



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



6th Semester Syllabus for B.Tech ECE

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Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1.	CC	PCCEC601	Control System	3	0	0	3	3
2.	CC	PCCEC602	Computer Network	3	0	0	3	3
3	CC	PCCEC603	Digital Signal Processing	3	0	0	3	3
3.	ECEL	PEEC604	<u>Program Elective-2</u> A. Nano Electronics B. Industrial Automation II C. Internet of Things D. Power Electronics	3	0	0	3	3
		PEC602	Automotive					
4.	OEC	OEEC604	<u>Open Elective-1</u> A. Deep learning with Generative AI B. Operating Systems	3	0	0	3	3
5.	GSC	ESP 602	Essential Studies for Professionals (EC) - VI	1	0	0	1	0.5
6.	GSC	HSM 605	Principles of Management	2	0	0	2	2
7.	CC	PCCEC691	Control System Laboratory	0	0	2	2	1
8.	CC	PCCEC692	Computer Network Laboratory	0	0	2	2	1
9	CC	PCCEC693	Digital Signal Processing Laboratory	0	0	2	2	1
10	CC	PCCEC694	Design Lab	0	0	2	2	1

9.	Sessional	PCCEC681	Advanced VLSI Design	0	0	2	2	1
10.	GSC	SDP 682	SDP VI	0	0	1	1	0.5
11.	ECP	PRJEC681	Mini Project	-	-	-	2	1
12.	Mandatory Course	MAR 681	Mandatory Additional Requirement (MAR)	0	0	0	0	0
13		IFC	Industry and Foreign Certification	0	0	0	0	0
Total Credit Points =								23



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Subject Name: CONTROL SYSTEM
Subject Code: PCCEC601
Credit: 3
Lecture Hours: 36

Pre-requisite: Transient analysis, electrical machines, Laplace transformation, calculus.

Coursera link: <https://www.coursera.org/learn/modeling-feedback-systems>

Linkedin learning: <https://www.linkedin.com/learning/search?keywords=control%20system&u=229219690>

Study material:

<https://docs.google.com/presentation/d/1lYoVA1SLnVyczxScaAkpo81t4BlqGxif/edit?usp=sharing&oid=103182554906530888608&rtpof=true&d=true>

COURSE OBJECTIVE:

1. To learn basic linear control systems.
2. To learn how control system is used in industrial sectors.
3. To learn about stability of control systems for SISO systems.
4. To learn State Space analysis for MIMO systems.

COURSE OUTCOMES:

1. Know the basic control system & it's applications, concept of open loop and closed control systems
2. Define and explain Transfer function, feedback control system and discuss the importance of performance, robustness and stability in control design
3. Student will be able to calculate the transfer function by applying block diagram reduction methods and signal

flow diagrams for representations of different control systems.

4. Student will learn time and frequency domain analysis, calculation of static and dynamic error for the system. They will learn to calculate the stability of linear control systems using different frequency domain analysis methods such as root locus, Nyquist and Bode plot techniques for the open and closed loop systems.
5. Student will be able to learn design and study of different controllers such as PI, PD and PID controllers.
6. Student will learn State Space analysis for MIMO systems.

Module number	Topic	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment (PCCECE601)	Text Books/ Study Material
1	Introduction to control system	Types of control system, concept of feedback and automatic control systems, linear and nonlinear systems, examples of feedback control systems. Transfer function concept, pole and zeroes of a transfer function, properties of transfer function. Block diagram representation of control systems with block diagram reduction method, signal flow graph &	International Academia : https://web.stanford.edu/class/archive/ee/ee392m/ee392m.1056/ AICTE-prescribed syllabus:(https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)	6	Familiarization with MATLAB Control System tool Box, LAB- SIMULINK tool box & pSPICE	Linear Control System: B S Manke, Khanna Publishers. Chapter 1 Chapter 2 Chapter 3 Chapter 4

		Mason's gain formula.				
2	Mathematical modelling of dynamic systems:	Translation & rotational systems, electrical analogy of spring-mass-dashpot system, transfer function model of mechanical & electrical systems, servomechanism. Control system components: Synchro's, tachogenerators, servomotors, actuators.	International Standards: https://web.stanford.edu/class/archive/ee/ee392m/ee392m.1056/ AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	4	Simulation of step response & impulse response for Type- I & Type-II system with unity feedback using MATLAB & pSPICE.	Linear Control System: B S Manke, Khanna Publishers Chapter 5
3	Time domain analysis & State variable analysis	Performance specifications in time-domain, concept of undamped natural frequency, damping, overshoot, rise time and settling time. Step and impulse response of first and second	International Standards: https://web.stanford.edu/class/archive/ee/ee392m/ee392m.1056/ International Standards: https://efaidnbmnnnibpcajpcglclefin.dmkaj/https://lall.stanford.edu/engr210a/lectures/lecture4_2001_10_10_01.pdf	14	Determination of step response for 1st order & 2nd order system with unity feedback on CRO & calculation of control system specifications for variations of system design using MATLAB	Linear Control System: B S Manke, Khanna Publishers Chapter 6 & Chapter 9 Control Systems Engineering, R.

		order systems, effects of pole and zeros on transient response. Steady state errors & error constants in control systems due to step, ramp and parabolic inputs. Concepts of state variable, state space model, solution of state equations, Diagonalization of transfer function, eigenvalues. Concept of Controllability & Observability. PI, PD and PID controllers.	AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf		Finding transfer function, output response and characterization for different systems from a state model using MATLAB. State Space model for classical transfer function using MATLAB. Determination of PI, PD, and PID controller action on simulated process using MATLAB /Instrument set up. Design and hardware implementation of a temperature Controller, PID controller, DC Position Controller and linear system simulator.	Anandanatarajan & P. Ramesh Babu, Scientech Publications. Chapter 2
4	Stability Analysis	Stability by pole location, Routh-Hurwitz criteria and applications. Root locus	International Standards: https://web.stanford.edu/class/archive/ee/ee392m/ee392m.1056/	12	Evaluation of steady-state error, setting time, percentage peak overshoots, gain	Linear Control System: B S Manke,

		techniques, construction of root loci for simple systems, effects of gain on the movement of pole and zeros. Frequency domain analysis of linear system: Relationship between time & frequency response, Polar plots, Bode plots. Stability in frequency domain, Nyquist plots, Nyquist stability criterion, measure of relative stability, phase and gain margin.	AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Mode1_Curriculum/Final_ECE.pdf)		margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB. Determination of stability using MATLAB simulation for various methods : Root locus, Nyquist and Bode Plot	Khanna Publishers Chapter 7
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Text Books:

1. Linear Control System: B S Manke, Khanna Publishers.
2. Control Systems Engineering, I. J. Nagrath & M. Gopal, New Age International Publishers

Reference Books:

1. Control Systems Engineering, R. Anandanatarajan & P. Ramesh Babu, Scientech Publications.
2. Automatic Control Systems (with MATLAB programs), S. Hasan Saeed, S. K. Kataria & Sons



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Subject Name: Computer Network

Credit: 3

Lecture Hours: 36

Subject Code: PCCECE602

[Study Material](#)

[Coursera Learning](#)

[Linkedin Learning](#)

[NPTEL](#)

COURSE OBJECTIVES:

1. To familiarize with the basic terminologies and concepts of OSI, TCP/IP reference model and functions of various layers.
2. To understand the ARQ protocols, design and performance issues associated with the functioning of LANs and WLANs.
3. To impart knowledge on IP addressing and basics of transport layer protocol.
4. To impart knowledge on cryptography and network security.

COURSE OUTCOMES:

CO 1: State the functions of the OSI, TCP/IP reference models, various switching techniques and internetworking devices. CO 2: Explain various switching techniques and Internet Protocol.

CO 3: Able to analyze various types of LAN and WAN technologies, different topologies, error detection techniques and ARQ protocol.

CO 4: Analyze the importance DNS, FTP, SMTP and HTTP, WWW, routing techniques and design subnets with information security.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	Overview of Data Communication and Networking	Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study. Physical Level: Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;	International Academia: https://ocw.mit.edu/course/s/6-829-computer-networks-fall-2002/pages/syllabus/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Cisco Packet Tracer, NS3, Wireshark, Cable connections.	5	DATA COMMUNICATIONS AND NETWORKING by Behrouz A. Forouzan: Part 1: Chapter 1 & 2 Part 2: Chapter 3 – 9	1. Familiarization with Transmission media and tools: Co-axial cable, UTP cable, Crimping tool, Connectors etc. 2. Preparing the UTP cable for cross and direct connection using crimping tool. 3. Study of various LAN topologies and their creation using network devices, cables and Computer.

2	Data link Layer	Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow	International Standards : https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/pages/syllabus/	5	DATA COMMUNICATIONS AND NETWORKING by	1. Write a program to implement GO BACK N ARQ Protocol. 2. Write a program to
		control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium Access sub layer: Point to Point Protocol, LCP, NCP, and Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, and fast Ethernet (in brief).	fall-2002/pages/syllabus/ AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Cisco Packet Tracer, NS3, Wireshark, Cable connections.		Behrouz A. Forouz an: PART 3: Data Link Layer Chapter 10 – 16	implement Stop & wait ARQ and Selective repeat ARQ Protocol

3	Network layer:	Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing: techniques, static vs. dynamic routing, Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, and IPV6.	International Standards : (https://ocw.mit.edu/course/s/6-829-computer-networks-fall-2002/pages/syllabus/ AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Cisco Packet Tracer, NS3, Wireshark, MATLAB.	6	DATA COMMUNICATIONS AND NETWORKING by Behrouz A. Forouzan: PART 4 Network Layer Chapter 19 – 22	1. Study and implementation of network IP to configure a network. 2. Configure a LAN topology using packet tracer software. 3. Configure a Network using Distance Vector Routing protocol. 4. LEACH Routing Protocol for a WSN using MATLAB 5. Ad Hoc On-Demand Distance Vector Routing algorithm using MATLAB
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4	Transport layer	Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,	International Standards: (https://ocw.mit.edu/course/s/6-829-computer-networks-fall-2002/pages/syllabus/ AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Cisco Packet Tracer, NS3, Wireshark.	6	DATA COMMUNICATIONS AND NETWORKING by Behrouz A. Forouzan: PART 5: Transport Layer Chapter 23	1. Configuration of TCP/IP protocols in Window/LINUX. 2. Write a program to implement Leaky bucket algorithm.
5	Application Layer	Introduction to DNS, SMTP, FTP, HTTP & WWW.	AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Cisco Packet Tracer, NS3, Wireshark.	4	DATA COMMUNICATIONS AND NETWORKING by Behrouz A. Forouzan: PART 6: Application Layer Chapter 25, 27 & 28	1. Study of socket programming and client-server model. 2. Configuration of TELNET protocols on router for remote access. 3. Mobility modeling for vehicular communication networks using MATLAB 4. AI for Positioning Accuracy Enhancement using MATLAB
6	Network Security	Cryptography (Public, Private Key based), Digital Signature, Firewalls.	AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	4	DATA COMMUNICATIONS AND NETWORKING by Behrouz A. Forouzan:	Implementation of different network security protocols.

		Modern topics: ISDN services & ATM, DSL technology Wireless LAN: IEEE 802.11, Introduction to blue-tooth. Fire Walls: Fire wall Design Principles.	india.org/sites/default/files/ Model_Curriculum/Final ECE.pdf Industry Mapping: Cisco Packet Tracer, NS3, Wireshark.		NETWORKING by Behrouz A. Forouzan: PART 7: Security Chapter 30 – 32	
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Text Book:

1. “DATA COMMUNICATIONS AND NETWORKING” by Behrouz A.

Forouzan, 4th Edition. **Reference Books:**

1. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
2. Bhavneet Sidhu, “An Integrated Approach to Computer Networks”, Khanna Publications.



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Subject Name: Nano Electronics
Credit: 3

Lecture Hours: 40

Subject Code: PEEC604A

Pre-requisite: Physics, Electronic devices, VLSI

Relevant Links:

[Study Material](#)

<https://drive.google.com/file/d/154qOeFOUvNYyhsj9Zk6BuJVQWW78EqZf/view?usp=sharing>

[Coursera:](#)

[1] <https://www.coursera.org/learn/nanotechnology1>

[2] <https://www.coursera.org/learn/nanotechnology>

[NPTEL:](#)

[1] <https://nptel.ac.in/courses/113106093>

[2] <https://nptel.ac.in/courses/113104102>

[Linkedin Learning:](#)

[1] <https://www.linkedin.com/learning/quantum-cryptography-and-the-future-of-cybersecurity/what-is-quantum-physics?u=229219690>

[2] <https://www.linkedin.com/learning/quantum-computing-fundamentals/learn-quantum-computing?u=229219690>

COURSE OBJECTIVES:

1. To introduce the basic terminologies and concepts of Nanotechnology, Quantum Mechanics, Schrödinger equation, DOS, Degeneracy, Eigen values and Eigen Functions
2. To impart knowledge on CMOS Scaling, The nanoscale MOSFET, limitations of scaling
3. To impart knowledge on the working principle of various quantum devices viz. Resonant Tunneling Diode, Single electron transistors
4. To impart knowledge on Carbon based nanomaterials viz. Carbon nanotube, Graphene, GNR, TMDs

COURSE OUTCOMES:

CO 1: Understand various parameters of nano-electronics and nano-technology viz. eigen values and eigen functions, DOS etc. in addition with the MOS device parameters. Describe the importance of different CMOS scaling and their limitations. Students can explain band theory of solids, basics of quantum mechanics, Schrödinger equation

CO 2: Apply/use the aforementioned knowledge in different quantum devices viz. Resonant Tunneling Diode (RTD), Single electron transistors (SET). They can interpret various aspects of nano-technology and the processes involved in making nano-components and material.

CO 3: Differentiate different modes of operation in a nanoscale MOSFET. They can distinguish and optimize different parameters for obtaining optimal performance of the nanoscale MOSFET. Analyze and examine different carbon based nanomaterials viz. Carbon nanotube, Graphene, GNR

CO 4: Construct density of states (DOS) function for the following 3D, 2D, 1D structure viz. quantum well, quantum wire and quantum dot

	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	Basics of Nano Technology and Engineering Quantum Mechanics	Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States: 3D, 2D, 1D and the concepts of respective quantization. Particle in a box Concepts, Energy Eigen values and Eigen Functions, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones, Quantum wells, wires and dots (descriptive + n_0 electron concentration), Electronic properties of various technologically important Nano Structured materials having various band structures, Potential Impact of Artificial Intelligence in nanotechnology, Neural Schrödinger Equation, Machine learning for the solution of the Schrödinger equation	International Academia: https://online.stanford.edu/courses/soe-veeqmse01-quantum-mechanics-scientists-and-engineers https://ocw.mit.edu/courses/8-321-quantum-theory-i-fall-2017/pages/syllabus/ AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Python (NumPy, SciPy, Matplotlib), MATLAB, NanoHub's RTD simulation	15	The physics of Low Dimensional Semiconductors, J. H. Davies, Cambridge University Press, 1998 (Chapter 1)	- Calculate and visualize energy eigenstates and wavefunctions for a particle in a potential well. - Solve the Schrödinger equation numerically for a particle in an infinite potential well using Python and MATLAB. - Plot the energy levels and corresponding wavefunctions.

2	Fundamentals of Nanoscale MOSFETs and Quantum Devices	CMOS Scaling, The nanoscale MOSFET, Limits to Scaling, Transmission coefficient as a function of energy in square potential barrier, Resonant Tunneling Diode (RTD), Single	<i>International Standards</i> 1. https://online.stanford.edu/courses/ee316-advanced-vlsi-devices 2.	15	Fundamentals of Modern VLSI Devices, Yuan Taur, Tak H. Ning, 1998 (Chapter 2-5, 10)	1. Simulate the potential barrier at the source-channel junction for different
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		electron transistors (SET), Artificial Intelligence Networks in Nano-scale MOSFET Modeling, Modeling of the Degradation of Resonant-Tunneling Diodes Using Artificial Neural Networks, Machine learning based analytical study of single electron transistor	https://ocw.mit.edu/course/s/6-701-<u>introduction-to-nanoelectronics-spring-2010/</u> AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Software-TCAD for Semiconductor Process and Device Simulation, MATLAB, NanoHub's RTD simulation			V_{DS} 2. Calculate the shift in V_{th} with increasing V_{DS} 3. Simulate and analyze the I-V characteristics of an RTD and observe the quantum mechanical tunneling and negative differential resistance (NDR). 4. Simulate and observe the Coulomb blockade effect in an SET and study the influence of gate voltage on current.
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3	Discussions on Nano materials like graphene, and its different derivatives	Graphene: 2D structure, properties, Band Structure, Dirac point, GNR and CNT (Elementary discussion), Transition-metal dichalcogenide (TMD), Recursive neural network in the applications of 2D materials, Recent Advances	International Standards : 1. https://online.stanford.edu/courses/e311-advanced-integrated-circuits-technology 2. https://ocw.mit.edu/courses/	10	G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009 (Chapter 5)	1. Simulate the electronic properties of Graphene Nanoribbons (GNRs) using quantum computing
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		of in Artificial Intelligence and in machine learning for the study of Graphene and Related 2D Materials	8-513- modern-quantum-many-body-physics- for-condensed-matter-systems-fall-2021/ AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Software: Qiskit, Python (NumPy, Matplotlib)			frameworks like Qiskit. 2. Model the GNR as a quantum system with defined source and drain regions. Use Qiskit's quantum circuit tools to represent electron transport through the ribbon.
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TEXT BOOKS:

1. The physics of Low Dimensional Semiconductors, J. H. Davies, Cambridge University Press, 1998, (Module 1: Chapter 1)
2. Fundamentals of Modern VLSI Devices, Yuan Taur, Tak H. Ning, 1998 (Module 2: Chapter 2-5, 10)
3. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009. (Module 3: Chapter: 5)

REFERENCE BOOKS:

1. Basic Electronics, Debashish De and Kamakhya Prasad Ghatak, Pearson Publisher, 2010 (Module 1: Chapter 1)
2. Semiconductor Devices: Physics and Technology, S. M. Sze, M. K. Lee, John Wiley & Sons, 3rd Edition (Module 2: Chapter: 5, 6)
3. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003 (Module 3: Chapter: 5.4, 5.5)



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Subject Name: Industrial Automation – II

Credit: 3

Lecture Hours: 20

Subject Code: PEEC604B

Pre-requisite: Industrial Automation – I

Course Objectives

1. To understand process control techniques and real-time feedback systems.
2. To develop PLC programming for real industrial applications.
3. To learn integration of SCADA/HMI, communication networks, and control hardware.
4. To familiarise students with VVVF drive and servo control principles.
5. To introduce Industry 4.0 automation concepts such as IoT-enabled automation.

Course Outcomes (CO)

- CO1** Analyze process control strategies such as PID, Ratio, Feedforward and Adaptive control.
- CO2** Develop PLC-based automation programs for industrial processes.
- CO3** Integrate PLC with SCADA, drives and communication networks.
- CO4** Apply automation concepts in Industry 4.0 frameworks including IIoT and remote monitoring.

Module No.	Topic	Sub-Topics	Mapping	Lecture Hours	Lab / Practical Work
1	Process Control System	Industrial Process Control Techniques: ON/OFF Control, Feedback Control & Feed Forward Control, Ratio Control, Split Range Control & Adaptive Control, PID Control.	Syllabus proposed by Automation Industry (SMS India Pvt Ltd.)	3	Industrial Project (SMS India Pvt Ltd.)
2	Control System Design	Basic & Detail Engineering: Engineering Drawings etc. Selection of Control System Hardware & Software, Control System Network Design.	Syllabus proposed by Automation Industry (SMS India Pvt Ltd.)	5	Industrial Project (SMS India Pvt Ltd.)
3	VVVF Drives	Basics about VVVF Drives.	Syllabus proposed by Automation Industry (SMS India Pvt Ltd.)	1	Industrial Project (SMS India Pvt Ltd.)
4	PLC Programming	PLC Programming for Different Types of Control Systems.	Syllabus proposed by Automation Industry (SMS India Pvt Ltd.)	11	Industrial Project (SMS India Pvt Ltd.)

Text Books

1. Programmable Logic Controllers – Frank D. Petruzella
2. Process Control Instrumentation Technology – Curtis Johnson
3. Industrial Control Systems – Bolton

Reference Books

1. ABB VFD Application Manuals
2. Siemens SCADA & HMI Technical Guides
3. IIoT and Industry 4.0 Guide – IEC 62443 compliance



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Subject Name: Internet of Things

Credit: 3

Lecture Hours: 36

Subject Code: PEEC604C

Course Objective:

On successful completion of the course students will be able to:

1. Able to understand the application areas of IOT
2. Able to understand building blocks of Internet of Things and characteristics
3. Able to realize the revolution of Internet in Mobile Devices & Sensor Networks

Course Outcome:

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

1. Get familiarize with IoT and understand its internet communications and various communication protocols
2. Understand Arduino programming and Connecting Arduino with ESP8266 WiFi module
3. Apply microPython programming with IoT modules and implement with Raspberry Pi & Pico.
4. Understand the application of IoT in Industrial Automation and Realworld Design Constraints.

Industry Mapping:

Coursera Assignments:

1. <https://www.coursera.org/specializations/developing-industrial-iot>
2. <https://www.coursera.org/specializations/iot>

3. <https://www.coursera.org/learn/iot-wireless-cloud-computing>

Linkedin Learning Assignments:

1. <https://www.linkedin.com/learning/iot-foundations-fundamentals>

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours
1	IoT Introduction and Fundamentals	Introduction to IoT, Concept of Smart sensors and actuators Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press): Chapter 4 (Emergence of IoT) & 5 (IoT Sensing and Actuation)	International Academia: https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf	6
2	Communication and Networking in IoT	L1- Basic of IoT networking Internet Communications: AnOverview MQTT, CoAP, REST Api and gRPC, Different Communication protocols :(RFID, IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth), LoRa, Machine-to-Machine (M2M) Communications, MQTT Broker Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press): Chapter 7 (IoT Connectivity Technologies) Chapter 8 (IoT Communication Technologies): 8.2, 8.4	International Standards : https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf)	10

3	Modern networking	Introduction to Arduino Programming, integration of Sensors having analog and i2c. Connecting Arduino with ESP8266 WiFi module, L1-Introduction to Python programming with IoT modules, Introduction & Implementation of Raspberry Pi, Pico using microPython in IoT Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press): Chapter 16 (Beginning IoT Hardware Projects) Arshdeep Bahga and Vijay Madisetti , “Internet of Things, a hands on approach” , Universities Press (India) Pvt. Ltd. 2017: Chapter 6 (IOT Systems- Logical design with Python) Chapter 7 (IOT Physical devices & Endpoints)	International Standards : https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20af%20addedum.pdf) Industry mapping: Python, micropython	8
4	Cloud Computing & IoT Analytics	Introduction to cloud computing, Cloud models & implementation; Introduction to ML in IoT and implementation of few selected algorithms in IoT Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press): Chapter 10 (Cloud Computing) & Chapter 17 (IoT Analytics)	International Standards : https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20af%20addedum.pdf)	6
5	IoT Applications	IoT applications like Home Automation, Precision Agriculture, Smart vehicles, Smart Grid Arshdeep Bahga and Vijay Madisetti , “Internet of Things, a hands on approach” , Universities Press (India) Pvt. Ltd. 2017: Chapter 9 (Case Studies illustrating IoT design) Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press):	International Standards : https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=EE%20284A:%20Introduction%20to%20Internet%20of%20Things&academicYear=20182019 AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20af%20addedum.pdf) Industry mapping: Python, micropython	6

		Chapter 12, 13, 14 & 15		
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Text Books:

1. “Introduction to IoT” by Sudip Misra, Anandarup Mukherjee, Arijit Roy (Cambridge University Press)
2. Arshdeep Bahga and Vijay Madisetti , “Internet of Things, a hands on approach” , Universities Press (India) Pvt. Ltd. 2017

Reference Book:

1. Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things Principles and Paradigms, Elsevier Inc



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Subject Name: POWER ELECTRONICS

Credit: 3

Subject Code: PEEC604D Lecture Hours: 38

Prerequisites: Basic knowledge about components, Resistors, Inductors, Capacitors; Network Theorems; Basic knowledge about the operation of Semiconductor devices (Transistor, Diode etc.); Fourier analysis.

Course Objective:

1. Different types of power semiconductor devices and their switching.
2. Operation, characteristics and performance parameters of controlled rectifiers.
3. Operation, switching techniques and basic topologies of DC-DC converters and switching regulators.
4. Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5. Operation of AC and DC drives.

Course Outcomes:

After completion of this course, students will be able to :

- CO1** Acquire knowledge on different power semiconductor devices with Gallium Nitride and Silicon as primary materials.
- CO2** Acquire knowledge on different AC to DC converters
- CO3** Acquire knowledge on different DC to DC converters.
- CO4** Acquire knowledge on different DC to AC converters and PWMs.

Relevant Links:

1. Link for Study Material:

<https://docs.google.com/document/d/1atmhTaG7lg9ZHa671lDrkaw42n8cPAwb/edit?usp=sharing&ouid=116508199826018918971&rtpof=true&sd=true>

2. Link for NPTEL Course:

i) https://onlinecourses.nptel.ac.in/noc19_ee37/preview

3. Link for Coursera Course:

<https://www.coursera.org/search?query=power%20electronics>

<https://www.coursera.org/search?query=introduction%20to%20power%20electronics>

<https://www.coursera.org/search?query=modeling%20and%20control%20of%20power%20electronics>

ii) https://onlinecourses.nptel.ac.in/noc24_ee130/preview

iii) https://onlinecourses.nptel.ac.in/noc19_ee37/preview

5. Link for Infosys Springboard Course:

i) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013986385481318400909/overview

ii) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384787217657856055552_shared/overview

iii) https://infyspringboard.onwingspan.com/web/en/ap/toc/lex_auth_0138417282215936002370_shared/overview

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Power Semiconductor Devices Using GaN and Silicon as primary materials: Text book: Md. H Rashid (Chapter 1, 2, 3, 7)	-Introduction, Operation, Ratings and Static and Dynamic Characteristics of Rectifier diodes, diode, Power BJT, Power MOSFET, SCR, TRIAC, IGBT and GTO. - Concept of Fast recovery diodes, Schottky diodes as freewheeling and feedback diode. -SCR turn-on and turn-off methods, Triggering, circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit.	As per International Standards : (https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on) and AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: LT-SPIICE software, Proteus, Matlab_Simulink.	6	No Lab

2.	Controlled Rectifiers: (AC to DC Converter) Text book : Md. H Rashid (Chapter 10)	-Single phase: Study of semi and full bridge converters for R, RL, RLE loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor. -Effect of source impedance, Input current, Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.	As per International Standards : (https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on) and AICTE-prescribed syllabus : (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: LT-SPICE software, Proteus, Matlab_Simulink	6	No Lab
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3	Choppers: (DC to DC Converter) Text Book: Md. H Rashid (Chapter 5)	-Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, -Step up and Step down choppers, -Control techniques for choppers -Time ratio control and current limit control, -Buck, Boost, Buck-Boost and Cuk Converters, - Concept of Resonant Switching	As per International Standards : https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on and AICTE-prescribed syllabus : https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: LT-SPICE software, Proteus, Matlab_Simulink.	6	No Lab
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4	Inverters: (DC to AC Converter) Text Book: Md. H Rashid (Chapter 6, 8, 9)	-Single phase and three phase inverters: -Principle of operation of half-bridge and full-bridge square wave and quasi-square inverter, - mathematical analysis for output voltage and harmonics.	As per International Standards : https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on	6	No Lab
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		–PWM techniques, Single pulse PWM, Multi pulse PWM, Sinusoidal PWM, modified Sinusoidal PWM, -mathematical analysis for output voltage and harmonics, harmonic Control using PWM, Series resonant inverter. -Single phase Current Source Inverter.	and AICTE-prescribed syllabus : https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: LT-SPICE software, Proteus, Matlab_Simulink.		
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5	Switching Mode Power Supplies: Text Book: Md. H Rashid (Chapter 14)	-Switching Mode Power Supplies: -Analysis of fly back, forward converters for SMPS, - Resonant converters, -Concept of soft switching, switching trajectory and SOAR, Load resonant converter -Series loaded half bridge DC-DC converter.	As per International Standards : https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on and AICTE-prescribed syllabus : https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf, Industry Mapping: LT-SPICE software, LabView, Proteus. Hardware Chipset: IC741, IC328.	5	No Lab
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6	Applications: Text Book: Md. H Rashid (Chapter 15 and 16)	-Power line disturbances, EMI/EMC, power conditioners. -Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings and sizing of UPS. -Separately excited DC motor drive. PM Stepper motor Drive. -EV Charger.	As per International Standards: (https://explorecourses.stanford.edu/search?q=Power+electronics&view=catalog&page=0&academicYear=&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&collapse=&filter-coursestatus-Active=on) and AICTE-prescribed syllabus : (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf), Industry Mapping: LT-SPIICE software, Proteus, Matlab_Simulink.	6	No Lab
7	Application of GEN AI Tools for Analysis and Design of Simple Power Electronic Circuits	-Introduction of GEN AI -Use of GEN AI for Analysis of Power Electronic Circuits - Use of GEN AI for Design of Power Electronic Circuits	https://in.mathworks.com/solutions/artificial-intelligence.html	3	No Lab

Text book and Reference books:

TextBook:

1. Muhammad H.Rashid, "Power electronics" Prentice Hall of India.

Reference Books:

1. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
2. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
3. V.R.Moorthi, "Power Electronics", Oxford University Press.
4. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



SUBJECT NAME: DEEP LEARNING & GENERATIVE AI

Credit: 3

Lecture Hours: 48

Subject Code: OEEC604A

Pre-Requisites: (1) Introduction to Artificial Intelligence & Machine Learning (PCEC403);
(2) Data Structures and Algorithms;
(3) Mathematics & Statistics (Linear Algebra, Statistics and Probability, Multivariate Calculus)

Relevant Links:

[Study Material](#)

[NPTEL](#)

[Coursera](#)

[LinkedIn Learning](#)

Course Objectives (CO): The primary objectives of this course are:

1. Introduce the fundamental principles and mathematical foundations of artificial neural networks and deep learning.
2. Equip students with practical skills to design, implement, and train deep neural network models using modern frameworks such as TensorFlow and PyTorch.
3. Explore convolutional neural networks (CNNs) and their applications in computer vision, object detection, and transfer learning.
4. Enable understanding of sequence modelling using RNN, LSTM, GRU, and their use in natural language processing tasks.
5. Provide conceptual and practical exposure to generative models like GANs and VAEs, and their applications in image generation, anomaly detection, and data synthesis. Encourage ethical thinking by addressing issues such as hallucination, bias, and fairness in generative AI systems
6. Introduce deep reinforcement learning and Q-learning as tools for intelligent decision-making in dynamic environments.

Course Modules:

Module & Topics	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours
1	Introduction to Artificial Intelligence, Machine Learning and Deep Learning	IIT Madras syllabus (CS6910: Deep Learning): https://www.cse.iitm.ac.in/~miteshk/CS6910.html https://www.cse.iitm.ac.in/~miteshk/CS6910.html	2
AI, ML and DL and their applications and Limitations of Machine Learning	Research Domains and Industry Applications a) Healthcare b) Manufacturing c) Retail d) Virtual Assistants e) Self-Driving Cars Major Limitations of Machine Learning versus Deep Learning: a) Over-Dependency on Data Quality and Quantity b) Over-Dependency on Model Selection c) Automatic feature selection (no manual feature engineering required) d) Scaling up to Data Volume Why Deep Learning?	International Academia: Stanford University: https://www.coursera.org/specializations/deep-learning international curriculum of Stanford CS231n MIT: https://ocw.mit.edu/course/s/6-s191-introduction-to-deep-learning-january-iap-2020/	
2	Understanding the Biological Neuron		6
Fundamentals of Neural Network	Exploring the Artificial Neuron Early Implementations of ANN: a) McCulloch-Pitts Model of Neuron b) Rosenblatt's Perceptron	<i>Industry Mapping:</i> TensorFlow, Keras, PyTorch	
	Types of Activation Functions: a) Linear Function b) Non-linear Function c) Softmax Function d) Thumb Rule for Selecting Activation Function	IIT Madras syllabus (CS6910: Deep Learning): https://www.cse.iitm.ac.in/~miteshk/CS6910.html	

	<u>Architectures of Neural Network:</u> a) Single Layer Feedforward Network b) Multi-Layer Feedforward ANN c) Convolution Network d) Recurrent Network <u>Learning Process in ANN:</u> a) Weight of Interconnection between Neurons b) Gradient Descent and Backpropagation <u>Deep Neural Network</u>	<u>International Academia:</u> <u>Stanford University:</u> https://www.coursera.org/specializations/deep-learning international curriculum of Stanford CS231n	
3	<u>Mathematics Behind Backpropagation</u>	<u>MIT:</u> https://ocw.mit.edu/course/s/6-s191-introduction-to-deep-learning-january-iap-2020/ Industry Mapping: TensorFlow, Keras, PyTorch	6
	Training Deep Neural Networks Deep L-Layer Neural Network: Stochastic Gradient Descent Other Optimization Algorithms Gradient Descent with Momentum <u>Regularization</u> a) L1/L2 Regularization b) Early Stopping c) Dropout Regularization d) Data Augmentation <u>Normalization of Inputs</u> a) Batch Normalization b) Group Normalization		
4	<u>Introduction to Computer Vision</u> a) Healthcare b) Manufacturing c) Agriculture How the computer sees the world Challenges faced by Traditional ANN to work with Image Data <u>Building blocks of Convolution Neural Network</u> a) Kernel/Filter b) Image Convolution c) Pooling <u>Building a Convolution Neural Network</u> a) Going under the hood of CNN b) Comparing CNN with traditional ANN		8
	Convolutional Neural Networks (CNNs) and its application in Computer Vision		

	<u>Popular CNN Architectures:</u> LeNet, AlexNet, VGGNet, ResNet, Inception Network, GoogLeNet, U-Net <u>Object Detection</u> a) Bounding Box b) Sliding Window based Object Detection c) YOLO Algorithm d) Landmark Detection <u>Transfer Learning</u> <u>Essential Pre-processing Task in Computer Vision</u> a) Image Scaling b) Data Augmentation		
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5	Introduction to Sequence Data a) Different types of tasks in Sequence b) Neural Networks: A Brief Revisit Recurrent Neural Network (RNN) a) Data Preparation for RNN b) Vanishing Gradient Problem and RNN Long-Short Term Memory (LSTM) Gated-Recurrent Units (GRU) Bi-directional Models – e.g., Bi-LSTM Encoder-Decoder Architecture Transformers & Attention Mechanism Transformer Architectures Language Modelling and Sequence Models --- Large Language Models (LLMs) Generative Artificial Intelligence (Gen AI) - Variational Autoencoders (VAE) Generative Adversarial Networks (GAN) a) Adversarial Examples b) Basic Concepts of GAN c) Few popular variants of GAN d) Application of GAN	IIT Madras syllabus (CS6910: Deep Learning): https://www.cse.iitm.ac.in/~miteshk/CS6910.html International Academia: Stanford University: https://www.coursera.org/specializations/deep-learning international curriculum of Stanford CS231n MIT: https://ocw.mit.edu/course/s/6-s191-introduction-to-deep-learning-january-iap-2020/ <i>Industry Mapping:</i>	18
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	Agentic-AI	TensorFlow, Keras, PyTorch	
6	Deep Reinforcement Learning:		8
Deep Reinforcement Learning	- Policy Gradients - Markov Decision Process - Q-learning in simulated environments. - Implementation of Deep Q-Learning - Overview of some popular Deep RL Algorithms Agentic-AI (implementing with RL)		

Course Outcome:

- 1) Understand the foundational concepts of neural networks, perceptron, and the architecture of deep neural models.
- 2) Analyze and implement deep learning training algorithms including backpropagation, optimization, and regularization techniques.
- 3) Design and evaluate convolutional neural networks (CNNs) for visual data processing, including object detection and segmentation.
- 4) Apply sequence-based models such as RNN, LSTM, GRU, and bidirectional architectures for tasks involving sequential data and language modeling.
- 5) Develop and utilize generative models such as GANs and VAEs for creative tasks, anomaly detection, and data augmentation.
- 6) Demonstrate basic applications of deep reinforcement learning and Q-learning in simulated environments.

Theory Textbooks:

1. ZLLS: Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola: Dive into Deep Learning (Cambridge University Press, December 2023). can be freely accessed online at: <https://d2l.ai/>
2. CA : Charu C. Aggarwal: “Neural Networks and Deep Learning” (Springer, 2nd edition, July, 2024)

(NOTE: Dr. Charu C. Aggarwal is a US-based award-winning Distinguished Senior AI Research Scientist at IBM T.J.Watson Research Center, Yorktown Heights, New York, USA, with a PhD in AI from MIT)

Theory Textbooks + Hands-On Implementation Guidebooks (in Python, using PyTorch framework):

1. AG: Aurelien Geron: Hands-On Machine Learning with Scikit-Learn and PyTorch: Concepts, Tools, and Techniques to Build Intelligent Systems – (O'REILLY – Shroff Publishers and Distributors India, December, 2025)

(Part-II consists of the DEEP LEARNING related portions)

2. NNP: Nithin Buduma, Nikhil Budhuma & Joe Pappa: “Fundamentals of Deep Learning” (O'REILLY, Shroff Publishers and Distributors, India, 2nd edition, May, 2022) (NOTE: Both the authors are MIT educated AI professionals based in USA)

Theory Reference Books:

1. RN: Stuart Russell and Peter Norvig: “Artificial Intelligence - A Modern Approach”, (Pearson, 4th edition, 2022),

(Ch.21 - onwards consists of DEEP LEARNING related portions)

2. SP: Simon J.D. Prince: “Understanding Deep Learning” (MIT Press, July_02_2024)

3. B&B: C.M. Bishop with H.Bishop: “Deep Learning – Foundations and Concepts”, (Springer, November, 2023)



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Subject Name: Operating Systems

Credit: 3

Lecture Hours: 36

Subject Code: OEEC604B

Pre-requisite: Computer Architecture & Organization

Course Objective:

1. To learn the fundamentals of Operating Systems and mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS.
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management.

Course Outcome:

Upon completion of the course, the students will be able to:

CO1: Understand the basic structure of OS and create process and threads and interpret algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.

CO2: Understand the concepts of process coordination, use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and also understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.

CO3: Understand the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time for a given specification of memory organization.

CO4: Understand the types of I/O management, file systems, disk scheduling, and protection and security problems faced by operating systems and how to minimize these problems.

Relevant Links:

Study Material

NPTEL

Coursera

LinkedIn Learning

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Overview & Operating System Structure Operating System Concepts Essentials, 9th Edition by A. Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition. Chapter:1,2,3,4	Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS	International Academia: (https://online.stanford.edu/courses/cs111-operating-systems-principles) AICTE-prescribed syllabus: (chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: Tools --- GCC, GDB, Objdump, shell scripts	6	1. Usage of tools --- unix shell commands (file commands, ps, ls, top), text editor (nano, vi, gedit, emacs) 2. C programming language refresher --- header files, compilation and linking using GCC, program execution, functions 3. Usage of tools --- GCC, GDB, Objdump, shell scripts

		Operating System. Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads			
2	Process Management & Process Synchronization Operating System Concepts Essentials, 9th Edition by A. Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition. Chapter:5,6,7	Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	International Standards :(https://online.stanford.edu/courses/cs212-operating-systems-and-systems-programming) AICTE-prescribed syllabus: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: 1. Tools usage --- nice, /proc/<pid>/status	14	1. Simple strace usage to showcase different interfaces (stdlib, system call) 2. Tools usage --- ps, pstree, top 3. Usage of process control system calls to identity process identifiers, create process hierarchies, launch new executables, control exit sequence of parent and child processes. 4. Familiarity with files in the /proc/<pid>/ directory 5. Demonstration of process execution interleaving in different orders 6. Simulation based analysis of scheduling policies 7. Tools usage --- nice, /proc/<pid>/statu

		Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery			
3	Memory Management & Virtual Memory & Storage Management Operating System Concepts Essentials, 9th Edition by A. Silberschatz,	Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of	International Standards : https://online.stanford.edu/courses/cs111-operating-systems-principles AICTE-prescribed syllabus: chrome-extension://efaidnbmnnnibpcajpgclclefindmkaj/https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping:	10	1. (Virtual) addresses of variables and initialized pointers. 2. Use of malloc() and demonstration of per-process virtual addresses 3. Tools usage --- strace, free, top, htop, vmstat,

	Peter Galvin, Greg Gagne, Wiley Asia Student Edition. Chapter:8,9	operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms.	Implement a custom memory allocator using system calls		/proc/<pid>/maps 4. Free memory statistics correlated with malloc(). 5. Number of system calls and malloc() usage. 6. Implement a custom memory allocator using system calls
4	Storage Management Operating System Concepts Essentials, 9th Edition by A. Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition. Chapter:10,12	Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN,	International Standards: https://online.stanford.edu/courses/cs111-operating-systems-principles AICTE-prescribed syllabus: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping: Basics of Android	5	1. Tools usage --- state, file, du, df, fsck. Implementation of file utilities (e.g., find, grep) using the system call API. 2. Implement a simple file system to handle files on an emulated disk (via a large file) --- file system API, superblock, inode and data block management. 3. Designing a 64 bit operating system.

		Disk reliability, Disk formatting, Boot-block, Bad blocks.			
5	Operating System for AI & Gen AI Research papers	Structure & Application of Operating System for AI & Gen AI		1	

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Reference Books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, AddisonWesley
3. Design of the UNIX Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates
5. OperatingSystemcoursesofferedonNPTEL,<https://nptel.ac.in/>
6. Think OS, A Brief Introduction to Operating Systems. Allen B.Downey<https://www.greenteapress.com/thinkos/index.html>



University of Engineering and Management
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University of Engineering & Management, Jaipur



Subject Name: Essential Studies for Professionals-VI

Credit: 0.5

Lecture Hours: 48

Subject Code: ESP 602

Module number	Topic	Sub-topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	Electromagnetics	Book Name: <u>GATE 2024 ELECTRONICS& COMMUNICATION ENGINEERING</u> Publication: <u>G.K. PUBLICATION (P) LIMITED</u> (TECHNICAL SECTION: Chapter 8) Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Pointing vector; Planewaves and properties: reflection and	National Exams: 1. GATE: (https://gate2024.iisc.ac.in/wp-content/uploads/2023/07/ec.pdf) 2. UPSC Engineering Service Examination: (https://upsc.gov.in/sites/default/files/Notif-ESEP-23-enql-140922-Final.pdf), Page- 25,26 3. SSC Junior Engineer: (https://ssc.nic.in/SSCFile/Server/PortalManagement/UploadedFiles/NOTICE	24	

		refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.	JE 2023 26072023.pdf 4. RRB JE, Technician, & Miscellaneous Category Posts: https://wcr.indianrailways.gov.in/uploads/files/1658493303114-english%20GDCE%20022022.pdf		
2	Digital Circuits	(TECHNICAL SECTION: Chapter 5) Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories:	National Exams: 1. GATE: https://gate2024.iisc.ac.in/wp-content/uploads/2023/07/ec.pdf) 2. UPSC Engineering Service Examination: https://upsc.gov.in/sites/default/files/Notif-ESEP-23-engl-140922-Final.pdf), Page- 24,25 3. SSC Junior Engineer: https://ssc.nic.in/SSCFileServer/PortalManagement	24	

		ROM, SRAM, DRAM; 8-bit microprocessor (8085): architecture, programming, memory and I/O interfacing.	/UploadedFiles/NOTICE JE 2023 26072023.pdf 4. RRB JE, Technician, & Miscellaneous Category Posts: https://wcr.indianrailways.gov.in/uploads/files/1658493303114-english%20GDCE%20022022.pdf		
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Text Books:

1. G.K publishers GATE ELECTRONICS & COMMUNICATIONS
2. McGraw hill GATE 2020 ELECTRONICS & COMMUNICATIONS
3. Wiley GATE 2020 ELECTRONICS & COMMUNICATIONS



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University of Engineering & Management, Jaipur



Subject Name: Skill Development for Professionals- VI

Credit: 0.5

Lecture Hours: 48

Subject Code: SDP681

Module number	Topic	Sub- topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	Revision and Advanced Problems in Quantitative Aptitude	Textbook: Quantitative Aptitude for Competitive Examination Author: R.S Agarwal Publishing House: S. Chand Algebra: Basic algebraic identities of School Algebra & Elementary surds, Graphs of Linear Equations Arithmetic- Miscellaneous Topics (advanced level of previous semester topics) Geometry- Lines, Angles, Triangles, Quadrilateral and circles.	National Exams: 1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304202	12	Geometry: - Problems based on Lines and Angles. - Problems based on complementary, supplementary, corresponding, alternative angles. - Problems based on acute, right, obtuse, scalene, equilateral, isosceles triangles. - Basis problems based on Quadrilaterals. - Basic Problems based on chords and tangents.

			3.pdf) pg. 20-22 4. Intelligence Bureau ACIO https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams: 1. Civil Services Executive Exam (WBCS) https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisem), pg 1 2. Miscellaneous Services Recruitment Examination https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) pg 1		
2	Revision and Advanced Problems in Reasoning	Textbook: Verbal and Non-Verbal reasoning Author: R.S Agarwal Publishing House: S. Chand 1. Coding, Series & Numbers, Blood Relations, Directions & Distance, Analogy 2. Data Sufficiency 3. Machine Input/Output 4. Sitting Arrangement, Puzzle	National Exams: 1. UPSC Civil Services Exam https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 2. UPSC Combined Defence Services https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. Combined Graduate Level conducted by SSC https://ssc.nic.in/SSCFileServ	12	1. Coding, Series & Numbers, Blood Relations, Directions & Distance, Analogy: • Coding-Decoding: Create coding schemes involving letters, numbers, or symbols and have students decode messages or create their own coded messages. • Number Series: Design complex number series with multiple patterns, including arithmetic, geometric, squares, cubes, Fibonacci, and prime number sequences. • Blood Relations: Craft intricate family tree puzzles with various relationships (e.g., uncles, aunts, cousins, in-laws) and have students deduce missing information.

			er/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22 4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)) State Level Exams: 1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement) , pg 1 2. Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf)) pg 1		• Directions & Distance: Design scenarios involving multiple turns, distances, and landmarks, requiring students to calculate final positions or determine the shortest path. • Analogy: Present word pairs with specific relationships (e.g., synonym, antonym, part-whole, cause-effect) and ask students to identify the correct analogy from a list of options. 2. Data Sufficiency: • Mathematical Problems: Pose word problems involving multiple statements and ask students to determine whether each statement alone or in combination with others is sufficient to solve the problem. • Logical Reasoning: Create scenarios with various statements and have students analyze if they are sufficient to draw a valid conclusion or make a decision. 3. Machine Input/Output: • Number-based Input-Output: Design a set of rules for transforming a numerical input into a specific output and ask students to identify the underlying pattern. • Word-based Input-Output: Create a set of rules for rearranging or modifying words and have students determine the final output based on a given input. • Mixed Input-Output: Combine both numerical and word-based operations to create more complex input-output patterns for students to decipher.
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					4. Sitting Arrangement, Puzzle: • Linear Arrangement: Arrange individuals or objects in a row or column based on given clues about their positions relative to each other. • Circular Arrangement: Place individuals or objects around a circular table or in a circular pattern, based on provided clues. • Square/Rectangular Arrangement: Position individuals or objects at the corners or sides of a square or rectangle based on their relationships. • Complex Puzzles: Combine elements of different arrangement types or introduce additional variables like facing direction, preferences, or occupations to create more challenging puzzles.								
3	Revision and Advanced Questions in Verbal English	Textbook: Objective General English Author: R.S Agarwal Publishing house: S. Chand 1. Match the columns 2. Starter and connector 3. Spotting Errors 4. Correct usage of words (vocabulary) 4. Reading Comprehension (Advanced level) 5. Curriculum Vitae writing/Argument Writing	National Exams: 1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadFiles/notice_CGLE_03042023.pdf) pg. 20-22 4. Intelligence Bureau ACIO	12	1. Match the Column: Test students’ ability to quickly associate related concepts, vocabulary, or facts. It helps with topics like vocabulary building, grammar pairs, historical dates, or scientific terms, sharpening quick recall and accuracy under timed conditions. <table><tr><th>Column A</th><th>Column B</th></tr><tr><td>A. Despite heavy rain, the match</td><td>D. was played without interruption.</td></tr><tr><td>B. The Prime Minister announced</td><td>E. a new scheme for farmers’ welfare.</td></tr><tr><td>C. The committee will submit</td><td>F. its report by the end of this month.</td></tr></table> 2. Starter and Connector: tests students’ command over sentence formation and coherent writing appropriate for English language sections. Usage of correct starters and connectors is crucial for clear communication in writing tasks and descriptive papers, reflecting proficiency required in exams like SSC, CAT, or banking tests.	Column A	Column B	A. Despite heavy rain, the match	D. was played without interruption.	B. The Prime Minister announced	E. a new scheme for farmers’ welfare.	C. The committee will submit	F. its report by the end of this month.
Column A	Column B												
A. Despite heavy rain, the match	D. was played without interruption.												
B. The Prime Minister announced	E. a new scheme for farmers’ welfare.												
C. The committee will submit	F. its report by the end of this month.												

			(https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams: 1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1 2. Miscellaneous Services Recruitment Examination (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) pg 1		_____ the success of the project, the team celebrated with great enthusiasm. a) Despite b) Because of c) Although d) Yet 3. Spotting Errors: • Verb Tense Errors • Subject-Verb Agreement Errors • Preposition Errors 4. Correct usage of words (vocabulary): help students focus on word meanings, synonyms, antonyms, idioms, and appropriate word choice that frequently appear in exams like UPSC, SSC CGL, or Railways. 5. Reading Comprehension: • Inference and Deduction • Summarizing • Identifying Author's Purpose 6. Curriculum Vitae (CV) Writing/Argument Writing: • CV Writing • Argument Writing
4	Data Interpretation	Textbook: Quantitative Aptitude for Competitive Examination Author: R.S Agarwal Publishing House: S. Chand	National Exams: 1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-english-010223.pdf), pg 25-26 2. UPSC Combined Defence	12	Application of Data Analysis in the forms of following charts: 1. Tabular 2. Bar 3. Pie 4. Line Graph

		1. Various Charts 2. Diagrams 3. Tables	Services https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. Combined Graduate Level conducted by SSC https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22 1. Intelligence Bureau ACIO https://www.pw.live/exams/wp-content/uploads/2023/11/I-B-ACIO-Recruitment-2023-Notification-Emp-News.pdf) 2. RBI Grade B https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADV_TGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF), pg 22-23 State Level Exams: 1. Civil Services Executive Exam (WBCS) https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1 2. Miscellaneous Services Recruitment Examination		
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			(https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) pg 1		
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University of Engineering and Management
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University of Engineering & Management, Jaipur



Subject Name: PRINCIPLES OF MANAGEMENT

Credit: 2

Lecture Hours: 36

Subject Code: HSM605

Pre-requisite:

1. Basic Knowledge of Business and Organizations.
2. Knowledge of basic economic principles.
3. Basic understanding of financial statements and how organizations manage resources.
4. Basic understanding of Human Behaviours.

Relevant Links:

[NPTEL](#)

[COURSERA](#)

[LINKEDIN](#)

Course Objectives:

To enable the students to study the evolution of Management.

1. To study the functions and principles of management and to learn the application of the principles in an organization.
2. To enable the effective and barriers communication in the organization
3. To study the system and process of effective controlling in the organization.

Course Outcomes:

Students will be able to

CO1: To have clear understanding of managerial functions like planning, and have same Basic knowledge on international aspect of management

CO2: To understand the planning process in the organization and the concept of Organization.

CO3: Demonstrate the ability to directing, leadership and communicate effectively.

CO4: To analysis isolate issues and formulate best control methods.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping
Module-I	Concepts of management and its functions	Basic concepts of management: Definition – Essence, Functions, Roles, Level. Functions of Management: Planning– Concept, Nature, Types, Analysis, Management by objectives; Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.	<u>AICTE</u> SWOT, PESTLE, Porter’s Five Forces <u>Mapping with Industry</u> Strategic goals, forecasting <u>Mapping with International Academia</u> Business Strategy, Environmental Scanning	8	Chapter 1, 2
Module-II	Society and People Management	Management and Society–Concept, External Environment, CSR, Ethical Standards. People Management– Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. IT Project Management. Managerial Competencies– Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.	<u>AICTE</u> Organizational theories, structure design <u>Mapping with Industry</u> Resource allocation, structures <u>Mapping with International Academia</u> Mintzberg’s Configurations, Contingency Theory	10	Chapter 3, 4, 5
Module-III	Leadership	Leadership: Concept, Nature, Styles. Decision making: Concept, Nature, Process, Tools & techniques. Corporate Governance, IT Governance, and Concept of COBIT. Economic, Financial & Quantitative Analysis– Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods– Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.	<u>AICTE</u> Leadership theories, employee engagement <u>Mapping with Industry</u> Leadership styles, motivation <u>Mapping with International Academia</u> Emotional Intelligence, Transformational Leadership	10	Chapter 6, 7, 8

Module-IV	Customer Management	Customer Management–Market Planning & Research, Marketing Mix, Advertising& Brand Management. Operations & Technology Management– Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six sigma, lean Management. Bench marking and Reverse Engineering.	<u>AICTE</u> Business ethics, CSR <u>Mapping with Industry</u> Ethical practices, sustainability <u>Mapping with International Academia</u> Global CSR standards, Ethical frameworks	8	Chapter 9, 10
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Text Books

- J. S. Chandan “Principles of management” Second Edit on, Vikash publishing house Pvt Ltd, 2012.

References

- "Principles of Management" by Harold Koontz and Heinz Weihrich
- "Management: Tasks, Responsibilities, Practices" by Peter F. Drucker



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Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Subject Name: Control System Lab

Credit: 1

Lecture Hours: 24

Subject Code: PCCEC691

Course Objective:

1. To get practical experience with different controlling system of first, second order.
2. To get practical experience of designing any control system circuit using simulation, coding and electronic controlling devices.
3. To learn hand on experience such that students can work as professionals in the area of Applied Control System and other Engineering fields.
4. To learn different tools to simulate different Control System circuits.

Course Outcomes:

CO 1: Students will have a thorough knowledge of different applications of Controller, Servo Motor.

CO 2: After completing this course, the students will be able to analyze and design of Control System circuits using different controlling system.

CO 3: They will be able to design PID Controller, Temperature Controller and DC Motor Speed Controller.

CO 4: After completing this course, the students will be able to analyze and design Circuits using First Order, Second Order, Type-I and Type-II system.

Experiment No.	Description of Topic
1	Familiarization with MATLAB Control System tool Box, MATLAB- SIMULINK tool box & pSPICE
2	Determination of step response for 1st order & 2nd order system with unity feedback on CRO & calculation of control system specifications for variations of system design.
3	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB & pSPICE.
4	Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2nd order transfer function & determination of different control system specifications.
5	Determination of PI, PD, and PID controller action on 1st order simulated process using MATLAB /Instrument set up .
6	Determination of approximate transfer function experimentally using Bode Plot
7	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB & pSPICE
8	Study of position control system using servomotor.
9	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.



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Subject Name: Computer Network Laboratory
Subject Code: PCCECE692

Course Objectives:

This course provides students with hands on training regarding the design, troubleshooting, modeling and evaluation of computer networks. In this course, students are going to experiment in a real test-bed networking environment, and learn about network design and troubleshooting topics and tools such as: network addressing, Address Resolution Protocol (ARP), basic troubleshooting tools (e.g. ping, ICMP), IP routing (e.g. RIP), route discovery (e.g. traceroute), TCP and UDP, IP fragmentation and many others. Student will also be introduced to the network modeling and simulation, and they will have the opportunity to build some simple networking models using the tool and perform simulations that will help them evaluate their design approaches and expected network performance.

Course Outcomes:

On the completion of this laboratory course, the students will be able to:

CO1: Familiarization with transmission media and tools: UTP cable, Crimping tool, Connectors etc.

CO2: Understand various network devices and IP for networking.

CO3: Familiarization with different network commands. Study of various network topologies and their creation using network devices, cables and Computer.

CO4: Configure a network using different routing protocols. Implement and analyze different data link protocols and socket programming.

List of Experiments:

Serial No.	Experiment No.	Experiment Name
1	1	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using Crimping tool.
2	2	Understand various network devices and IP for networking.
3	3	Study and implementation of network IP to configure a network.
4	4	Familiarization with different network commands.
5	5	Configure a LAN topology using packet tracer software.
6	6	Simulate and Implement a WAN with using packet tracer.
7	7	Ad Hoc On-Demand Distance Vector Routing algorithm using MATLAB
8	8	LEACH Routing Protocol for a WSN using MATLAB
9	9	Write a program to implement GO BACK N ARQ Protocol.
10	10	Mobility modeling for vehicular communication networks using MATLAB
11	11	AI for Positioning Accuracy Enhancement using MATLAB



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University of Engineering & Management, Jaipur



SUBJECT: Digital Signal Processing Lab
SUBJECT CODE: PCCEC693

Course Objective:

1. To develop an understanding of various programming techniques for plotting signals mathematically in continuous and discrete-time, and in the frequency domain with Matlab.
2. To develop an understanding to analyze discrete-time systems using z-transform, Linear and Circular Convolution of two sequences and understand the Discrete-Fourier Transform (DFT) and IDFT algorithms.
3. To develop the understanding of writing small programs in VHDL and downloading into Xilinx FPGA.
4. To develop the understanding of basic architecture, programming techniques of DSP Processors TMS320C 5416/6713 using Assembly Language and C and Design digital filters for various applications.

Course Outcome:

Students will be able to:

- CO1:** Understand different types of CT and DT signals from their mathematical / graphical representations and classify them into various categories. Ability to characterize random signals using their statistical properties.
- CO2:** Identify CT and DT signals in time domain and frequency domain to infer their characteristics. Ability to apply the acquired knowledge to classify CT and DT systems into various categories.
- CO3:** Analyze discrete-time signals using Linear Convolution.
- CO4:** Study Circular Convolution and understand the Discrete-Fourier Transform (DFT) and IDFT algorithms.
- CO5:** Evaluate the result of convolution of DT SIGNAL and verify with DSP Processor TMS320C6713.
- CO6:** Design and implementation of digital filters for various applications using Arduino Uno kit.

Syllabus Of Digital Signal Processing Lab

1. **Generation of unit impulse, unit steps, advanced & delayed signal, Generation of unipolar & bipolar saw tooth & square wave using 'for loop' in Matlab.**
2. **Impulse response & step response of the system, checking of linearity and time invariance properties (using filter command & for loop) in Matlab.**
3. **Z-transform of various sequences – verification of the properties of Z-transform.**
4. **Linear Convolution of two sequences using graphical methods & matrix multiplication methods (using 'conv' command & for loop) in Matlab/Scilab.**
5. **Plotting of magnitude and phase spectrum of Discrete time Signal. Calculation of DTFT.**
6. **DFTs/IDFTs using matrix multiplication in for loop & also using fft & ifft command, circular convolution of two sequences using loop and using commands, differentiation linear and circular convolution.**
7.
 - **Different modeling styles in VHDL,**
 - **Dataflow, behavioral, and structural modeling.**
 - **Synthesis and simulation concept ,**
 - **VHDL constructs and coding methods for combinational and sequential circuits,**
 - **Implementation of designed circuits on a FPGA kit.**
8. **Writing & execution of a program for addition and subtraction of any two arbitrary nos., convolution of two sequences using C language and implemented in DSP processor TMS320C6713.**



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Subject Name: DESIGN LAB

Subject Code: PCCEC694

Pre-requisite: Analog, Digital, Micro-controller, Power Electronics Python and C-Programming

COURSE OBJECTIVES:

To impart the essential knowledge of electronic circuit design and fault analysis, to enhance hands-on experience, and to encourage innovativeness.

COURSE OUTCOMES: This will be a sessional lab so students can employ all their resources to excel.

COURSE OBJECTIVES/OUTCOMES:

1. Develop Proficiency in Industry-Standard Tools and Technologies:

Gain hands-on experience with tools such as Proteus, CST Microwave Studio, Raspberry Pi Pico, Cadence Virtuoso, and Xilinx FPGAs to design, simulate, and implement practical solutions for real-world engineering problems.

2. Design and Implement Functional Systems:

Design, prototype, and test functional systems such as PCBs, 5G antennas, environmental monitors, energy harvesting circuits, and VLSI architectures, ensuring they meet specified performance and efficiency criteria.

3. Analyse and Optimize System Performance:

Use analytical and simulation tools to evaluate the performance of designed systems (e.g., antenna radiation patterns, power consumption of circuits, or energy efficiency of harvesting systems) and optimize them for improved functionality.

4. Apply Interdisciplinary Knowledge to Solve Engineering Challenges:

Integrate knowledge from electronics, communication, robotics, environmental monitoring, renewable energy, and VLSI to address complex engineering problems and develop innovative, sustainable solutions.

Module number	Topic	Corresponding Lab Assignment
1	PCB Design	❖ Design and fabricate a single-layer PCB for a basic Power Supply and different types of Filter circuits using Proteus simulator.
2	Communication and Networking	❖ Prototype and analyze a small-form-factor 5G antenna for wireless communication using CST Microwave Studio.
3	Robotics and Automation	❖ Design a Temperature and Humidity Monitor using the DHT11 or DHT22 sensors using the Raspberry Pi Pico
4	Environmental and Safety Monitoring	❖ Use Raspberry Pi Pico to monitor air quality parameters like CO2, SO2 etc. in an industrial environment. Tools: Pico, Air Quality Sensors (MQ-135), Wi-Fi Module.
5	Renewable Energy and Sustainability	❖ Create a circuit to harvest and store energy from piezoelectric sensors. Tools: Piezoelectric Transducers, Oscilloscope, Capacitor Banks.
6	Industry-based VLSI/embedded system projects using Cadence	❖ Design and Implementation of Low Power NAND Gate Tools: Cadence Virtuoso
7	Industry-based projects using Xilinx FPGAs	❖ VLSI Architecture for Removing Impulse Noise of an Image.

LIST OF PROJECTS

AI-Powered Surveillance Sensor

1. Use Raspberry Pi Pico to manage PIR sensors for detecting movement in restricted industrial zones and triggering a camera system.

Tools: Pico, PIR Sensors, ESP32 for Camera Integration.

2. Build a real-time speech recognition system using TensorFlow Lite on a microcontroller. Tools: ESP32, Python, Tensor Flow Lite.

Robotics and Automation

3. Develop a robotic arm that identifies and picks objects based on color and size. Tools: Arduino, Raspberry Pi.

FPGA-Based Medical Imaging System

4. Implement a high-resolution imaging system for ultrasound or CT scan signal processing using Xilinx FPGAs.

Key Tools: Vivado, MATLAB for algorithm development.

Skills: Signal processing, real-time data handling and image reconstruction.



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Subject Name: Advanced VLSI Lab

Subject Code: PCCECE 681

Credit: 1

Total Lab Hours: 34

List of Experiments

Exp. No.	Experiment Title	Key Activities
1	Design and Verification of Flip-Flops using Verilog HDL	• Writing Verilog RTL for D, JK, and T flip-flops. • Test bench development for functional verification. • Simulation and waveform analysis using Cadence Xcelium / Vivado Simulator.
2	Design and Verification of Counters using Verilog HDL	• Implementation of 4-bit Up Counter, Down Counter

		• Test bench creation with clock/reset generation. • Functional simulation using Xcelium / Vivado Web PACK.
3	RTL to GDS-II Flow for Counter – Part I (Simulation, Synthesis & Floor planning)	• RTL simulation of counter using Xcelium. • Synthesis using Cadence Genus (timing, area, power reports). • Floor planning and power planning using Cadence Innovus.
4	RTL to GDS-II Flow for Counter – Part II (Placement, Routing & Layout Generation)	• Standard cell placement and clock tree synthesis. • Global and detailed routing using Innovus. • Physical verification and GDS-II generation. • Layout viewing
5	Design of a basic current mirror and cascode current mirror and noting their difference	• Schematic design • Pre-layout analysis and simulation in Cadence • Layout design • Post-layout analysis and simulation in Cadence • GDS-II generation
6	Design of a resistive loaded differential amplifier and noting the different performance parameters	• Schematic design • Pre-layout analysis and simulation in Cadence • Layout design • Post-layout analysis and simulation in Cadence • GDS-II generation
7	Design of a current reference and noting the different performance parameters	• Schematic design • Pre-layout analysis and simulation in Cadence (PVT variation analysis)

		• Layout design • Post-layout analysis and simulation in Cadence (PVT variation analysis) • GDS-II generation
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Course Outcomes (COs)

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

CO1

Design and verify sequential digital circuits such as flip-flops and counters using Verilog HDL and simulate them using Cadence Xcelium or Vivado Simulator.

CO2

Develop synthesizable RTL modules, create structured testbenches, and perform functional verification of sequential circuits using industry-standard EDA tools.

CO3

Apply the complete ASIC design flow by performing RTL synthesis using **Cadence Genus**, physical design using **Cadence Innovus**, and generating the final **GDS-II** for a digital subsystem.

CO4

Design and implement FSM-based digital systems using Verilog, verify functionality through HDL simulation, and deploy the design on FPGA hardware using **Xilinx Vivado WebPACK**.

CO5

Design and implement complex analog circuits in **Cadence**, verify pre-layout and post-layout simulation results and generate **GDS-II** file stream



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Subject Name: Digital Signal Processing

Subject Code: PCCEC603

Credit: 3

Lecture Hours: 36

Pre-requisite: Mathematics, Signal and System, Digital System Design

COURSE OBJECTIVES:

1. Define and comprehend the fundamental concepts of signals and systems. Understanding of Sampling and Nyquist Criterion. Differentiate between continuous-time and discrete-time signals, including Fourier analysis and transforms (DTFT).
2. Analyze signals in both time and frequency domains using appropriate mathematical tools. Interpret and manipulate signals through time and frequency transformations. Z-Transform and its properties.
3. Grasp the concepts of DFT and FFT algorithms. Apply FFT algorithms for efficient computation of the frequency domain representation of signals.
4. Design and implement digital filters using various filter design techniques. Understand the characteristics of different types of filters and their applications. Gain hands-on experience with DSP hardware (DSP Processors) and software tools. Implement and simulate DSP algorithms using software tools like MATLAB.

COURSE OUTCOMES:

CO1. Understand and implement DSP algorithms, including FFT, convolution, and correlation. Apply algorithms to solve practical signal processing challenges.

CO2. Demonstrate the ability to analyze signals in both time and frequency domains. Apply mathematical concepts to solve DSP problems.

CO3. Design and implement digital filters for specific applications. Develop solutions for signal processing problems using appropriate algorithms.

CO4. Apply DSP techniques to real-world applications such as audio and image processing. Understand the role of DSP in various industries. Successfully implement DSP algorithms using both hardware and software tools. Evaluate the performance of implemented solutions.

COURSERA ASSIGNMENT:

Digital Signal Processing Specialization:

<https://www.coursera.org/specializations/digital-signal-processing>

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction: Discrete-Time Signals and Systems, Sampling, DTFT	Discrete time signals and systems: Sequences; representation of signals, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate; Discrete-Time Fourier Transform.	International Academia: (https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/resources/lecture-videos/) AICTE-prescribed syllabus: (https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Language: C++, Assembly Code Software: MATLAB, CCSTUDIO IDE Hardware: DSP Processor: TMS320C5416, TMS320C6713,	6	1. Generation of a sinusoidal sequence with different frequency/ phase for defined sampling frequency 2. Signal generation using for loop (without using inbuilt command) 3. To Find under, critical and over sampling for given signals 4. Implementation of DTFT with and without using software command.
2	z-Transform	z-Transform, Region of Convergence, Properties of ztransform, Inverse ztransforms.	International Standards: (https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/resources/lecture-videos/) AICTE prescribed syllabus: (https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Software: MATLAB	4	5. Implementation of z-Transform with and without using software command. 6. Implementation of Inverse z-Transform with and without using software command. 7. Verification of Properties of z-transform with and without using software command.

3	Discrete Fourier Transform and Fast Fourier Transform	Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Concept and relations for DFT/IDFT, Twiddle factors and their properties, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. Fast Fourier Transform Algorithm.	International Standards : https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/resources/lecture-videos/) AICTE prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Language: C++, Assembly Code Software: MATLAB, CCSTUDIO IDE Hardware: DSP Processor: TMS320C5416, TMS320C6713, TMS320C6657	8	8. To find out DFT/IDFT/ Twiddle factor of a given sequence with and without using software command. 9. Verification of Properties of Twiddle Factor with and without using software command. 10. To find out linear and circular convolution of a given sequence with and without using software command. 11. Implementation of FFT Algorithm with and without using software command.
4	Realization of Digital Filters. IIR and FIR Filter Design	Direct Form I, Direct Form II, Cascade and Parallel Realization of system. Design of IIR Digital Filters: Impulse Invariant Transformation, Bilinear Transformation Design of FIR Digital filters: Window method	International Standards: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/resources/lecture-videos/) AICTE prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Software: MATLAB	10	12. Design of Digital Filters (e.g., IIR, FIR etc.) are given as Lab Projects (Application oriented projects)
5	DSP Processor and ARM Processor, VHDL Implementation	Elementary idea about the architecture and important instruction sets of TMS320C6xxx processor, General-Purpose Embedded Processor Cores: The ARM; FPGA: Architecture, mapping of DSP algorithms onto FPGA	International Standards: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/resources/lecture-videos/) AICTE prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Language: VHDL, C++, Assembly Code Software: MATLAB, PeakVHDL, Xilinx, CCSTUDIO IDE Hardware: Xilinx-Spartan 3E Vertex kit, DSP Processor: TMS320C6657, ARM Processor: ARM7TDMI, Qualcomm APQ8096SG Processor (Integrated with - 64-bit ARM v8-compliant Qualcomm Kryo CPU - Qualcomm Adreno 530 GPU - Qualcomm® Hexagon™ 680 DSP)	8	13. To perform various operations (e.g., convolution) using TMS320C6657/ ARM7TDMI/ APQ8096SG (refer to Module 1, 2 and 3) 14. Implementing VHDL programming in Xilinx platform using FPGA kit. 15. Mapping of DSP algorithms onto FPGA with MATLAB. 16. Projects on current technology trends combining DSP and machine learning techniques: - Internet of things (IoT) - Robotics - Autonomous vehicles

TEXT BOOKS:

1. DIGITAL SIGNAL PROCESSING, P. RAMESHBABU, SCITECH PUBLICATIONS (INDIA).
2. DIGITAL SIGNAL PROCESSING – PRINCIPLES, ALGORITHMS AND APPLICATIONS, J.G. PROAKIS & D.G. MANOLAKIS, PEARSON ED.
3. DIGITAL SIGNAL PROCESSING BY A. ANAND KUMAR, PUBLISHER: PHI

REFERENCE BOOKS:

1. DIGITAL SIGNAL PROCESSING, S. SALIVAHANAN, A. VALLABRAJ & C. GNANAPRIYA, TMH PUBLISHING CO
2. DIGITAL SIGNAL PROCESSING – A COMPUTER BASED APPROACH, S.K. MITRA, TMH PUBLISHING CO
3. VLSI DIGITAL SIGNAL PROCESSING SYSTEMS DESIGN AND IMPLEMENTATION, WILEY INTERNATIONAL PUBLICATION.
4. TEXAS INSTRUMENTS DSP PROCESSOR USER MANUALS AND APPLICATION NOTES.

XILINX FPGA USER MANUALS AND APPLICATION NO

