors.

Module 3: DC motor drives

WORKING DAY	LESSON PLAN – DESCRIPTION
10	DC motor and their performance, Starting, Braking
11	Transient analysis
12	Speed control, Single phase, three phases fully controlled and half controlled DC drives
13	Dual converter control of DC drives.
14	Power factor, supply harmonics and ripple in motor current.

15	Chopper controlled DC motor drives.
16	Closed loop control of DC drives.
17	Applications of AI in speed control of DC motor drive.

Module 4: Induction motor drives

WORKING DAY	LESSON PLAN – DESCRIPTION
18	Starting an Breaking of three phase induction motor
19	Stator voltage variation by three phase controllers
20	Speed control using chopper resistance in the rotor circuit
21	slip power recovery scheme.
22	Pulse width modulated inverter fed and current source inverter fed induction motor drive.
23	Applications of AI in speed control of induction motor drive.

Module 5: Special motor drives

WORKING DAY	LESSON PLAN – DESCRIPTION
24	Variable frequency and Self- Control of synchronous motor
25	Brushless DC motor drive

26	Solar and Battery Powered Drive
27	Stepper motor and Switched Reluctance motor drive

Module 6: Industrial application

WORKING DAY	LESSON PLAN – DESCRIPTION
28	Drive consideration for Textile mills, Steel rolling mills
29	Cement mills, Paper mills, Machine tools.
30	Cranes & hoist drives. Design the control circuit of a Lift mechanism

Text Books:

1. Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, Narosa Publishing House.
2. Electric Drives Concepts and Applications, Vedam Subrahmanyam, 2nd Edition, TMH

Reference Books:

1. Electric Drives Concepts and Applications, Vedam Subrahmanyam, 2nd Edition, TMH.
2. A first course on Electrical Drives, S.K. Pillai, New Age International Publication.
3. Electric Drives, N.K. De, P.K.Sen, PHI Learning Pvt. Ltd.

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Embedded system **Credit:** 2 **Lecture Hours:** 40
Subject Code: OECEE701A

Suggested Learning Resources:

Study Material

Course Objective:

The purpose of learning this course is-

1. To introduce the Building Blocks of Embedded System.
2. To Educate in Various Embedded Development Strategies.
3. To Introduce Bus Communication in processors, Input/output interfacing.
4. To impart knowledge in various processor scheduling algorithms.
5. To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Acquire a basic knowledge about fundamentals of microcontrollers and programming and system control to perform a specific task.
CO2. Acquire knowledge about devices and buses used in embedded networking and develop programming skills in embedded systems for various applications.
CO3. Acquire knowledge about basic concepts of circuit emulators.
CO4. Acquire knowledge about Life cycle of embedded design and its testing.

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Introduction to Embedded systems**: Introduction – Features – Microprocessors – ALU - Von Neumann and Harvard Architecture CISC and RISC - Instruction pipelining. Microcontroller: characteristics and Features, Overview and architectures of Atmel 89C52 and Microchip PIC16F877 and 18F452. Examples of embedded Systems: Bar-code scanner, Laser printer, Underground tank monitoring.		10	NA	Embedded Systems Architecture, Programming and Design, Ral Kamal TMH, 2008	Chapter 1,2
2	**PIC Microcontroller:** PIC Microcontrollers: 16F877 Architecture and Instruction Set. External Interrupts, Timers, watch-dog timer, I/O port Expansion, analog-to-digital converter, UART, I2C and SPI Bus for Peripheral Chips, Accessories and special features		8	NA	Embedded Systems Architecture, Programming and Design, Ral Kamal TMH, 2008	Chapter 3,4
3	**Software architecture and RTOS:** Software Architecture: Round Robin- Round Robin with interrupts -Function Queue. Scheduling Architecture RTOS: Architecture -Tasks and Task States -Tasks and Data -Semaphores and Shared Data Message Queues -Mail Boxes and pipes -Timer Functions -Events -Memory Management Interrupt Routines		8	NA	Embedded Systems Architecture, Programming and Design, Ral Kamal TMH, 2008	Chapter 5
4	**Basic design using a real time operating system**: Overview. General principles. Design of an embedded system.		6	NA	Embedded Systems Architecture, Programming and Design, Ral Kamal TMH, 2008	Chapter 3,7
5	**Software development tools and debugging techniques:** Development Tool: Cross-Compiler, Cross-Assemblers, Linker/locator. PROM Programmers, ROM Emulator, In-Circuit Emulators. Debugging Techniques. Instruction set simulators. The assert macro. Testing using laboratory tools.		8	NA	Embedded Systems Architecture, Programming and Design, Ral Kamal TMH, 2008	Chapter 12

Lesson Plan:

Module	Working Day	Lesson Plan – Description
Module 1: Introduction to Embedded systems		
	1	**Syllabus discussion: Overview of the course structure, objectives, and outcomes**
	2	Introduction – Features – Microprocessors
	3	ALU - Von Neumann and Harvard Architecture
	4	CISC and RISC - Instruction pipelining
	5	Microcontroller: characteristics and Features
	6	Overview and architectures of Atmel 89C52
	7	Microchip PIC16F877 and 18F452
	8	Examples of embedded Systems: Bar-code scanner
	9	Laser printer
	10	Underground tank monitoring.
Module 2: PIC Microcontroller		
	11	IoT Networking Basics: Overview of internet communications, M2M communication
	12	MQTT Protocol: Basics, message structure, application examples in IoT
	13	CoAP and REST API: Introduction to CoAP, RESTful architecture, use in lightweight IoT systems
	14	Other Communication Protocols: RFID, IEEE 802.15.4, Zigbee; Comparison and use cases
	15	LoRa and Bluetooth: Low-power wireless technologies for IoT, application scenarios
	16	6LoWPAN and WiFi: Features and benefits for IoT, integration in IoT devices
	17	gRPC Protocol: Introduction, role in IoT communication, practical examples
	18	IoT Connectivity Technologies: Comparative study, design considerations

	19	Standards in IoT: International standards and regulations, role in global IoT deployment
	20	Lab Session on IoT Protocols: Practical implementation of MQTT and CoAP, network simulation tools
Module 3: Software architecture and RTOS		
	21	Introduction to Arduino Programming: Basics of Arduino IDE, simple LED and sensor programming
	22	Integration of Sensors: Interfacing analog and I2C sensors with Arduino, practical examples
	23	ESP8266 WiFi Module: Features, applications, connecting to Arduino for IoT projects
	24	Introduction to Python for IoT: Basics of Python programming, Python libraries for IoT
	25	MicroPython Programming: Overview, examples with ESP8266 and sensors
	26	Introduction to Raspberry Pi: Setup, features, basic IoT applications using Raspberry Pi
	27	Introduction to Pico: Features of Raspberry Pi Pico, IoT examples using MicroPython
	28	Implementation of Raspberry Pi using MicroPython: Part 1
	29	Implementation of Raspberry Pi using MicroPython: Part 2
	30	Lab Session on Microcontrollers: Hands-on integration of sensors and WiFi modules, IoT project simulation
Module 4: Basic design using a real time operating system		
	31	Introduction to Cloud Computing: Overview of cloud models and implementation, role in IoT data management
	32	IoT Data Storage and Analytics: Methods for storing and analyzing IoT data, challenges and solutions
	33	Machine Learning in IoT: Overview of ML concepts for IoT, applications in predictive analytics
	34	Selected ML Algorithms in IoT: Implementing algorithms like k-NN, regression, real-world use cases
	35	Cloud Platforms for IoT: Examples like AWS IoT Core, Google Cloud IoT, practical examples and integration
	36	IoT Analytics: Part 1

	37	Lab Session on Cloud Analytics: Uploading IoT data to the cloud, visualizing data using analytics tools
Module 5: Software development tools and debugging techniques		
	38	Home Automation and Precision Agriculture: Smart homes (lights, appliances, security systems), agriculture (irrigation, crop monitoring)
	39	Smart Vehicles and Traffic Management: IoT in autonomous vehicles, traffic optimization systems
	40	Smart Grid and Energy Optimization: IoT in energy management, examples of smart grids
	41	IoT in Healthcare: Wearable health monitoring devices, remote health diagnostics
	42	Real-World Design Constraints: Scalability, security, cost issues, overcoming real-world IoT challenges
	43	Capstone Project Review: Discussion of project ideas, course wrap-up, future trends in IoT
	44	Advanced IoT Applications: Exploration of cutting-edge IoT applications and technologies

Text Books

1. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.

Reference Books

1. Bimal K. Bose, “Modern power electronics and AC drives”, Prentics Hall, 2002.
2. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.
3. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.

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Syllabus and Lesson Plan for B.Tech Admission Batch 2022

Subject Name: VLSI Circuits **Credit: 2** **Lecture Hours: 40**

Subject Code: OEC-EE 701 B

Pre-requisite: Analog and Digital Electronics

Course Objective:

The purpose of learning this course is-

1. To design digital systems
2. To understand and implement verilog code.
3. To analyse Design of Arithmetic function

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Apply arithmetic function

CO2. Obtain the Algorithmic State Machine Charts,

CO3. Design of memories

CO4. Obtain simulation, Synthesis, Place and Route, and Back Annotation

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction and Fundamental concepts:** MOS, PMOS, CMOS, and BiCMOS, Technologies, VLSI systems, CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture.	9
2	**VLSI Circuit Design Processes:** VLSI design flow, MOS layers, Stick diagram, Design rules and layout, Lambda-based design rules for wires, contacts and transistors, Layout diagrams for NMOS and CMOS inverters and gates, Scaling of MOS circuits, limitations of scaling. FSM & HDL, different modeling styles in Verilog, Data types and objects, Dataflow.	9
3	**Gate Level Design:** Logic gates and complex gates, switch logic, alternate gate circuits, sheet resistance R_s and its concept to MOS, area capacitance calculations, inverter delays, Fan-in and Fan-out	7
4	**Packaging and Testing:** Types of IC packages, package models, Flip-chip package, CMOS testing, need for testing, Test principles, Design strategies for test, chip level and board level test techniques, FPGA, Xilinx	5

Suggested Learning Resources:

Name of the Text Book	Author Name	Edition	Publisher Name	Chapter No.	Module No. and Name of the proposed Syllabus
CMOS Digital Integrated Circuits Analysis & Design	Kang, Leblebici	3rd Edition	PHI	Chapter 2,3,5, 7	Module 1
				Chapter 14,	Module 2
				Chapter 16	Module 4
VLSI design	Debaprasad Das	2nd Edition	Oxford University Press	Chapter 1, 2, 16	Module 1
				Chapter 3, 4, 5	Module 2
				Chapter 6, 8, 9	Module 3
				Chapter 13,14,15	Module 4

Text Books

1. Kang, Leblebici, CMOS Digital Integrated Circuits Analysis & Design, 3rd Edition, PHI.
2. Debaprasad Das, VLSI design, 2nd Edition, Oxford University Press

Reference Books

1. N. Weste and K. Eshranghian, Principles of CMOS VLSI Design, Addison Wesley. 1985
2. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985
3. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
4. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
5. D. Perry, VHDL, 2nd Ed., McGraw Hill International, 1995

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Big Data Analysis **Credit: 2** **Lecture Hours: 48**

Subject Code: OEC-EE 702 A

Pre-requisite: Data base management system

Course Objective(s):

The purpose of learning this course is-

1. Understand big data for business intelligence.
2. Learn business case studies for big data analytics.
3. Understand nosql big data management.
4. Perform map-reduce analytics using Hadoop and related tools

Course Outcomes:

At the end of this course, students will demonstrate the ability to

C**O1** Describe big data and use cases from selected business domains
C**O2** Explain NoSQL big data management
C**O3** Install, configure, and run Hadoop and HDFS
C**O4** Perform map-reduce analytics using Hadoop

Detailed Syllabus

Module	Content	Hour
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
2	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
3	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
4	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	7
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6
Total		48

Suggested Learning Resources:

Text Books

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017)

Reference Books:

1. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

Alan Gates, "Programming Pig", O'Reilley, 2011.

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Syllabus and Lesson Plan for B.Tech Admission Batch 2022

Subject Name: Computer Network **Credit: 2** **Lecture Hours: 40**

Subject Code: OEC-EE 702 B

Pre-requisite: Analog Communication, Digital Communication, Wireless Networks, Embedded systems, Operating Systems

Course Objective:

To expose the students to the following:

1. Learn the functions of the different layer of the OSI Protocol.
2. Able to draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. Able to develop the network programming for a given TCP/IP protocol.

Course Outcome:

Upon completion of this course, students should be able to:

1. CO1: Remember functional block diagram of different network.
2. CO2: Explain the functions of the different layer of the OSI Protocol
3. CO3: Apply TCP/IP protocol for the network programming
4. CO4: Analyze the configuration of DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open-source available software and tools

Relevant Links:

Coursera Hyperlinked	**Nptel**	**LinkedIn Learning:**	**Infosys Springboard:**

Detailed Syllabus

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	Academic Mapping: CTE Model Curriculum for (aicte-india.org) **Industry Mapping:**	7		Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill	Ch 1, Ch 2
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.	Academic Mapping: CTE Model Curriculum for (aicte-india.org) **Industry Mapping:**	8		Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill	Ch 10, Ch 11, Ch 12, Ch 13, Ch 14, Ch 15, Ch 16, Ch 17, Ch 18
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	Academic Mapping: CTE Model Curriculum for6(aicte-india.org) **Industry Mapping:**	6		Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill	Ch 19, Ch 20, Ch 21, Ch 22

4	Transport Layer-Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	Academic Mapping: CTE Model Curriculum for (aicte-india.org) **Industry Mapping:**	6		Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill	Ch 23, Ch 24
5	Application Layer-Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	Academic Mapping: CTE Model Curriculum for (aicte-india.org) **Industry Mapping:**	6		Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill	Ch 25, Ch 26, Ch 27, Ch 29

TEXT BOOK:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.

REFERENCE BOOKS:

1. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
2. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
3. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
4. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Human Resources Development & Organisational Behaviour **Credit: 2**

Subject Code: HSMC- 701 **Lecture Hours: 24**

Pre-requisite: English, Basic knowledge of Management

Relevant Links: Study Material Coursera NPTEL

Course Objectives:

At the end of this course, students will demonstrate the ability to

1. Build up Organizational Behaviour, Personality and Attitude
2. Develop Group Behaviour & Communication skill
3. Handle the Organizational Politics.
4. Improve Organizational Design structure

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. know how to behave in organization, to develop attitude, personality, perception, motivation
CO2. know about Group Behaviour, communication, leadership
CO3. know about Organizational Politics, conflict management
CO4. Design of organisation

Detailed Syllabus

Module	Content	Hour
1	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.	2
2	Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.	2
3	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual electivity, Link between Perception and Decision Making.	2
4	Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	4
5	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.	2
6	Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.	2
7	Leadership: Definition, Importance, Theories of Leadership Styles.	2
8	Organizational Politics: Definition, Factors contributing to Political Behaviour.	2
9	Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.	2
10	Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Conceptsof Organizational Climate and Organizational Culture	4

Lesson Plan:

Module 1: Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

Sl. No.	Day	Description	Recommended books for the topic
1	Lecture-1	Define Organizational Behaviour, its importance, and historical background.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
2	Lecture-2	Discuss key OB concepts, challenges, and future opportunities.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 2: Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

Sl. No.	Day	Description	Recommended books for the topic
3	Lecture-3	Explain the meaning of personality and its key determinants and traits.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
4	Lecture-4	Describe how personality develops and influences workplace behavior.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
5	Lecture-5	Examine types of attitudes, their impact on job satisfaction, and organizational outcomes.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 3: Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual electivity, Link between Perception and Decision Making. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

Sl. No.	Day	Description	Recommended books for the topic
6	Lecture-6	Define perception and explain its nature and significance in organizational behaviour.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
7	Lecture-7	Identify key factors that influence perception and the concept of perceptual selectivity.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
8	Lecture-8	nalyze the link between perception and decision-making in the workplace.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 4: Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

Sl. No.	Day	Description	Recommended books for the topic
9	Lecture-9	Define motivation and its relevance in influencing employee behavior and performance.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
10	Lecture-10	Discuss content theories of motivation including Maslow's, McGregor's, Herzberg's, Alderfer's, and McClelland's models.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
11	Lecture-11	Explain Vroom's Expectancy Theory and its application in understanding motivation at work.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 5: Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

12	Lecture-12	Describe the characteristics, types, and stages of group development in organizations	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
13	Lecture-13	Explore group decision-making processes and their impact on organizational effectiveness.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 6: Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. . (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

14	Lecture-14	Explain the communication process and its directional flow within an organization.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

15	Lecture-15	Identify common barriers to effective communication and strategies to overcome them.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 7: Leadership: Definition, Importance, Theories of Leadership Styles. . (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

16	Lecture-16	Define leadership and its importance in guiding and influencing teams	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
17	Lecture-17	Discuss major theories and styles of leadership in organizational settings.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 8: Organizational Politics: Definition, Factors contributing to Political Behaviour. . (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

18	Lecture-18	Define organizational politics and its role in workplace dynamics.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
19	Lecture-19	Analyze key factors that contribute to political behavior in organizations.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 9: Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

20	Lecture-20	Compare traditional and modern views of conflict, including functional and dysfunctional aspects.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

21	Lecture-21	Examine the conflict process along with negotiation strategies and the negotiation process.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Module 10: Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Conceptsof Organizational Climate and Organizational Culture. (Prof. Riya Barui Prof. Dr. Samapika Das Biswas)

22	Lecture-22	Introduce various organizational structures and their influence on employee behavior.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill
23	Lecture-23	Explain the concept and significance of organizational climate in shaping workplace experiences.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

24	Lecture-24	Discuss organizational culture and its role in guiding values, beliefs, and practices within an organization.	**Text Books:** Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education Organizational Behavior, Luthans, Fred, McGraw Hill

Suggested Learning Resources:

Text Books:

1. Organizational Behavior, Robbins, S. P. & Judge, T.A, Pearson Education
2. Organizational Behavior, Luthans, Fred, McGraw Hill

Reference Books:

1. Understanding Organizations – Organizational Theory & Practice in India, Shukla, Madhukar, PHI
2. Principles of Organizational Behaviour, Fincham, R. & Rhodes, P. , OUP
3. Management of Organizational Behavior Leading HumanResources, Hersey, P., Blanchard, K.H., Johnson, D.E.- PHI