Punyashlok Ahilyadevi Holkar Solapur University, Solapur

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।

NAAC Accredited-2022
'B^{++}'Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Structure: Electronics & Computer Engineering

Name of the Course: F.Y. B. Tech. to Final Y. B. Tech.

(The syllabus to be implemented from June 2025)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

NEP 2020 Compliant Curriculum

With effect from 2024-2025

Semester I (Common for All Engineering Branches)

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*		*Credits*	*FA*	*SA*		*Total*
			L	*P*		*ESE*	*ISE*	*ICA*	
BSC	BS-01/ BS-02	Engineering Physics / Engineering Chemistry $	3	2	4	70	30	25	125
	BS-03	Engineering Mathematics-I	3	2	4	70	30	25	125
ESC	ES-01/ ES-02	Basics of Civil and Mechanical Engineering / Basic Electrical & Electronics Engineering $	3	2	4	70	30	25	125
	ES-03	Engineering Mechanics	3	2	4	70	30	25	125
AEC	AE-01	Communication Skills	1	2	2		25	25	50
CC	CC-01	Sports and Yoga or NSS/NCC/UBA (Liberal Learning Course-I)	1	2	2			25	25
SEC	SE-01	Workshop Practices		2	1			25	25
		Total	**14**	**14**	**21**	**280**	**145**	**175**	**600**
		Student Induction Program**							

Semester II (Common for All Engineering Branches)

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*		*Credits*	*FA*	*SA*		*Total*
			L	*P*		*ESE*	*ISE*	*ICA*	
BSC	BS-01/ BS-02	Engineering Physics / Engineering Chemistry $	3	2	4	70	30	25	125
	BS-04	Engineering Mathematics - II	3	2	4	70	30	25	125
ESC	ES-01/ ES-02	Basics of Civil and Mechanical Engineering / Basic Electrical & Electronics Engineering $	3	2	4	70	30	25	125
		Engineering Graphics and CAD		4	2		25	50	75
SEC	SE-02	Data Analysis and Programming Skills	1	2	2		25	25	50
CC	CC-02	Professional Personality Development (Liberal Learning Course-II)	1	2	2		25	25	50
IKS	IKS-01	Introduction to Indian Knowledge System	2		2		25	25*	50
		Total	**13**	**14**	**20**	**210**	**190**	**200**	**600**
		Democracy, Elections and Good Governance *	**1**			**50**			

***For IKS activity report should be submitted**

BSC- Basic Science Course ESC- Engineering Science Course, PCC- Programme Core Course, AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses, VSEC-Vocational and Skill Enhancement Course

- Legends used–

L	Lecture	FA	Formative Assessment
T	Tutorial	SA	Summative Assessment
P	Lab Session	ESE	End Semester Examination
		ISE	In Semester Evaluation
		ICA	Internal Continuous Assessment

Notes-

1. $ - Indicates approximately half of the total students at F. Y. will enroll under Group A and the remaining will enroll under Group B.

   Group A will take up a course of Engineering Physics (theory & laboratory) in Semester I and will take up course of Engineering Chemistry (theory & laboratory) in semester II.

   Group B will take up a course of Engineering Chemistry (theory & laboratory) in Semester I and will take up course of Engineering Physics (theory & laboratory) in semester II.

2. # - For the Course (C113) Basic Electrical & Electronics Engineering, Practical's of Basic Electrical Engineering and Basic Electronics Engineering will be conducted in alternate weeks.

3. @ - For the Course (C113) Basics of Civil and Mechanical Engineering, Practical's of Basics of Civil Engineering and Basics of Mechanical Engineering will be conducted in alternate weeks.

4. In Semester Evaluation (ISE) marks shall be based upon student's performance in minimum two tests & mid-term written test conducted & evaluated at institute level.
   Internal Continuous Assessment Marks (ICA) is calculated based upon student's performance during

laboratory sessions / tutorial sessions.

5. *- Democracy, Elections & Good Governance is mandatory course. The marks earned by student with this course shall not be considered for calculation of SGPA/CGPA. However, student must complete End Semester Examination (ESE) of 50 marks (as prescribed by university) for fulfilment of this course. This course is not considered as a passing head for counting passing heads for ATKT. However, student must pass this subject for award of the degree.
6. Student must complete induction program of minimum five days before commencement of the regular academic schedule at the first semester.

**** GUIDELINES FOR INDUCTION PROGRAM (C119)**

New entrants into an Engineering program come with diverse thoughts, mind set and different social, economic, regional and cultural backgrounds. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose.

An induction program for the new UG entrant students is proposed at the commencement of the first semester. It is expected to complete this induction program before commencement of the regular academic schedule.

Its purpose is to make new entrants comfortable in their new environment, open them up, set a healthy daily routine for them, create bonding amongst the peers as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The Induction Program shall encompass (but not limited to) below activity –

1. Physical Activities
2. Creative Arts
3. Exposure to Universal Human Values
4. Literary Activities
5. Proficiency Modules
6. Lectures by Experts / Eminent Persons
7. Visit to Local Establishments like Hospital /Orphanage
8. Familiarization to Department

Induction Program Course do not have any marks or credits however performance of students for Induction Program is assessed at institute level using below mandatory criteria –

1. Attendance and active participation
2. Report writing

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Semester -III

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-01	Fundamentals Of Digital Techniques	3			03	70	30			100
PCC	ECEPCC-02	Data Structures and Algorithms	3			03	70	30			100
PCC	ECEPCC-03	Electronic Devices and Circuit	3		2	04	70	30	25	25	150
CEP/FP	ECEFP-01	Python & Data Structures Programming			2	01			25	25	50
CEP/FP	ECEFP-02	Fundamentals Of Digital Techniques Practical's			2	01			25	25	50
Entrepreneurship	EM-01	Product Development and Entrepreneurship	1	1		02		50	25		75
OE	OE-01	Open Elective-I	2		2	03	70	30	25		125
MDM	ECEMDM-01	ECE MD Minor-I	2		2	03	70	30	25		125
VEC	VEC-01	Universal Human Values	1		2	02	50*		25		75
		Total	**15**	**1**	**12**	**22**	**400**	**200**	**175**	**75**	**850**
		Environmental Science	1								

***For VEC-based examination to be conducted.**

PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses, VSEC-Vocational and Skill Enhancement Course
MDM-Multidisciplinary Minor: It should be selected from another UG Engineering Minor Programme

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Semester -IV

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-04	Computer Architecture and Organization	3			03	70	30			100
PCC	ECEPCC-05	Network Theory and Linear Integrated Circuits	3		2	04	70	30	25		125
PCC	ECEPCC-06	Object Oriented Programming	3		2	04	70	30	25	25	150
SEC	ECESEC-01	PCB Design Lab			2	01			25	25	50
Economic/ Management	EM-02	Project Management and Economics	2		0	02		25	25		50
OE	OE-02	Open Elective-II	2		2	03	70	30	25		125
MDM	ECEMDM-02	MD Minor-II	2		2	03	70	30	25		125
VEC	VEC-02	Professional Ethics	1		2	02	50*		25		75
		Total	**16**		**12**	**22**	**400**	**175**	**175**	**50**	**800**
		Environmental Science	1				40	10			50

***For VEC-02: MCQ based examination to be conducted.**

PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses, VSEC-Vocational and Skill Enhancement Course
MDM-Multidisciplinary Minor: It should be selected from other UG Engineering Minor Programme

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Semester -V

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-07	Analog and Digital Communication	3			03	70	30			100
PCC	ECEPCC-08	8085 Microprocessors and Peripherals	3		2	04	70	30	25		125
PCC	ECEPCC-09	Operating Systems	3		2	04	70	30	25	25	150
PEC	ECEPEC-01	Programme Elective Course-I	3		2	04	70	30	25		125
AEC	AEC-02	Creativity and Design Thinking	1		2	02	50*		25		75
OE	OE-03	Interdisciplinary Mini Project	1		2	02			25	25	50
MDM	ECEMDM-03	MD Minor-III	2		2	03	70	30	25		125
		Total	**16**		**12**	**22**	**400**	**150**	**150**	**50**	**750**

*** For AEC-02: MCQ- based examination to be conducted.**

PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses , VSEC-Vocational and Skill Enhancement Course
MDM-Multidisciplinary Minor: It should be selectedfrom other UG Engineering Minor Programme

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Semester -VI

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-10	Software Testing	2			02	70	30			100
PCC	ECEPCC-11	Database Management System	2		2	03	70	30	25	25	150
PCC	ECEPCC-12	Microcontrollers and Applications	3		2	04	70	30	25		125
PEC	ECEPEC-02	Programme Elective Course-II	3		2	04	70	30	25	25	150
PEC	ECEPEC-03	Programme Elective Course-III	3	1		04	70	30	25		125
SEC	ECESEC-02	Projects on Industrial Application			4	02			25	50	75
MDM	ECEMDM-04	MD Minor-IV	2		2	03	70	30	25		125
		Total	**15**	**1**	**12**	**22**	**420**	**180**	**150**	**100**	**850**

PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses, VSEC-Vocational and Skill Enhancement Course
MDM-Multidisciplinary Minor: It should be selected from other UG Engineering Minor Programme

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Semester -VII

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-13	Computer Networks	3			03	70	30			100
PCC	ECEPCC-14	Web Development	2		2	03	70	30	25		125
PEC	ECEPEC-04	Project Elective Course-IV or MOOCS##	4			04	100				100
Project	ECE Project	Capstone Project			8*	04			100	100	200
RM	RM	Research Methodology and IPR	3		2	04	70	30	25		125
MDM	MDM-05	MD Minor-V	2			02	70	30			100
		Total	**14**		**12**	**20**	**380**	**120**	**150**	**100**	**750**

Students should attend MOOCS in that 4hrs, if MOOCS is chosen, Mini Project/ Assignment related to MOOCS and ICA marks to be given based on that.

PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses, VSEC-Vocational and Skill Enhancement Course
MDM-Multidisciplinary Minor: It should be selected from another UG Engineering Minor Programme

*Load based on the project groups

List of MOOCS courses related to ECEPEC-04 will be provided by BOS time to time.

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Semester -VIII

Distribution	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*			*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	*OE/ POE*	
PCC	ECEPCC-10	Self -Learning Mode and online or MOOCs	4#			04	100				100
PEC	ECEPEC-05	Professional Elective Course (Option of NPTEL)	4#			04	100				100
OJT	**OJT**	**On-Job Training**			24	12			200	100	300
		Total	**8**		**24**	**20**	**200**		**200**	**100**	500

Students will practice or attend in Self-Learning mode.
PCC- Programme Core Course, PEC-Programme Elective Course
AEC- Ability Enhancement Course, IKS- Indian Knowledge System, CC- Co-curricular Courses,
VSEC-Vocational and Skill Enhancement Course

List of MOOCS courses related to ECEPEC-05 will be provided by BOS from time to time.

Basket of Programme Elective Course (PEC)

PEC/Sem	Course code and name
ECEPEC - 01/ V	ECEPEC –01A: **Basics of Artificial Intelligence** ECEPEC – 01B: **Python for Data Science** ECEPEC – 01C: **VLSI Design** ECEPEC – 01D: **Digital Signal Processing**
ECEPEC - 02/ VI	ECEPEC – 02A: **Machine Learning** ECEPEC – 02B: **Network Security** ECEPEC --02C: **System Design using Arduino & Raspberry Pi** ECEPEC – 02D: **Digital Image Processing**
ECEPEC - 03/ VI	ECEPEC – 03A: **Deep Learning** ECEPEC – 03B: **Data Visualization (Power BI/Tableau)** ECEPEC – 03C: **Electronic System Design** ECEPEC – 03D: **Computer Vision**
ECEPEC - 04/ VII	ECEPEC – 04A: **Data Integration and Management (Informatica 10.x)** ECEPEC – 04B: **Mobile Application Development using Android** ECEPEC – 04C: **Industrial Electronics** ECEPEC – 04D: **Satellite Communication** **OR** MOOC Courses offered by NPTEL/SWAYAM ECPEC – 04E: <As per the list provided by BoS> ECEPEC – 04F: <As per the list provided by BoS>
ECEPEC - 04/ VIII	ECEPEC – 05A: **Data Science** ECEPEC – 05B: **Cyber Security** ECEPEC – 05C: **Internet of Things** ECEPEC – 05D: **5G Communication** **OR** MOOC Courses offered by NPTEL/SWAYAM ECEPEC – 05E: <As per the list provided by BoS> ECEPEC – 05F: <As per the list provided by BoS>

Electronics & Computer Engineering Multidisciplinary Minor:

A. Advanced Embedded Systems:

Semester	Course Code	Course Title
III	ECEMDM-01A	Fundamentals Of Digital Circuits
IV	ECEMDM-02A	Microprocessors and Peripherals
V	ECEMDM-03A	Microcontrollers and Applications
VI	ECEMDM-04A	Internet Of Things (IoT)
VII	ECEMDM-05A	System Design Using Raspberry Pi

B. Artificial Intelligence:

Semester	Course Code	Course Title
III	ECEMDM-01B	Fundamentals of Artificial Intelligence
IV	ECEMDM-02B	Fundamentals of Machine Learning
V	ECEMDM-03B	Fundamentals of Deep Learning
VI	ECEMDM-04B	Data Visualization Tools (Tableau OR Power BI)
VII	ECEMDM-05B	Data Science

A. Honors in AI TECHNOLOGY:

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ECEHON-01A	Computational Statistics	3	1		4	70	30	25	125
IV	ECEHON-02A	Python for AI	3		2	4	70	30	25	125
V	ECEHON-03A	Soft computing	3		2	4	70	30	25	125
VI	ECEHON-04A	AI Applications	3		2	4	70	30	25	125
VII	ECEHON-05A	Mini Project			4*	2			50	50
		Total	12	1	10	18	280	120	150	550

*indicates contact hours

FA Formative Assessment
SA Summative Assessment

B. Honors in the INTERNET OF THINGS (IOT) AND SMART SYSTEMS:

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ECEHON-01B	IoT architecture and protocols.	3	1		4	70	30	25	125
IV	ECEHON-02B	Sensors, actuators and embedded systems	3		2	4	70	30	25	125
V	ECEHON-03B	Cloud computing for IoT applications	3		2	4	70	30	25	125
VI	ECEHON-04B	IoT security and privacy	3		2	4	70	30	25	125
VII	ECEHON-05B	Applications in healthcare, agriculture and smart cities			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

*indicates contact hours

C. Honors in Railway Engineering:

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ECEHON-01C	Railway Engineering: A Beginner's Perspective	3	1		4	70	30	25	125
IV	ECEHON-02C	Data Communication and Signaling in Railway	3		2	4	70	30	25	125
V	ECEHON-03C	Applications of IT and Control Engineering in Railway	3		2	4	70	30	25	125
VI	ECEHON-04C	Advanced Communication and Modern Signaling in Railway	3		2	4	70	30	25	125
VII	ECEHON-05C	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

*Indicates contact hours

D. Honors in RENEWABLE ENERGY AND POWER ELECTRONICS:

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	ECEHON-01D	Solar and wind energy systems	3	1		4	70	30	25	125
IV	ECEHON-02D	Advanced power converters and inverters	3		2	4	70	30	25	125
V	ECEHON-03D	Grid integration and smart grids	3		2	4	70	30	25	125
VI	ECEHON-04D	AI in renewable energy optimization	3		2	4	70	30	25	125
VII	ECEHON-05D	Mini Project			4*	2			50	50
		Total	**12**	**1**	**10**	**18**	**280**	**120**	**150**	**550**

*Indicates contact hours

E. **Honors with Research***

Semester	*Course Code*	*Name of the Course*	*Engagement Hours*	*Credits*	*SA*		*Total*
			P		*ICA*	*OE*	
VII	ECERES-01	Research Project Phase-01	9 #	9	100	100	200
VIII	ECERES-01	Research Project during OJT	9 ##	9	100	100	200
		Total	18	18	200	200	400

#Along with 9 hours of engagement hours, 4.5 Hrs. activities for preparation for community engagement and service, preparation of reports, etc.

Along with 9 hours of engagement hours, 4.5 Hrs. activities for preparation for community engagement and service, preparation of reports etc. and independent reading during On Job Training and preferably related to On Job Training activities.

These Courses are open for students of all the UG Engineering Program.

Semester: III List of open electives - I

Sr. No.	List of Open Electives
1.	OE-01A: Advanced Mathematics and Statistics
2.	OE-01B Digital Marketing and E- Commerce
3.	OE-01C Humanities and Social Sciences
4.	OE-01D Industrial and Quality Management
5.	OE-01E Mathematics for Software and Hardware
6.	OE-01F Soft Skills and Personality Development

Semester: IV List of open electives – II

Sr. No.	List of Open Electives
1.	OE-02A Entrepreneurship and Innovation
2.	OE-02B Environmental Sustainability
3.	OE-02C Renewable Energy
4.	OE-02 D Measurement, Instrumentation and Sensors
5.	OE-02E Operation Research
6..	OE-02F Computational Mathematics
7.	OE-02 G Professional Business Communication

Semester III

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)
Semester-III
ECEPCC-01 Fundamentals of Digital Techniques

Teaching Scheme
Lectures: 3Hrs/Week, 3 Credits

Examination Scheme
ESE:70 Marks
ISE:30Marks

Introduction: This course provides a comprehensive understanding of digital electronics, focusing on the design and analysis of digital circuits. It covers number systems, Boolean algebra, combinational and sequential circuits, and introduces programmable logic devices.

Course Prerequisite: Basic knowledge of binary number systems and logic gates.

Course Objectives:

1. To introduce the fundamental concepts of digital logic circuits, including number systems, Boolean algebra, and the operation of various gates.
2. To enable students to design combinational and sequential circuits.
3. To introduce the concept of synchronous state machines.
4. To provide an understanding of programmable logic devices.

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

1. Understand and apply the principles of digital logic circuits.
2. Design and analyse combinational and sequential circuits.
3. Comprehend the functioning of synchronous state machines.
4. Utilize programmable logic devices in digital circuit design.

SECTION I

UNIT-1: Number Systems and Boolean Algebra (07 Hours)

- Introduction to binary, octal, decimal, and hexadecimal number systems.
- Conversion between number systems.
- Binary arithmetic: addition, subtraction, multiplication, and division.
- Boolean algebra: laws, theorems, and simplification of Boolean expressions.
- Logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR.

UNIT-2: Combinational Logic Design (08 Hours)

- Standard representation of logical functions.
- Karnaugh Map (K-map) representation and simplification up to 4 variables.
- Design and analysis of combinational circuits: adders, subtractors, multiplexers, demultiplexers, encoders, decoders.

UNIT-3: Sequential Logic Design (08 Hours)

- Introduction to sequential circuits.
- Flip-flops: SR, JK, D, T flip-flops – their operation and characteristic tables.
- Design and analysis of counters: asynchronous and synchronous counters.
- Shift registers and their applications.

SECTION II

UNIT-4: Synchronous State Machines (07 Hours)

- Finite State Machines (FSM): Moore and Mealy models.
- State diagrams and state tables.
- Design of synchronous sequential circuits using FSM.

UNIT-5: Programmable Logic Devices (PLDs) (08 Hours)

- Introduction to PLDs: PROM, PAL, PLA.
- Architecture and programming of PLDs.
- Introduction to Field Programmable Gate Arrays (FPGAs).

Unit 6: Memory and Digital System Applications (07 Hours)

- RAM, ROM, PROM, EPROM, EEPROM
- Introduction to ADC and DAC

Textbooks:

1. "Fundamentals of Digital Circuits" by A. Anand Kumar, 4th Edition, PHI Learning.
2. "Digital Design" by M. Morris Mano and Michael D. Ciletti, 5th Edition, Pearson Education.
3. "Digital Electronics: Principles and Integrated Circuits" by Anil K. Maini, Wiley India.

Reference Books:

1. "Digital Principles and Applications" by Donald P. Leach, Albert Paul Malvino, and Goutam Saha, 8th Edition, McGraw Hill Education.
2. "Modern Digital Electronics" by R. P. Jain, 4th Edition, McGraw Hill Education.
3. "Digital Logic and Computer Design" by M. Morris Mano, Pearson Education.

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Second Year B. Tech (Electronics & Computer Engineering)

Semester-III

ECEPCC-02 Data Structures and Algorithms

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/Week, 3 Credits	ESE: 70 Marks
	ISE: 30 Marks

Introduction: This course introduces students to various data structures and algorithms essential for problem-solving in computer science. It covers the design, analysis, and implementation of data structures such as arrays, linked lists, stacks, queues, trees, and graphs, along with algorithms for searching, sorting, and hashing. The course emphasizes selecting appropriate data structures and algorithms to optimize performance and resource utilization.

Course Prerequisites:

- Basic programming knowledge in C or C++
- Understanding of fundamental programming concepts

Course Objectives:

1. To understand the importance of data structures in computer science.
2. To learn the implementation and applications of various data structures.
3. To analyze the efficiency of algorithms.
4. To develop problem-solving skills using data structures and algorithms.

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

1. Select and implement appropriate data structures for problem-solving.
2. Analyze the time and space complexity of algorithms.
3. Apply data structures in real-world applications.
4. Develop efficient algorithms for various computational problems.

SECTION I

UNIT-1: Introduction to Data Structures (06 Hours)

- Definition and classification of data structures
- Abstract Data Types (ADTs)
- Overview of arrays, linked lists, stacks, and queues

UNIT-2: Arrays and Linked Lists (07 Hours)

- Array operations: insertion, deletion, traversal
- Singly linked lists: creation, insertion, deletion
- Doubly linked lists and circular linked lists

UNIT-3: Stacks and Queues (07 Hours)

- Implementation of stacks using arrays and linked lists
- Applications of stacks: expression evaluation, recursion
- Implementation of queues: simple queue, circular queue, priority queue

SECTION II

UNIT- 4: Trees (06 Hours)
- Introduction to trees and binary trees
- Binary Search Trees (BST): insertion, deletion, traversal
- Balanced trees: AVL trees, B-trees

UNIT- 5: Graphs (07 Hours)
- Graph representations: adjacency matrix, adjacency list
- Graph traversal algorithms: Breadth-First Search (BFS), Depth-First Search (DFS)
- Shortest path algorithms: Dijkstra's algorithm

UNIT- 6: Sorting and Searching Algorithms (07 Hours)
- Sorting algorithms: bubble sort, quick sort, merge sort, heap sort
- Searching algorithms: linear search, binary search
- Analysis of algorithm efficiency and complexity

Recommended Textbooks: References:

1. "Data Structures Using C" by Reema Thareja.
2. "Data Structures Through C" by Yashavant Kanetkar.
3. "Data Structures Through C in Depth" by S.K. Srivastava and Deepali Srivastava

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Recommended Textbooks: References:

1. "Fundamentals of Data Structures in C" by Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed.
2. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
3. "Data Structures and Algorithms" by Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)

Semester-III

ECEPCC-03 Electronic Devices and Circuit

Teaching Scheme	**Examination Scheme**
Lectures: 3Hrs/Week, 3 Credits	ESE:70 Marks
Practical: 2 Hour/week, 1 Credit	ISE:30Marks
	ICA:25 Marks
	POE - 25 Marks

Course Description: This course introduces the fundamental principles and applications of electronic devices and circuits. It covers the theory, characteristics, and operation of semiconductor devices such as diodes, transistors, and operational amplifiers. The course also focuses on small signal analysis, biasing techniques, amplifiers, and practical circuit design. Laboratory experiments provide hands-on exposure to these concepts.

Prerequisites:

Basic knowledge of electrical circuits and physics.

Course Objectives:

1. To understand the fundamental principles and behavior of semiconductor devices such as diodes, BJTs, and MOSFETs.
2. To analyze and design basic electronic circuits, including rectifiers, amplifiers, and oscillators.
3. To introduce operational amplifiers and their applications in electronic circuit design.
4. To enhance practical skills through laboratory experiments, enabling students to build and test electronic circuits.

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

1. Select and implement appropriate data structures for problem-solving.
2. Analyze the time and space complexity of algorithms.
3. Apply data structures in real-world applications.
4. Develop efficient algorithms for various computational problems.

SECTION I

Unit 1: Diodes and Their Applications (07 Hours)

- PN Junction Diode: Characteristics and Working Principle.
- Diode Models: Ideal and Practical.
- Zener Diode: Characteristics and Voltage Regulation.
- Diode Circuits:
  - Rectifiers (Half-Wave, Full-Wave, and Bridge Rectifiers).
  - Filters and Regulation Circuits.
  - Clippers, Clampers, and Voltage Multipliers.

Unit 2: Bipolar Junction Transistors (07 Hours)

- Construction, Operation, and Characteristics of BJTs.
- Modes of Operation: Active, Saturation, and Cutoff.
- DC Biasing: Fixed Bias, Collector-to-Base Bias, Voltage Divider Bias.
- Small Signal Analysis:
    - h-Parameter Model and Hybrid-π Model.
- BJT Amplifiers:
    - Single Stage CE Amplifiers.
    - Frequency Response and Bandwidth.

Unit 3: Field Effect Transistors (07 Hours)

- Introduction to JFET and MOSFET: Construction, Characteristics, and Operation.
- Biasing Techniques for JFET and MOSFET.
- Small Signal Analysis of FETs:
    - Common Source (CS), Common Drain (CD), and Common Gate (CG) Configurations.
    - Frequency Response of FET Amplifiers.
- MOSFET Applications in Switching Circuits.

- **SECTION II**

Unit 4: Feedback and Oscillators (07 Hours)

- Concept of Feedback: Positive and Negative Feedback.
- Effect of Feedback on Stability, Bandwidth, and Gain.
- Oscillators:
    - RC Phase Shift Oscillator.
    - LC Oscillator and Crystal Oscillators.

Unit 5: Power Electronics Devices and Voltage Regulators (07 Hours)

- Introduction to SCR, TRIAC, and DIAC.
- Power Amplifiers: Class A, Class B, and Class AB Amplifiers.
- Voltage Regulators: Linear Voltage Regulators and IC-Based Regulators (e.g. LM7805, LM7905).

Unit 6- IC 555 Timer (05 Hrs)

- IC 555- pin diagram, internal block diagram astable and monostable multivibrator design using IC 555

Internal Continuous Assessment (ICA):

- ICA shall consist of minimum 10 practical assignment problems based on all above topics in line with course outcome. Practical problem statements should cover all topics mentioned in the syllabus.

Recommended Textbooks and References:

1. "A Textbook of Electrical Technology - Volume IV" by B.L. Theraja and A.K. Theraja, S. Chand publication
2. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky
3. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith.
4. "Electronic Devices" by Thomas L. Floyd.
5. “Electronic Devices and Circuits” by J B Gupta

Recommended Textbooks and References:

1. “Electronic Devices & Circuits an Introduction” by Allen Mottershead Prentice Hall of India
2. “Electronic Devices and Circuits” (Sie) by Jacob Millman, Mc Graw Hill India
3. “Electronic Devices and Circuits” 5E by David A. Bell Oxford Publication

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Laboratory Experiments:

1. Study and Characterization of PN Junction Diode.
2. Study and Characterization of Zener Diode.
3. Design and Testing of Half-Wave Rectifier Circuits
4. Design and Testing of Full-Wave Rectifier Circuits.
5. Clipper and Clamper Circuits.
6. DC Biasing of BJTs
7. Analysis of CE Amplifiers.
8. Frequency Response of a Single Stage BJT Amplifier.
9. JFET/MOSFET Characteristics and Amplifier Design.
10. Study of RC Phase Shift Oscillators.
11. Study of Crystal Oscillators.
12. Analysis of Voltage Regulators Using Zener Diodes.
13. Analysis of Voltage Regulators Using IC 7805.
14. Analysis of Voltage Regulators Using IC 7905.
15. Design and Testing of an Astable Multivibrator using IC 555
16. Design and Testing of a Monostable Multivibrator using IC 555

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)
Semester-III
ECEFP-01 Python Programming

Teaching Scheme	**Examination Scheme**
Lectures: 1 Hrs/Week, 3 Credits	ICA: 25 Marks
Practical: 2 Hour/week, 1 Credit	POE: 25 Marks

Course Description:

This course introduces students to the fundamentals of Python programming, covering basic syntax, data structures, object-oriented programming, and advanced concepts like file handling and database operations. Students will also learn problem-solving techniques and develop hands-on experience through real-world applications and projects.

Course Objectives (Aligned to Bloom's Taxonomy):

1. **Understand (L1, L2):** Grasp the syntax, semantics, and key features of Python programming.
2. **Apply (L3):** Solve computational problems using Python programming techniques.
3. **Analyze (L4):** Evaluate algorithms and select appropriate Python constructs to optimize solutions.
4. **Evaluate (L5):** Assess and debug Python programs for efficiency and accuracy.
5. **Create (L6):** Design and develop Python-based applications and projects.

Course Outcomes (COs):

By the end of this course, students will:

1. Describe the syntax, control structures, and libraries of Python.
2. Use Python programming to solve computational problems and automate tasks.
3. Analyze the efficiency of Python programs and optimize algorithms.
4. Debug and troubleshoot Python programs using best practices.
5. Develop Python-based projects integrating multiple concepts.

SECTION I

Unit 1: Basics of Python Programming

- Introduction to Python: Features, applications, and development environments.
- Syntax and structure: Variables, operators, data types- Numeric, Boolean, String, List, Tuple, set, Dictionary.
- Input and output operations.

Unit 2: Control Structures and Functions

- Conditional statements: if, else, elif
- Loops: for, while, and nested loops
- Functions: Defining and calling functions, default arguments, and variable scope
- Lambda expressions and recursion

Unit 3: Data Structures in Python

- String handling: Slicing, concatenation, and built-in methods
- Lists, tuples, sets and Dictionaries: Creation, manipulation, and applications

SECTION II

Unit 4: Object-Oriented Programming in Python

- Classes and objects: Definition, attributes, and methods
- Constructors, destructors, and inheritance
- Method overloading and overriding
- Polymorphism and encapsulation

Unit 5: File Handling, Debugging and GUI programming

- File operations: Reading and writing.
- Exception handling: try, except, finally, and raising exceptions
- Debugging techniques and logging
- Introduction to GUI programming

Unit 6: Modules, Libraries, and Frameworks

- Importing modules and standard libraries
- Python libraries: math, datetime and random
- Introduction to third-party libraries: NumPy, pandas, and matplotlib
- Overview of frameworks: Flask and Django basics

Internal Continuous Assessment (ICA):

- ICA shall consist of minimum Eight practical's must be conducted for the Fundamentals of Python Programming practical. Similarly, four practical must also be conducted for Data Structures and Algorithms in line with course outcome.

Python Programming Laboratory Experiments:

1. Explore various development environments and execute basic Python scripts.
2. Write a program to determine if a given number is positive, negative, or zero using if, elif, and else.
3. Demonstrate the use of a lambda function for filtering even numbers from a list.
4. Implement operations like adding, removing, and updating elements in a list, tuple, set, and dictionary.
5. Create a dictionary to store student names and marks and display the average marks.
6. Create a base class Shape and derived classes Circle and Rectangle with methods to calculate area.
7. Demonstrate method overriding and polymorphism.
8. Write a program to read data from a file, count the number of words, and write the output to another file.
9. Build a simple GUI calculator using Python's tkinter module.
10. Demonstrate the use of math, datetime, and random libraries with suitable examples.
11. Create a basic web application using Flask.

Data Structures and Algorithms Laboratory Experiments:

1. Implementation of Array Operations (Insertion, Deletion, Searching).
2. String Manipulations (Pattern Matching, Palindrome Checking).
3. Implementation of and Doubly Linked Lists.
4. Queue Operations and Circular Queue Implementation.
5. Binary Search Tree Operations (Insertion, Deletion, Searching).
6. Graph Representation and Traversals (DFS and BFS).
7. Implementation of Sorting Algorithms (Merge Sort, Quick Sort).
8. Implementation of Hashing Techniques and Hash Tables.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)

Semester-III

ECEFP-02 Fundamentals Of Digital Techniques Practical's

Teaching Scheme	**Examination Scheme**
Practical: 2Hrs/Week, 1 Credits	POE:25 Marks
	ICA:25Marks

Introduction:

This course provides a comprehensive understanding of digital electronics, focusing on the design and analysis of digital circuits. It covers number systems, Boolean algebra, combinational and sequential circuits, and introduces programmable logic devices.

Course Prerequisite:

Basic knowledge of binary number systems and logic gates.

Course Objectives

1. To introduce the fundamental concepts of digital logic circuits, including number systems, Boolean algebra, and the operation of various gates.
2. To enable students to design combinational and sequential circuits.
3. To introduce the concept of synchronous state machines.
4. To provide an understanding of programmable logic devices (PLDs) and their applications in digital circuit design.

Course Outcomes

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

1. Analyze and implement logic circuits using number systems, Boolean algebra, and gates.
2. Create practical solutions using adders, subtractors, multiplexers, flip-flops, counters, and other circuits.
3. Design and implement state-based models such as sequence detectors using Moore and Mealy designs.
4. Apply knowledge of PLDs such as PLA and FPGA to develop and simulate digital systems.

Practical List

1. Verify the truth tables of basic gates (AND, OR, NOT) and universal gates (NAND, NOR).
2. Simplify given expressions using 2-variable, 3-variable, and 4-variable Karnaugh Maps (K-Maps).
3. Design and implement a half-adder, full-adder, half-subtractor and full-subtractor circuit
4. Implement a 4:1 multiplexer, 1:4 demultiplexer and verify its functionality.
5. Design and implement a 3-to-8 decoder using logic gates.
6. Design and implement an 8-to-3 priority encoder.

7. Design and implement a binary-to-gray code converter.
8. Design and implement a gray-to-binary code converter.
9. Verify the truth table of SR, JK, D, and T flip-flops.
10. Implement a JK flip-flop using NAND gates and verify its operation.
11. Design and implement a 4-bit synchronous counter.
12. Design and implement a 4-bit asynchronous counter.
13. Design and implement a 4-bit shift register (serial-in, serial-out).
14. Design and implement a parallel-in, parallel-out register.
15. Implement a combinational circuit using a Programmable Logic Array (PLA).
16. Design and simulate a simple circuit using a Field Programmable Gate Array (FPGA) simulator.

- ICA shall consist of minimum 12 practical assignment problems based on all above topics in line with course outcome. Practical problem statements should cover all topics mentioned in the syllabus.

Semester-IV

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)

Semester-IV

ECEPCC-04 Computer Architecture and Organization

Teaching Scheme	**Examination Scheme**
Lectures: 3Hrs/Week, 3 Credits	ESE:70 Marks
	ISE:30Marks

Course Description:

Computer Architecture and Organization is a foundational course designed to impart a thorough understanding of the structure, functionality, and operation of modern computer systems. It covers essential concepts such as instruction set architecture, memory hierarchy, control units, and pipelining techniques. With a blend of theoretical principles and practical design aspects, the course aims to equip students with the skills needed to analyse and optimize computer system performance.

Course Prerequisite

- Basic understanding of digital logic design and computer systems.
- Familiarity with programming concepts and data structures.

Course Objectives

1. To provide a comprehensive understanding of the basic structure and operation of a computer system.
2. To introduce the concepts of instruction set architecture and its impact on system performance.
3. To explore the design and functionality of memory systems, including cache and virtual memory.
4. To understand the principles of pipelining and parallelism in modern processors.
5. To familiarize students with input/output systems and their role in computer organization.

Course Outcomes

After completing this course, students will be able to:

1. Explain the fundamental concepts of computer architecture and organization.
2. Analyze and design basic components of a computer system, including ALU, control unit, and memory.
3. Evaluate the performance of different instruction set architectures.
4. Design and optimize memory hierarchies for efficient data access.
5. Understand and apply pipelining and parallelism techniques to improve system performance.
6. Demonstrate knowledge of input/output systems and their integration with the CPU.

SECTION I

Unit 1: Introduction to Computer Architecture and Organization (06 Hours)

- Basic concepts of computer systems
- Von Neumann architecture
- Instruction set architecture (ISA): CISC vs RISC
- Performance metrics: Clock rate, CPI, MIPS, and execution time

Unit 2: Arithmetic and Logic Unit (ALU) (07 Hours)

- Design of ALU: Addition, subtraction, multiplication, and division
- Integer and floating-point arithmetic
- Logic operations and shift operations

- ALU control signals and data paths

Unit 3: Control Unit and Instruction Execution (07 Hours)
- Hardwired and microprogrammed control units
- Instruction cycle: Fetch, decode, execute, and store
- Control signals and timing
- Introduction to pipelining

SECTION II

Unit 4: Memory Hierarchy (06 Hours)
- Memory types: RAM, ROM, cache, and secondary storage
- Cache memory: Mapping techniques, replacement policies, and write policies
- Virtual memory: Paging, segmentation, and TLB
- Memory interleaving and performance optimization

Unit 5: Pipelining and Parallelism (07 Hours)
- Instruction pipelining: Stages, hazards, and solutions
- Data hazards, control hazards, and structural hazards
- Superscalar architecture and out-of-order execution
- Introduction to parallel processing and multi-core systems

Unit 6: Input/Output Systems (07 Hours)
- I/O interface: Programmed I/O, interrupt driven I/O, and DMA
- I/O devices and controllers
- Introduction to peripheral devices and their integration

Recommended Textbooks
1. **Computer Architecture And Organization 3Ed** by John P. Hayes
2. **Basic Computer Architecture** Version 3.06 Smruti R. Sarangi January 20, 2025
3. **Computer Organization and Design: The Hardware/Software Interface** by David A. Patterson and John L. Hennessy
4. **Computer System Architecture** by M. Morris Mano

Reference Books:
1. **Computer Architecture: A Quantitative Approach** by John L. Hennessy and David A. Patterson
2. **Digital Design and Computer Architecture** by David Money Harris and Sarah L. Harris
3. **Computer Organization and Architecture: Designing for Performance** by William Stallings

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Second Year B. Tech (Electronics & Computer Engineering)

Semester-IV

ECEPCC-05 Network Theory and Linear Integrated Circuits

Teaching Scheme	**Examination Scheme**
Lectures: 3Hrs/Week, 3 Credits	ESE:70 Marks
Practical: 2Hrs/Week, 1 Credits	ISE:30Marks
	ICA: 25 Marks

Course Description:

This course combines fundamental principles of network theory with the design and application of linear integrated circuits (LICs). Topics include circuit analysis, network theorems, frequency response, operational amplifiers, active filters, and signal conditioning. Students gain the knowledge and skills to design, simulate, and analyze complex circuits using modern tools.

Course Objectives (Aligned to Bloom's Taxonomy):

1. Grasp fundamental network analysis techniques and linear integrated circuit principles.
2. Solve real-world circuit problems using network theorems and LIC-based designs.
3. Evaluate circuits for performance characteristics such as stability and frequency response.
4. Assess the performance of linear integrated circuits in various applications.
5. Design and implement LIC-based solutions for signal processing and control applications.

Course Outcomes (COs):

By the end of this course, students will:

1. Explain the principles of network analysis, theorems, and LIC fundamentals.
2. Apply circuit analysis methods and LIC configurations in problem-solving.
3. Analyze the stability, frequency response, and performance of networks and circuits.
4. Evaluate the suitability of LICs for specific applications, including active filters and amplifiers.
5. Design and simulate LIC-based circuits for applications like oscillators and signal conditioning.

SECTION I

Unit 1: Basics of Network Theory (09 Hours)

- Review Kirchhoff’s Current Law (KCL) and Kirchhoff’s Voltage Law (KVL).
- Node and mesh analysis techniques.
- Concept of linearity and superposition.
- Thevenin’s and Norton’s theorems.
- Maximum power transfer theorem.
- Applications of network theorems in practical circuit design.

Unit 2: Frequency Domain Analysis (05 Hours)

- AC analysis: Phasors, impedance, and admittance.
- Frequency response and resonance in series and parallel RLC circuits.
- Quality factor and bandwidth considerations.
- Bode plot analysis.

Unit 3: Two-Port Networks (06 Hours)

- Parameters: Z, Y, h, and ABCD.
- Interconnection of two-port networks.
- Applications of two-port network analysis.

SECTION II

Unit 4: Introduction to Linear Integrated Circuits (05 Hours)

- Basics of operational amplifiers (Op-Amps): Ideal and practical characteristics.
- Differential amplifiers and the importance of CMRR.
- Feedback configurations: Inverting, non-inverting, and voltage follower.
- Applications of Op-Amps in LICs.

Unit 5: Op-Amp Applications (07 Hours)

- Arithmetic circuits: Adders, subtractors, multipliers, and dividers.
- Signal conditioning: Integrators, differentiators, and instrumentation amplifiers.
- Comparators and Schmitt triggers.
- Voltage regulators and precision rectifiers.

Unit 6: Active Filters and Oscillators (07 Hours)

- Design of active filters: Low-pass, high-pass, band-pass, and band-stop filters.
- Butterworth and Chebyshev filter designs.
- Oscillator circuits: Wien bridge, phase-shift, and crystal oscillators.
- Frequency stability and practical applications.
- Phase-locked loops (PLL): Principles and applications.
- Design and simulation of LIC-based systems using tools like MATLAB or Multisim.

Laboratory Experiments :

1. Verify Kirchhoff's Current Law (KCL) and Voltage Law (KVL) using simple resistive circuits.
2. Determine the Thevenin and Norton equivalents for a given resistive network.
3. Apply superposition principle and validate maximum power transfer conditions experimentally.
4. Use mesh and nodal analysis techniques to calculate currents and voltages in a given network.
5. Analyze the resonance behavior in series and parallel RLC circuits and calculate the quality factor (Q).
6. Plot and interpret Bode plots for a first-order RC circuit to determine cutoff frequency.
7. Measure and calculate Z, Y, and ABCD parameters for a simple two-port network.
8. Design and analyze Op-Amp based inverting and non-inverting amplifier circuits.
9. Implement voltage follower and differential amplifier circuits to demonstrate high input impedance and CMRR.
10. Design and test integrator and differentiator circuits using operational amplifiers.
11. Construct and verify Op-Amp based adders, subtractors, multipliers, and dividers.
12. Design and demonstrate the working of comparator and Schmitt trigger using Op-Amps.
13. Implement precision rectifier circuits and study the working of Op-Amp based voltage regulators.
14. Design and test low-pass and high-pass active filters using Op-Amps with desired cutoff frequencies.
15. Build and analyze the output of a Wien bridge oscillator and study frequency stability.

Internal Continuous Assessment (ICA):

- ICA shall consist of minimum 10 practical assignment problems based on all above topics in line with course outcome. Practical problem statements should cover all topics mentioned in the syllabus.

Recommended Textbooks and References:

1. **"Circuits and Networks: Analysis and Synthesis"** by Sudhakar and Shyammohan
2. **"Engineering Circuit Analysis"** by Hayt, Kemmerly, and Durbin
3. **"Circuit Theory - Analysis and Synthesis"** by Abhijit Chakrabarti
4. **"Op-Amps and Linear Integrated Circuits"** by Ramakant A. Gayakwad**.**
5. **"Linear Integrated Circuits" by** Rishabh Anand Khanna Publishing House
6. **"Linear Integrated Circuits"** by D. Roy Choudhury and Shail B. Jain.
7. Online Resources: NPTEL lectures, MATLAB tutorials, Multisim guides.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR
Second Year B.Tech. (Electronics & Computer Engineering)
Semester – IV
ECEPCC-06: Object Oriented Programming

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hr/Week, 3 Credit	ESE: 70 Marks
Practical: 2 Hrs/Week, 1 Credit	ISE: 30 Marks
	ICA: 25 Marks
	POE: 25 Marks

Introduction:
The course introduces Java language's syntax and object-oriented programming paradigms from the perspective of Java language. Further, the course thoroughly touches upon the vital aspects of the usage of Java runtime library packages' classes and methods.

Course Prerequisite:
Students must be familiar with basic programming languages like C.

Course Objectives:

1. Recognize the fundamental principles of object-oriented programming and Java features.
2. Implement OOP concepts in Java programs, including inheritance, polymorphism, and abstraction.
3. Evaluate Java-based applications for modularity, reusability, and efficiency using OOP principles.
4. Assess the appropriateness of multithreading, exception handling, and collections for software solutions.
5. Design and develop real-world Java applications with advanced Java programming features.

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

1. Explain object-oriented programming concepts and the features of Java.
2. Develop Java programs using classes, inheritance, and polymorphism
3. Analyze Java programs to identify potential performance issues and recommend optimizations.
4. Evaluate exception-handling mechanisms and multithreaded programs for reliability.
5. Design and implement GUI-based Java applications using Swing or JavaFX.

SECTION-I

Unit 1 - Basics of Java and Strings in Java (6 Hours)

Basics: Java Runtime Environment (Oracle JDK, OpenJDK), Naming Conventions and Java profilers. Basics: Variables, Operators, Expressions, Statements, Blocks, Control flow Statements, Input and Output, Data Types, Arrays, Type Casting.Fundamentals: String Class and Methods, Immutability of Strings, String Buffer Class and Methods, String Builder class and Methods.

Unit 2 - Introduction to OOPs (7 Hours)

Objects and Classes, Fields and Methods, Abstraction, Encapsulation, Inheritance, Polymorphism, Type Compatibility and Conversion, Overriding Methods, Access control, Modifiers, Constructors, Abstract classes, Nested classes, Packages, Wrapper classes, Interfaces, Object Life time &Garbage Collection.

Unit 3 - Exceptions, Error Handling and Basic IO (7 Hours)

Exceptions and Error Handling: Exceptions and Errors, Catching and Handling Exceptions, The try Block, The catch Blocks, The finally Block, Throwing Exceptions, Chained Exceptions, Custom Exceptions. JUnit Testing Framework. Basic I/O: I/O Streams, Byte Streams, Character Streams, Buffered Streams, Scanning and Formatting, Data Streams, Object Streams, File I/O Classes: Reading, Writing, and Creating Filesand Directories

SECTION-II

Unit 4 - Java Collections Framework (6 Hours)

Introduction, The Arrays Class, Searching and sorting arrays of primitive data types, Sorting Arrays of Objects, The Comparable and Comparator Interfaces, Sorting using Comparable & Comparator, Collections: Lists, Sets, Maps, Trees, Iterators and Collections, The Collection Class.

Unit 5 - Multithreading and Networking (7 Hours)

Multithreading: Creating Threads, Thread scheduling and priority, Thread interruptions and synchronization. Network Programming: Inet Address, URLs, Socket (TCP & UDP) communication in Java, Servlet Programming

Unit 6 - GUI Programming (7 Hours)

GUI Programming using Swing: Swing package, Layouts, Events, Listeners and Event handling, and Swing Components.

ISE Evaluation: ISE Evaluation for the course will consist of three programming (hands on) tests.

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum of 12 practical assignment problems.

The assignments should test and develop students' practical proficiency and ability to use Java API Classes correctly for writing code for varied applications scenarios & use case requirements.

Use of IDEs like Blue J, Eclipse, Net beans or any other FOSS alternative for Interactive development and debugging of Java applications is highly recommended to enhance hands on skills in Java Programming of Students.

Text Books:

1. Head First Java, Kathy Sierra, Bert Bates, O'Reilly Publication
2. The Java TM Programming Language, Ken Arnold, James Gosling, David Holmes, Pearson Publication
3. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt Ltd.
4. Programming with Java, Bala Guruswamy, TMH
5. Internet and Java Programming, Tanweer Alam, Khanna Publishing House

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Reference Books:

1. The Java Language Specification, Java SE 8 Edition Book by James Gosling, Oracle Inc.
2. Java: The Complete Reference 8 Edition - Herbert Schildt , Tata McGraw - Hill Education
3. Head First Servlets and JSP – Bryan Bosham, Kathy Sierra, Bert Bates, O'Reilly Publication
4. The Java TM Tutorials. Oracle Inc.
5. Java Server Programming for Professionals - Ivan Bay ross, Sharanam Shah, Cynthia Bay ross and Vaishali Shah, Shroff Publishers and Distributors Pvt. Ltd, 2nd Edition

e-resources :

1. http://docs.oracle.com/javase/specs/
2. http://docs.oracle.com/javase/tutorial/

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR
Second Year B.Tech. (Electronics & Computer Engineering)
Semester – IV
ECESEC-01: PCB Design Lab

Teaching Scheme
Practical: 2 Hrs/Week, 1 Credit

Examination Scheme
ICA: 25 Marks
POE: 25 Marks

Course Description:

This course introduces students to the principles, tools, and techniques used in designing and fabricating Printed Circuit Boards (PCBs). Emphasis is placed on schematic capture, layout design, simulation, routing, and final board output using standard Electronic Design Automation (EDA) tools. Students gain hands-on experience by designing single- and double-layer PCBs for real-world applications.

Course Prerequisite

- Basic knowledge of electronic components and circuits
- Familiarity with circuit simulation tools (e.g., Multisim, LTspice)
- Understanding of microcontroller-based systems (recommended)

Course Objectives

1. To introduce students to PCB design methodologies and tools.
2. To develop skills in schematic entry and layout designing.
3. To enable students to design and simulate single and multi-layer PCBs.
4. To provide hands-on experience in the design-to-fabrication process.
5. To promote good design practices, including component placement, routing, and EMI/EMC considerations.

Course Outcomes

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

1. Identify and use appropriate PCB design tools.
2. Create and simulate electronic schematics.
3. Design single-layer and double-layer PCB layouts.
4. Generate Gerber files and documentation for fabrication.
5. Apply PCB design principles in real-world electronic system development.

Unit 1: Introduction to PCB Design

- Overview of PCB types and applications
- PCB design flow: Schematic to fabrication
- Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA, MultiSim, P Spice)
- PCB design standards and file formats (Gerber, BOM, Drill files)

Unit 2: Schematic Capture

- Creating and editing schematics
- Electronic components and symbols
- Assigning footprints and netlists
- Hierarchical schematics and annotations

Unit 3: PCB Layout Design Basics

- Board dimensioning and layers
- Component placement strategies
- Routing techniques: manual vs auto-routing
- Design rules: spacing, trace width, clearance

Unit 4: Simulation and Verification

- Netlist verification and ERC/DRC checks
- Signal integrity basics
- Circuit simulation using integrated tools
- Troubleshooting and design optimization

Unit 5: Output Generation and Fabrication

- Generating Gerber files and fabrication outputs
- Bill of Materials (BOM) and pick-and-place files
- Introduction to PCB fabrication process
- Introduction to soldering and PCB assembly basics

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum of 8 practical assignment problems including a mini project

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List of Practical's:

1. Introduction to PCB design tools (Eagle, KiCad, EasyEDA, or Altium)
2. Design of a simple LED blinking circuit schematic and layout
3. Creating custom components/footprints in the tool
4. Demonstration of soldering and PCB fabrication techniques
5. Design and layout of single-phase rectifier circuit
6. PCB layout for a voltage regulator circuit (e.g., LM7805)
7. Design and layout of a 555 Timer-based multivibrator circuit
8. Simulation and design of an Op-Amp-based amplifier PCB
9. Design of a microcontroller-based system (e.g., Arduino + sensors)
10. Design of a power supply PCB with proper decoupling and filtering
11. Generate and verify Gerber and drill files for a completed project
12. Design of an audio amplifier PCB with filtering
13. PCB layout for a temperature sensor interface circuit
14. Mini project: Design, simulate, and generate output for a small embedded system PCB

Textbooks:

1. **"PCB Design Using KiCad 6"** – *Peter Dalmaris* Publisher: Tech Explorations.
2. **"Printed Circuit Board Design and Technology"** – *Walter C. Bosshart*
   Publisher: Tata McGraw-Hill Education
3. **"Electronic Circuit Design and Application"** – *Stephan J. G. Gift*
   Publisher: Springer (Available in India via distributors)
4. **"Practical Electronics for Inventors"** – *Paul Scherz and Simon Monk*
   Publisher: McGraw Hill Education.

Reference Books

1. **"High-Speed Digital Design: A Handbook of Black Magic"** – *Howard Johnson and Martin Graham* Publisher: Prentice Hall.
2. **"Printed Circuit Boards: Design and Technology"** – *Madhu S. Gupta*
   Publisher: Tata McGraw-Hill Education
3. **"Fundamentals of Printed Circuit Board Technologies"** – *G. Shroff*
   Publisher: TMH (Tata McGraw-Hill)
4. **"Designing with Op-Amps and Analog ICs"** – *Sergio Franco*
   Publisher: McGraw Hill Education.
